TRANSPORT STUDY FOR THE DANUBE MACRO-REGION

Final Report

Study prepared for:

EUROPEAN INVESTMENT BANK

TRT Trasporti e Territorio

Milan, 30 June 2017

Document Control Sheet

Customer	European Investment Bank
Contract Number	CC8414/PO92839
Project name	Transport Study for the Danube Macro-Region
File name	EIB Transport Study for the Danube Macro-Region – Final Report D5
Version	
Date	30/04/2019

Document classification

Draft		Final	X	Confidential	X	Restricted	X	Public	

Main editor	Silvia Maffii and Marco Brambilla
Contributors	Angelo Martino, Marco Pascucci, Ernesto Marzano, Zoltan Gati, Drazenko Glavic, Fabio Torta, Riccardo Parolin, Claudia de Stasio, Luca Bellodi, Eglantina Dani, Loredana Zani and Dorota Bielanska
Final approval	Silvia Maffii
Available to	European Investment Bank Assignment Manager

Contact

Dr. Silvia Maffii
TRT Trasporti e Territorio
Via Rutilia 10/8
Milano - Italy
Tel: +39 02 57410380
e-mail: maffii@trt.it
Web: www.trt.it

LIST OF ABBREVIATIONS

ACROSSEE	Accessibility Improved at Border Crossing for the Integration of South East Europe
AADT	Average Annual Traffic per Day
ANSP	Air Navigation Service Provider
ASFINAG	Autobahnen - und Schnellstraßen-Finanzierungs - Aktiengesellschaft
ATC	Air Traffic Control
ATM	Air Traffic Management
B/C	Benefit Cost ratio
BVWP	Bundesverkehrswegeplan
CCNR	Central Commission for the Navigation of the Rhine
CEF	Connecting Europe Facility
CO_2	Carbon Dioxide
DARS	Družbe za avtoceste v Republiki Sloveniji
EC	European Commission
EaP	Eastern Partnership
EASA	European Aviation Safety Agency
EBRD	European Bank for Reconstruction and Development
EEA	European Environmental Agency
EIA	Environmental Impact Assessment
EIB	European Investment Bank
EIRR	Economic Internal Rate of Return
ENI	European Neighbourhood Instrument
ENPV	Economic Net Present Values
ERTMS	European Rail Traffic Management System
ESPON	European Territorial Observatory Network
ETCS	European Train Control System
EU	European Union
EUROCONTROL	European Organization for the Safety of Air Navigation
FFH	Flora and Fauna Habitats

FIRR	Financial Internal Rate of Return
FNPV	Financial Net Present Value
FR	Functional Region
GDP	Gross Domestic Product
GSM-R	Global System for Mobile Communications – Railway
HGV	Heavy Good Vehicle
HUF	Hungarian Forint
HŽ	Hrvatske Željeznice
IATA	International Air Transport Association
IBRD	International Bank for Reconstruction and Development
ICAO	International Civil Aviation Organization
IFI	International Financing Institution
INEA	Innovation and Networks Executive Agency
IPA	Instrument for Pre-accession Assistance
ITF	International Transport Forum
JASPERS	Joint Assistance to Support Projects in European Regions
MOEW	Ministry of Environmental and Waters
NRIC	National Railway Infrastructure Company of Bulgaria
NUTS	Nomenclature of territorial units for statistics
OECD	Organisation for Economic Co-operation and Development
PA	Priority Area
PPP	Public Private Partnership
RCC	Regional Cooperation Council
REBIS	The Regional Balkans Infrastructure Study
RWY	Runway
SEE	South East Europe
SEETO MAP	South-East Europe Transport Observatory Multi Annual Plan
TEN-T CNC	TEN-T Core Network Corridor
TRACECA	TRAnsport Corridor Europe-Caucasus-Asia

TRUST	TRansport eUropean Simulation Tool
UNECE	Economic Commission for Europe
VAT	Value Added Tax
VIA	Vienna International Airport
WB6	Group of the Six Western Balkan Prime Ministers
WBIF	Western Balkans Investment Framework

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

1.1 Purpose of the study

The EU Strategy for the Danube Area (EC, 2010) aims to provide a robust and integrated framework for countries and regions in order to address issues that cannot be handled satisfactorily in an isolated way, but that instead require transnational and supranational strategic approaches.

This study has been conceived specifically for the Priority Area 1b of Mobility and Multimodality, which addresses road, rail and air transport modes. This is one of the eleven Priority Areas that constitute the heart of the EU Strategy. The Strategy addresses mobility challenges and identifies opportunities readily available to support the development of transport networks within the so-called Danube Macro-Region, whose geographical scope embraces fourteen countries.

Mobility challenges at stake consist of multimodality improvement, better interconnection amongst the modes and modernisation and extension of infrastructure networks. In this respect, the opportunities rely on the potential to improve the TEN-T Core Network Corridors crossing the Danube Macro-Region, connect the countries of the Western Balkans and extend towards the countries of the Eastern Partnership initiative. Besides, the study should also identify and make relevant potential linkages to the ports identified in the Priority Area 1a of Inland Waterways.

The objectives of this study are present an overview of the transport modes and identify regional transport projects that are relevant at country level and important for the Danube Macro-Region, while achieving the maximum geographical coverage. The study has been developed on the basis of available and recent documents, factoring current demand volumes and trends by mode, transport and infrastructure bottlenecks (i.e., physical and non-physical) as well as environmental and safety issues.

To meet these objectives, the study provides a targeted snapshot of the current situation, through the reconstruction of the present status of transport infrastructures, transport demand volumes and the expected impact of infrastructures on traffic flows. Moreover, to address issues that cannot be handled in a country centric way, a Functional Region approach has been developed. On this basis, the study is expected to contribute to the future development of (i) the TEN-T Core Network Corridors, starting from the pre-identified priority sections, (ii) the South East Europe regional transport network and (iii) the Eastern Partnership strategic network.

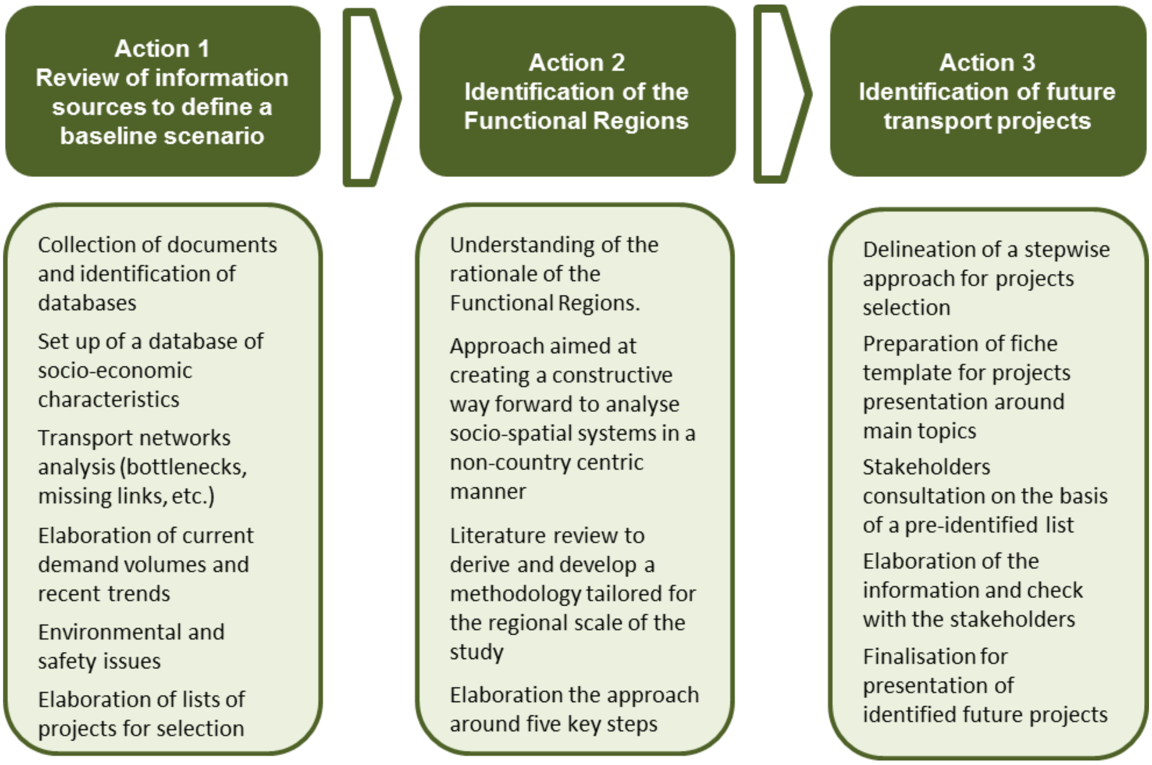
The study aims at identifying transport projects suitable for EIB co-financing. Being the bank of the EU, the EIB supports a large scope of projects that contribute to the implementation of high-level policy objectives of the EU, creating high-quality infrastructure, promoting intermodality and interoperability amongst modes, facilitating the optimum use of existing infrastructures and connecting major urban agglomerations and regions.

Especially, in the Danube Macro-Region the EIB plays an important role and is well positioned to support transport projects compliant with the objectives laid down by the EU Danube Strategy. Furthermore, under its external mandates, the EIB can play a role in the foreign policy of the EU fostering regional development in form of cohesion and convergence, operating mainly in favour of the accession countries of the Western Balkans, as well as the neighbouring countries.

1.2 Content of the document and annexes

The purpose of this Final Report is to present the findings and conclusions of the transport study for the Danube Macro-Region. The content of the Final Report has been organised to reflect the flow of the main actions undertaken (see Figure 1-1) and structured according to the sections described hereinafter. Where necessary, the key findings from the interim reports delivered during the study has been cross-referenced.

Figure 1-1: Flow of the main actions of the study



Source: TRT elaboration

Starting from a recap of the major historical events that shaped the Danube Macro-Region, **Section 2** presents the main socio-economic characteristics and their recent trends, the transport networks context and the demand volumes of the modes considered. A descriptive analysis in section 2.1 illustrates the recent trends of population and patterns of explanatory variables of the economies of the concerned countries. Section 2.2 describes the main transport networks of road, rail and air modes and how these are interlinked in the light of the transport policy context, and especially addressing the extension of the TEN-T Core Network Corridors towards the Western Balkans countries and the neighbouring countries of the Eastern Partnership initiative. Section 2.3 describes the recent trends and current demand volumes observed until 2015. Additional elaborations suggest indicative ranges of projections for population, GDP and demand volumes for the time interval 2015-2030.

Section 3 presents the methodological approach developed to identify the nine Functional Regions within the Danube Macro-Region. The Functional Regions are the building blocks on which the transport study has been developed in a non-country centric approach. The identification process starts investigating the scientific literature and addresses five dimensions: (i) the size of the basic spatial entities, (ii) the spatial interactions, (iii) the socio-economic characteristics, (iv) the transport context and (v) a measure of potential accessibility of freight transport.

Section 4 describes the stepwise screening methodology set up to select the future transport projects. The methodology has been developed checking through a broad scope of information sources, applying selection criteria and consulting the stakeholders.

Section 5 illustrates the identified future transport projects embedded in the context of the Functional Regions. From section 5.1 to 5.9, each Functional Region is presented through subsections describing the socio-economic characteristics, transport demand volumes, infrastructure networks, bottlenecks, indicative projections of key socio-economic characterictics and transport demand volumes, environmental and safety aspects and accessibility. Each subsection highlights the key points emerged, lists the identified future projects and presents the short version of the projects fiches. Section 5.10 summarises the key findings emerged from the identified future transport projects.

Finally, two annexes gather the relevant information collected. **Annex I** assembles the data used to analyse the context of the Danube Macro-Region in socio-economic terms and with respect to the observed demand volumes. The Annex I also includes the list of pre-identified projects assembled to consult the stakeholders and the template of the project fiche used to present the information gathered of the future transport projects. **Annex II** gathers the long versions of the fiches that describe the identified future transport projects.

2 The Danube Macro-Region

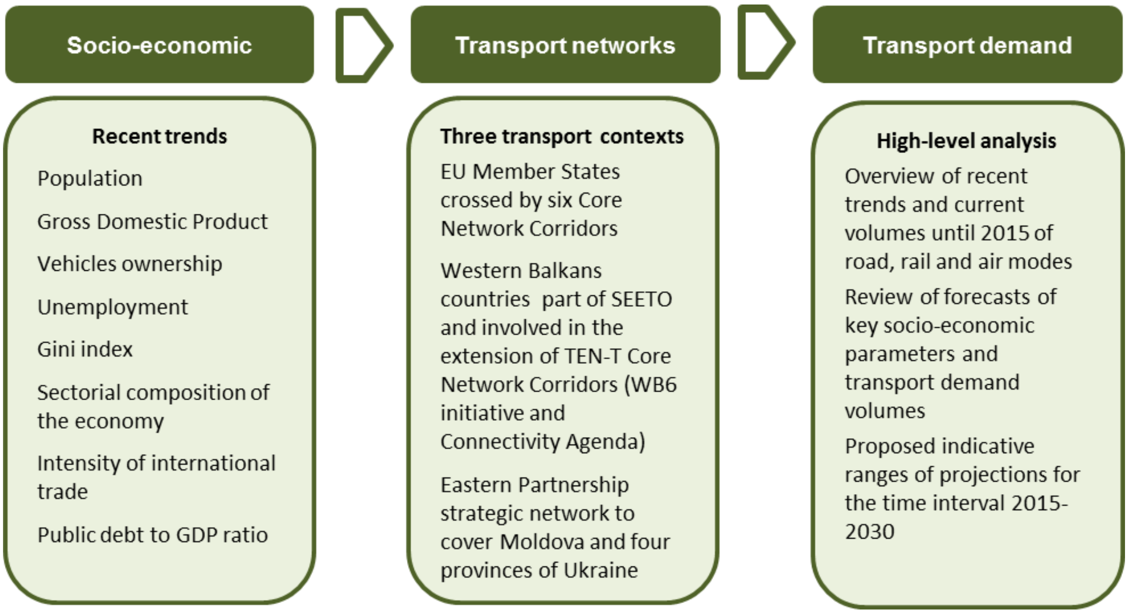
As identified by the EU Strategy for the Danube Area (EC, 2010), requested by the European Council to the EC in response to the enlargements of 2004 and 2007, the Danube Macro-Region consists of 14 countries[1]. The Strategy aims at developing an integrated framework for the concerned countries and address issues that cannot be handled satisfactorily in an isolated way, but instead requiring a transnational strategic approach.

Elaborating on the basis of the available documents and databases, sections from 2.1 to 2.3 introduce the Danube Macro-Region presenting three important aspects (see Figure 2-1):

- the main socio-economic characteristics and recent trends,
- the transport networks crossing the region, and
- the overview of key socio-economic parameters and current transport demand and their projections to 2030.

The description of the Danube Macro-Region is complemented with an overview of physical and non-physical bottlenecks and environmental and safety issues (see sections 2.4 and 2.5).

Figure 2-1: Summary of socio-economic characteristics, transport networks and transport demand aspects of the Danube Macro-Region



Source: TRT elaboration

[1] Austria, Bulgaria, Croatia, Czech Republic, Germany (the laenders of Bavaria and Baden-Württemberg), Hungary, Romania, Slovakia, Slovenia, Bosnia and Herzegovina, Montenegro, Serbia, Moldova and Ukraine (the provices of Zakarpats'ka, Odes'ka, Ivano-frankivs'ka and Chernivets'ka).

2.1 Main socio-economic characteristics

The Danube Macro-Region is a functional area, defined by its river basin, stretching from the Black Forest in Southern Germany to the river's delta on the Western shores of the Black Sea. Strategically located on the Eastern continental Europe, the Danube Macro-Region can give the opportunity to the EU to open its borders to neighbouring regions of the Black Sea and South Caucasus and towards the Central Asia.

The Danube river has been the cradle of many European civilisations. Geographically, the river delineates a natural border with the Balkan peninsula from the rest of the continental Europe and serves as a natural link of the inner European regions to South-Eastern territories. Historically, the Danube river marked ages of cultural trends and socio-political experiences. Since the Roman empire, the Danube area has existed as a common space for interaction, dividing and uniting civilisations and cultures throughout cycles of integrations and disintegrations. The Danube river has often been a border amongst great empires, but also one of the main trade routes (Busek and Gjoreska, 2010). Several historical events left their marks and conditioned in many ways how the Danube Macro-Region is shaped today.

Throughout a stepwise political process[2], today the Danube Macro-Region is home to approximately 115 million inhabitants[3] distributed in 14 countries[4], of which:

- 9 EU Member States (i.e., Austria, Bulgaria, Croatia, Czech Republic, Germany[5], Hungary, Romania, Slovakia and Slovenia) gathering the 81,3% of the total population;
- 3 accession countries (i.e., Bosnia and Herzegovina, Montenegro and Serbia) corresponding to the 10,3%; and
- 2 neighbouring countries (i.e., Moldova and Ukraine[6]) consisting of the 8,5%.

From 2006 to 2014 the total population has been reducing by 1,8%. The highest contraction occurred in the accession countries (i.e., -2,8%) followed by EU Member States (i.e., -1,8%). The population of neighbouring countries remained relatively unchanged.

Measuring the economy of the Danube Macro-Region in monetary values, the Gross Domestic Product (i.e., GDP) amounted to nearly € 2 trillion in 2014. Not surprisingly, the global crisis of 2008 markedly impacted on the economy. The year immediately after, the GDP dropped by a 6%. Since then, the GDP gradually recovered displaying an average growth of 3,6% on annual basis. With respect to the three groups of countries, the distribution of the GDP from 2006 to 2014 remained relatively stable and disproportionately unbalanced in favour of the EU Member States, weighting for the 96,6% of the total wealth. However, the size of the GDP of accession and neighbouring countries, over this period, marked remarkable increases by +37,8% and +47,8%, respectively.

As societies become wealthier, also vehicles ownership increases. Across the countries of the region, from 2006 to 2014, the motorisation rate (i.e., cars/1.000 people) increased by 16,9%. Such transition has been favoured by the increase of the average GDP per capita from € 10.133 to 12.691 (i.e., +25,2%), twice the

2 Firstly, the enlargement of the EU to Czech Republic, Hungary, Slovakia, Slovenia (in 2004), Romania, Bulgaria (in 2007) and Croatia (in 2013). Secondly, accession negotiations have been started with candidate countries of Serbia and Montenegro. Bosnia and Herzegovina is a potential candidate, while Ukraine and Moldova are amongst the target countries of the EU neighbourhood policy.

3 The data refers to the year 2015.

4 See section 2 of Annex I. Data on the socio-economic characteristics of the Danube Macro-Region have been elaborated on the databases of Eurostat, the World Bank and statistics at national level.

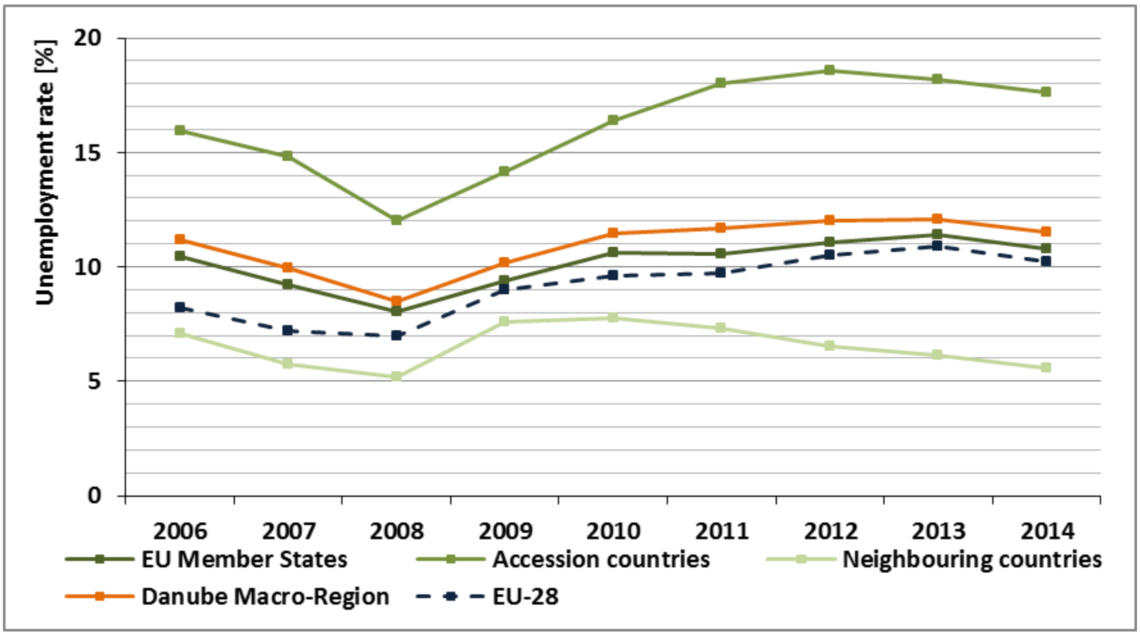
5 The German Federal States of Bavaria and Baden-Württemberg.

6 The provinces (i.e., the Oblast) of Zakarpats'ka, Odes'ka, Ivano-frankivs'ka and Chernivets'ka.

average of EU-28 (i.e., +12,2%). Amongst the three groups, one can observe the highest increase for the neighbouring countries (i.e., +60,9%) followed by the accession countries (i.e., +46,8%) and EU Member States (i.e., +23,1%). Analysing the average GDP per capita of the region in 2014, with respect to the average value at EU-28 level, this is approximately one half.

The global crisis also impacted on the labour market (see Figure 2-2). Data of the unemployment rate shows the lowest values regarding neighbouring countries[7], where the wave of the crisis has been absorbed earlier. The trend of the EU Member States approximates those at EU-28 level and the average of the Danube Macro-Region. Eventually, the accession countries show a significantly higher rate and slower recovery pace to pre-crisis level.

Figure 2-2: Trend of the unemployment rates of the Danube Macro-Region



Source: TRT elaboration from the World Bank database and Ukraine Office of statistics

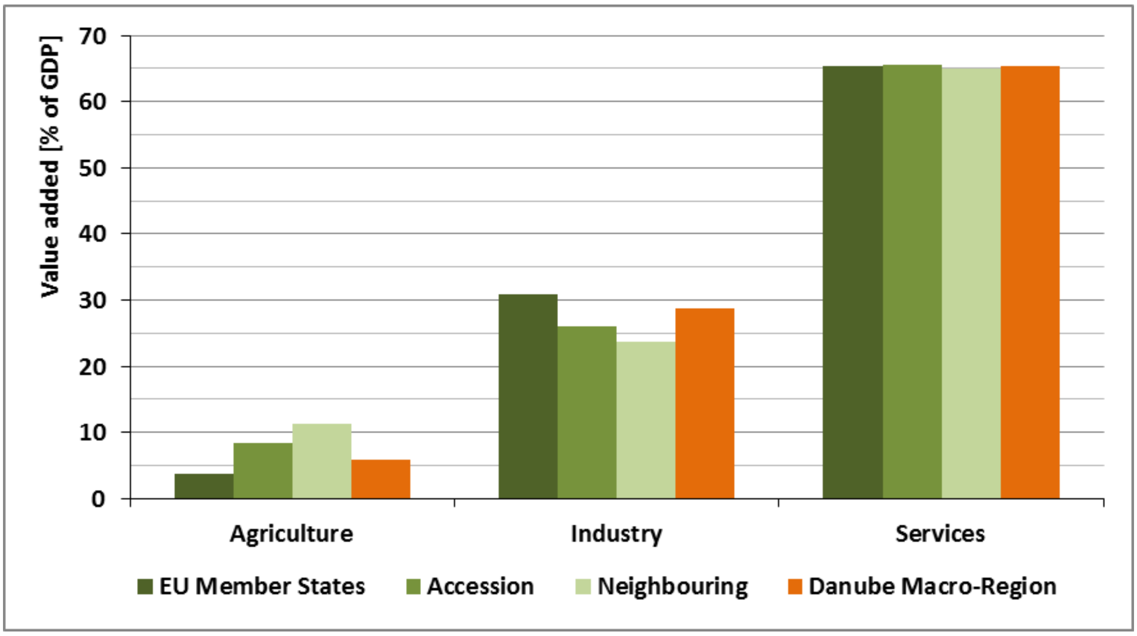
To some extent the finding above is corroborated elaborating on the Gini index[8]. The accession and neighbouring countries show opposite paths from 2006 to 2013. The measure of social inequality of accession countries increased from 29,5 to 33,2, while that of neighbouring countries reduced from 32,6 to 26,5. The Gini index of EU Member States and Danube Macro-Region show similar reductions, approximately from 30,6 to 28,9.

In terms of sectoral composition of the economy (i.e., as % of GDP in 2014), the value added of the services produced outweighs the share of agriculture and industry sectors, suggesting that the economic development and competitiveness rely on its strength. Contributing to approximately a 65% of the GDP, the weight of the services is also evenly distributed across the countries. The industry is the second sector for importance (i.e., 28,9%), while the agriculture accounts only for a 5,9% on average (see Figure 2-3).

[7] Data of Ukraine are on a country level. Specific figures of the four provinces are not available.

[8] The Gini index is a measure of the deviation of the income distribution amongst individuals. A Gini index equal to 0 means perfect equality, while an index equal to 100 implies perfect inequality.

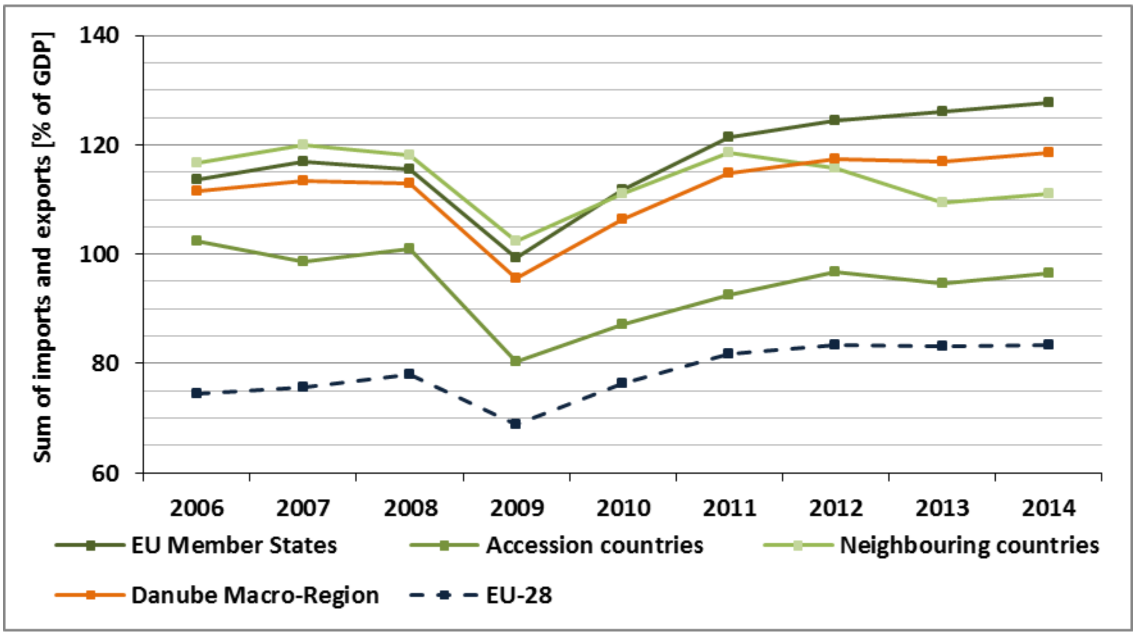
Figure 2-3: Sectoral composition of the economy of the Danube Macro-Region



Source: TRT elaboration from the World Bank database and Ukraine Office of statistics

The degree of economic integration can be captured analysing the intensity of international trade, measured as sum of imports and exports of goods and services (as % of GDP). The region shows a good level of integration, higher than at EU-28 level[9]. Figure 2-4 illustrates the trade intensity.

Figure 2-4: Trade intensity of the economy of the countries in the Danube Macro-Region



Source: TRT elaboration from the World Bank database and Ukraine Office of statistics

9 According to Achtnicht et al. (2014), a good level of trade interaction occurs amongst the countries of the Danube Macro-Region.

All in all, the emerging socio-economic context of the Danube Macro-Region is quite heterogeneous. The differences in terms of size of the economies and growth, unemployment rates and welfare distribution depict a context wherein the less developed regions lag behind the wealthier ones. Closing the economic gap is a major challenge for defining a common development path in the Danube Macro-Region. In this perspective, the EU Strategy for the Danube Region (EC, 2010), aimed at supporting sustainable development, territorial cohesion and regional cooperation, provides the policy framework to address such problem.

As regards the EU transport policy, the Strategy for the Danube Region is consistent with important pieces of legislation aiming at developing the transport networks (i.e., the TEN-T). Being a gateway towards the countries of Western Balkans, Eastern Europe and onwards to South Caucasus and Central Asia, the Danube Macro-Region is pivotal to support EU external policies, like the connectivity agenda to improve links within the Western Balkans and with the EU and the Eastern Partnership (i.e., EaP) initiative.

2.2 The transport networks

The Danube Macro-Region assembles three transport areas: the EU Member States crossed by the TEN-T Core Network Corridors (i.e., CNCs); the countries of the Western Balkans as part of the South East Europe (i.e., SEE) network (a multimodal transport network defined in 2004 to develop infrastructures at regional level) and the neighbouring countries as part of the Eastern Partnership strategic network.

2.2.1 TEN-T network and corridors

The TEN-T network has two layers: the core network, which carries the most important passengers and freight flows and the comprehensive network, which ensures access to the core network. In this context, the Core Network Corridors aim to facilitate the development of the core network. The TEN-T CNCs crossing the Danube Macro-Region and the core and comprehensive transport networks are presented in Figure 2-5 and Figure 2-6.

Nine TEN-T CNCs have been conceived to optimise projects prioritisation, budgeting and planning. These are identified in Annex I to the Connecting Europe Facility (i.e., CEF) EC Regulation 1315/2013 (EC, 2013), which includes the lists of pre-identified sections for potential EU funding, based on their added value and maturity status. The CNCs have been conceived also in view to bring together, with the help of the CEF programme, public and private resources, particularly in view to (i) remove bottlenecks, (ii) fill missing links and (iii) promote integration and interoperability amongst transport modes. Six CNCs cross the Danube Macro-Region countries (see Table 2-1).

In 2014, the EC supported the elaboration of the TEN-T CNC studies to analyse the compliancy of infrastructure networks with technical standards and market demand (see EC (2014a), EC (2014b), EC (2014c), EC (2014d), EC (2014e) and EC (2014f)). The studies delivered work plans in agreement with Member States on the basis of feasibility studies and experts infrastructure managers analyses. These work plans ensured that the lists of identified projects could achieve technical and financial maturity by 2030 and provided insights of relevant characteristics, like: maturity (i.e., study or work), timing, financing sources (i.e., national budget, EU funds, IFIs and other programmes) and critical issues[10].

[10] Updated versions of the work plans are forthcoming for the period 2015-2017, but they have not been validated officially yet.

Table 2-1: EU Member States of the Danube Macro-Region crossed by the TEN-T CNCs

TEN-T CNC	EU Member States crossed
Baltic-Adriatic	Czech Republic, Slovakia, Austria and Slovenia
Mediterranean	Slovenia, Croatia and Hungary
Rhine-Danube	Germany, Slovakia, Austria, Hungary, Croatia, Romania, Bulgaria and Czech Republic
Orient/East-Med	Czech Republic, Austria, Slovakia, Hungary, Romania and Bulgaria
Rhine-Alpine	Germany
Scandinavian-Mediterranean	Germany and Austria

Source: TRT elaboration on EC (2014a), EC (2014b), EC (2014c), EC (2014d), EC (2014e) and EC (2014f)

2.2.2 The SEETO and the WB6 initiative

The development of the Western Balkans regional transport network is supported by the South East Europe Transport Observatory (i.e., SEETO), which was established by the Memorandum of Understanding signed in 2004 (SEETO, 2005)[11]. Its main objectives are:

- integrate the Western Balkans in the framework of the wider TEN-T;
- develop and harmonise the regional transport policies and improve infrastructures technical standards;
- maintain an effective coordination and communication network.

The SEETO provides support to assess and prioritise transport projects through its Multi Annual Plans (i.e., MAPs) and actively participates to the Danube Strategy. In order to identify transport needs, the SEETO has been focussing on the main following actions:

- the Flagship Axes initiative aimed to identify physical and non-physical barriers in the region;
- the South East Europe 2020 Strategy (i.e., SEE 2020) developed under the Regional Cooperation Council (i.e., RCC), in view to support the transport sector to contribute to the socio-economic growth and integration with the EU;
- the Regional Balkan Infrastructure Study (i.e., updated REBIS; IBRD, 2015) to develop a priority action plan for enhancing the extension of the TEN-T network to the Western Balkans, analysing the physical and non-physical barriers and identifying potential investments and measures.

In 2013 the SEETO comprehensive network maps have been included in the TEN-T guidelines. On the basis of the Berlin process, initiated in 2014 with the Conference of the Western Balkan States, further progress in this direction was achieved in June of 2015 with the agreement reached by the six Western Balkan Prime Ministers (i.e., WB6) on the regional core transport network and integration with the Mediterranean, Orient/East-Med and Rhine-Danube CNCs. The tentative maps were prepared with the concerned countries and endorsed at the WB6 Summit held in Vienna in 2015 (EC, 2015; EC, 2016a).

The Connectivity Agenda agreed between the Western Balkans countries and the EU paved the way for priority projects identification and put the basis for leveraging investments in transport infrastructures, through the Western Balkans Investment Framework (i.e., WBIF)[12], the CEF and the Instrument for Pre-

---

[11] The signatory parties were the governments of Albania, Bosnia and Herzegovina, Croatia, the former Yugoslav Republic of Macedonia, Montenegro and Serbia and the United Nations Mission in Kosovo and the EC.

[12] Beyond national budgets and other financing instruments, the WBIF plays an important role in the SEE region. The WBIF was launched in 2009 by the EC, together with the Council of Europe Development Bank, the European Bank for Reconstruction and Development, the EIB, bilateral donors and subsequently KfW and the World Bank.

accession Assistance (i.e., IPA II). The WB6 has made the connectivity agenda one of its highest priorities, emphasising also the importance of the development of technical standards and soft measures to align and simplify cross border procedures, railway reforms, information systems, road safety and maintenance schemes, unbundling and third party access.

2.2.3 Eastern Partnership initiative and the extension of the TEN-T

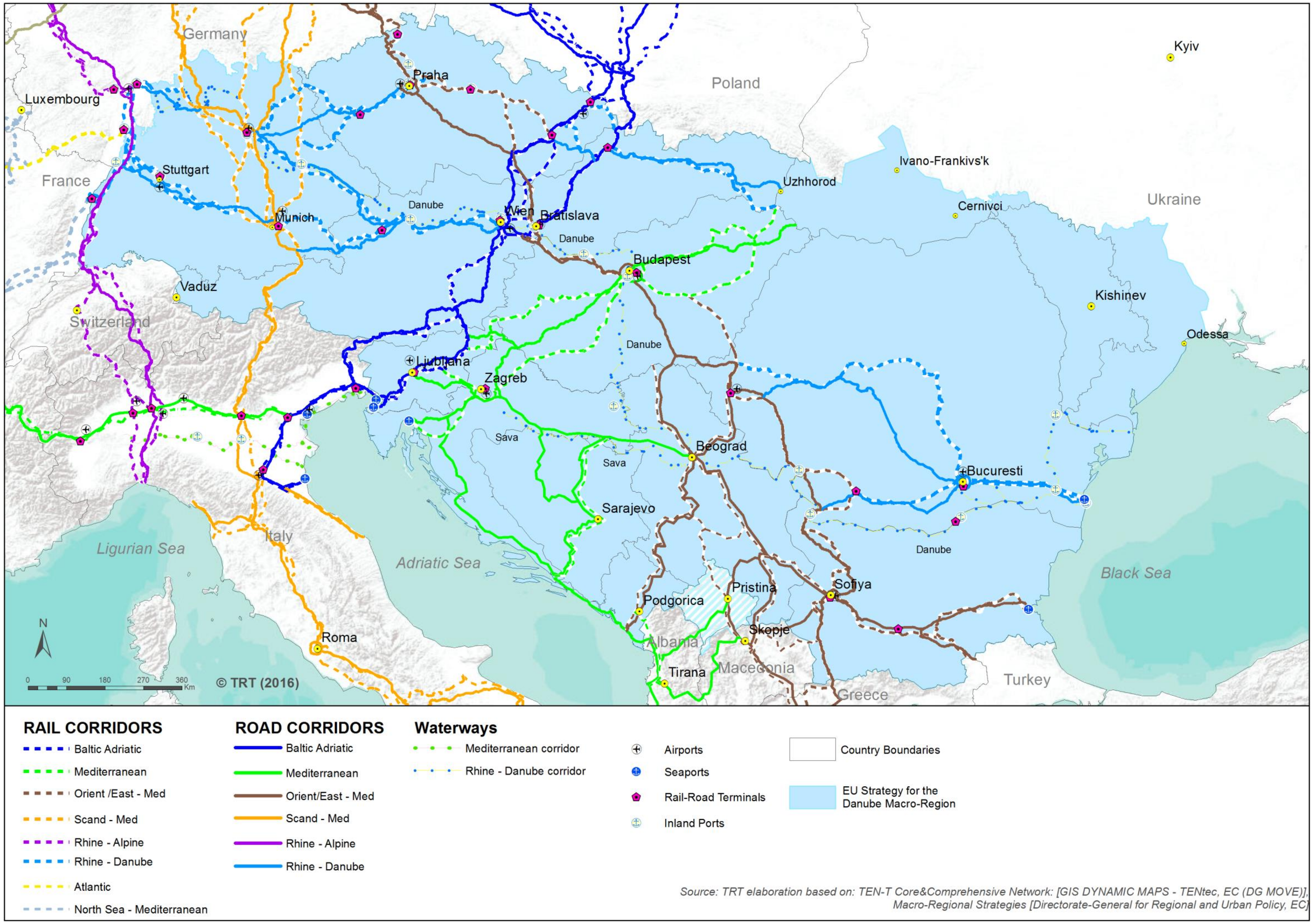
The development of the transport network infrastructures towards the Eastern Partnership (i.e., EaP) countries[13] is one of the key elements of the European Neighbourhood Policy (EP, 2014). The EaP initiative was established in 2009 building on bilateral relations to deepen the EU's cooperation with its neighbours towards the Eastern Europe and South Caucasus. With respect to the transport sector, the EaP initiative includes (i) the extension of TEN-T towards the EaP regional transport network, (ii) the regulatory convergence and (iii) regional cooperation and capacity building actions in all transport modes. To achieve a closer transport market integration with the neighbouring countries, in 2011 the EC published the EU Neighbourhood Transport Action Plan[14] and identified the actions needed.

In this view, the EC has established the EaP Transport Panel, which brings together the EC, the neighbouring countries, the EU Member States and the IFIs to discuss and plan networks integration and delineate a pipeline of infrastructure projects. The work of the EaP Transport Panel receives inputs from the other transport initiatives active in the region, notably the TRACECA programme and the EU Strategy for the Danube Region. The transport network of strategic interest for the TEN-T extension in this region has been agreed with the EaP countries. The list of priority infrastructure projects on the EaP regional network was endorsed at the meeting between the EU and EaP Transport Ministers held on 9 October 2013. The identified projects are financed through the financial envelope that EU provides from the European Neighbourhood Instrument (i.e., ENI) and complemented with funds of the IFIs. The financial envelope of the ENI is channelled through (i) bilateral programmes, (ii) multi-country programmes and (iii) cross-border cooperation programmes between EU Member States and partner countries.

[13] Beyond Moldova and Ukraine, the EaP also comprises Armenia, Azerbaijan, Belarus and Georgia.

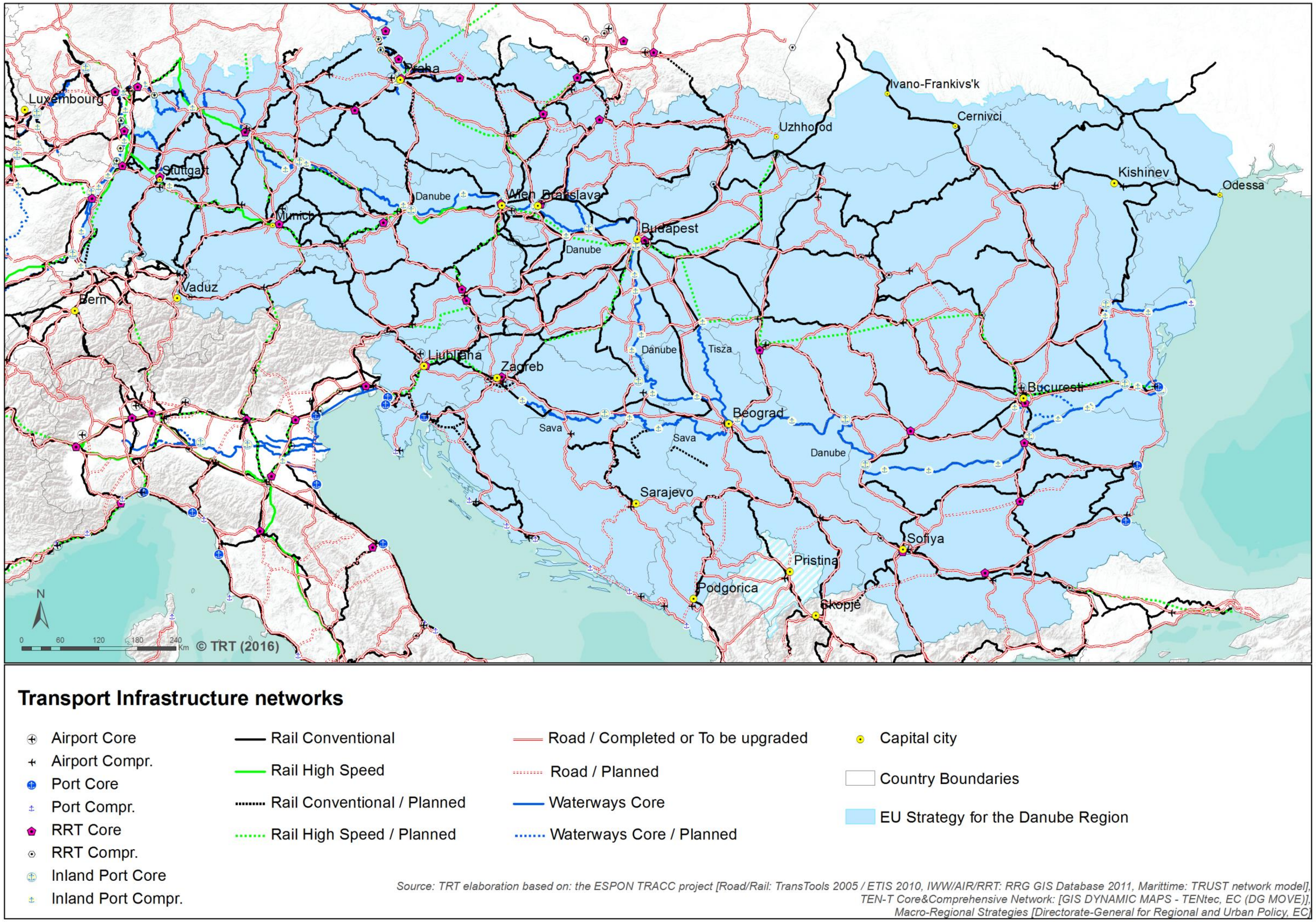
[14] The measures are set out in detail in the Communication on "The EU and its neighbouring regions: A renewed approach to transport cooperation".

Figure 2-5: TEN-T CNC crossing the Danube Macro-Region



Source: TRT elaboration based on: the ESPON TRACC project [Road/Rail: TransTools 2005/ETIS 2010, IWW/AIR/RRT: RRG GIS Database 2011, Maritime: TRUST network model], TEN-T Core and Comprehensive Network: [GIS DYNAMIC MAPS - TENtec, EC (DG MOVE)], Macro-Regional Strategies [Directorate-General for Regional and Urban Policy, EC]

Figure 2-6: TEN-T core and comprehensive network of the Danube Macro-Region



Source: TRT elaboration based on: TEN-T Core and Comprehensive Network: [GIS DYNAMIC MAPS - TENtec, EC (DG MOVE)], Macro-Regional Strategies [Directorate-General for Regional and Urban Policy, EC]

2.3 Transport demand

2.3.1 Current situation

The presentation on the current transport demand of the countries of the Danube Macro-Region drawn the information from different reference sources: outputs of modelling exercises, official databases and other documents developed for the region[15].

The transport demand volumes of **road and rail modes** have been elaborated chiefly on the basis of TRUST[16] transport model, which covers the EU Member States as well as accession and neighbouring countries. The Eastern Partnership regional transport study (TRT et al., 2015) integrates the previous source providing quantitative estimation of flow patterns on the EaP strategic transport network.

Table 2-2 summarises the total estimated volumes of freight and passengers modes with respect to the years 2010 and 2015[17]. The modal split is markedly in favour of the road transport, which dominates both freight and passengers. The variation of freight volumes through time shows a higher increase of the road mode compared to rail, while regarding the variation of passengers volume, this is higher for rail compared to road.

Table 2-2: Estimated volumes of transport flows for the countries of the Danube Macro-Region

Transport mode	Unit of measurement	Road		Rail		Total	
		2010	2015	2010	2015	2010	2015
Freight	thousand tonnes	937.657	989.476	220.147	224.764	**1.157.804**	**1.214.240**
	modal share (%)	81,0	81,5	19,0	18,5	**100,0**	**100,0**
	variation (%)		+ 5,5		+ 2,1		**+ 4,9**
Passengers	thousand passeng.	3.613.646	3.725.783	204.995	229.496	**3.818.679**	**3.955.280**
	modal share (%)	94,6	94,2	5,4	5,8	**100,0**	**100,0**
	variation (%)		+ 3,0		+ 12,0		**+ 3,5**

Source: TRT elaborations on TRUST transport model and Eastern Partnership regional transport study

According to REBIS (EC, 2003; IBRD, 2015), road and rail patterns in the Western Balkans are more intense on the recent extensions of the Mediterranean and Orient/East-Med CNCs (former Pan-European corridors Vc and X). Regarding the neighbouring countries, the portions of the Eastern Partnership strategic network showing significant flow patterns are in Odessa and Zakarpats'ka provinces, notably on the sections Odessa-Kiev and from L'viv to the border with Hungary and Slovakia (TRT et al., 2015).

The figures obtained also indicate that the transport flows of road and rail modes are mostly domestic and concentrate within the countries' borders. For instance, in 2010, the estimated domestic demand is around 90% of the total freight transported. The share of domestic passengers is even higher, being more than 95%. These findings suggest a short/medium distance nature of the transport demand.

With reference to the TEN-T CNCs, and their extensions to accession and neighbouring countries, the long distance demand segment has been roughly estimated identifying the road volumes in transit through the countries (namely, the volumes that are generated in one country, having destination in another country

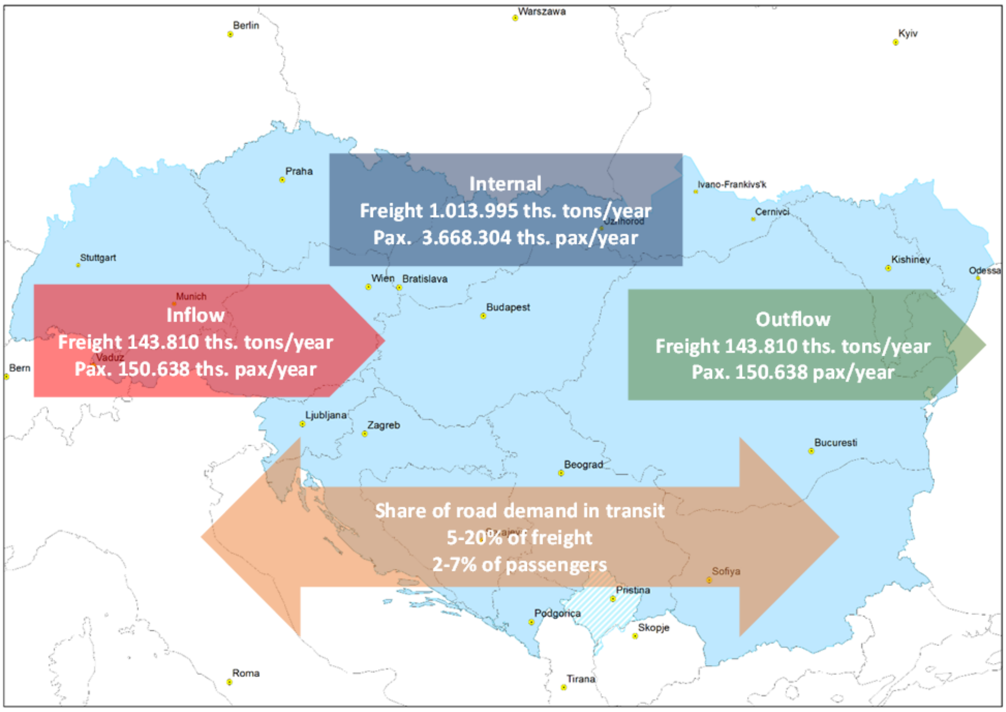
[15] See also the Interim Report on Multimodal Transport Overview by Functional Region (section 3) and the Interim Report on Current Transport Priorities and Developments (section 1.4).

[16] TRansport eUropean Simulation Tool. The TRUST model has been developed by TRT, building upon the TRANS-TOOLS transport network. TRUST allows for the assignment of Origin-Destination matrices at NUTS3 level, for passengers and freight and with respect to road, rail and maritime transport modes. The base year of the road and rail model relied on ETISPlus data.

[17] See also section 2 of Annex I.

and passing through a third one). The information elaborated with respect to the road mode suggests that the demand in transit could be in the interval 5%-20% for freight and 2%-7% for passengers.

Figure X-Y: Estimated volumes of transport flows for the countries of the Danube Macro-Region



Source: TRT elaborations on TRUST transport model and Eastern Partnership regional transport study

Differently from road and rail, air transport demand cannot be always allocated to one specific corridor and therefore the analysis of the volumes has been based on the trends of the Danube Macro-Region airports[18]. Between 2010 and 2015, yearly passengers traffic increased from 125 to 146 million (i.e., 17,3% or 3,5% per year), while cargo volume went up from 843 to 915 tonnes per year (i.e., 8,5% or 1,7% per year)[19]. Significant shares of passengers and cargo transit through the hubs of Munich and Vienna (respectively 44% and 67% in 2015), while other primary international airports are in Bucharest, Budapest, Praha and Sofia; the airports of Belgrade and Zagreb are regional hubs in the Western Balkans (IBRD, 2015).

According to the available data, business travellers are the largest customer group of Scandinavian-Mediterranean and Rhine-Danube CNCs' airports, possibly suggesting that this demand segment is more likely in the airports of Southern Germany and Austria. On the other hand, tourists and migrant communities are the largest groups of the Western Balkans ones. In this area, the demand of tourists concentrates in the Adriatic Sea airports, with significant peaks during the summer season, while the low intra-regional demand appears influenced by a relatively short distance amongst the airports (i.e., 75-135 km; see also SEETO, 2016).

The demand volume of the maritime sector is generated by the Adriatic Sea (i.e., Slovenia, Croatia and Montenegro) and Black Sea (i.e., Bulgaria, Romania and Ukraine) ports[20]. Between 2010 and 2015, freight transport increment from 133 to 149 million tonnes (with average annual growth of 3%) was essentially

[18] See section 2 of Annex I. Data of volumes of the air transport mode have been elaborated on Eurostat database and national and airports statistics.

[19] According to Eurostat database and national and airports statistics.

[20] See section 2 of Annex I. Data of volumes of the maritime transport mode have been elaborated on Eurostat database and national and port statistics.

concentrated in the Black Sea ports, which handled 75% of the traffic. It is worth noticing that all countries recovered to pre-crisis levels, except Croatia and, to a lower extent, Romania. As regards the types of cargo, dry bulk goods accounts for the largest share, (i.e., 44% of the total volume), followed by liquid bulk goods (i.e., 28%) and large containers (i.e., 14%). The picture is different for maritime passengers, the Croatia ports hold almost the entire traffic (i.e., 99,5% of the total), which grew from 23 to 27 million passengers between 2006 and 2015.

Concerning the inland waterways, data of the Danube Commission shows that the volume of goods shipped on the Danube river from 2001 to 2014 has been oscillating, with dry and liquid bulk as the most frequently transported goods (CCNR, 2016 and Eurostat data)[21]. The majority of Danube river ports handles around 1-2 million tonnes annually, while those having a higher traffic (i.e., 3-4 million) are the ones with sea-river relations (the lower Danube ports in Romania and Ukraine) or with intense multimodal flows (such as the upper Danube Austrian port of Linz) (Danube Commission, 2015).

2.3.2 Aggregate indicative projections of key socio-economic parameters and demand volumes

The Danube Macro-Region projections of key socio-economic drivers and demand volumes for road, rail and air transport modes are presented in form of indicative annual growth rates from 2015 to 2030 and should be treated with caution, as built upon a wide range of information sources that vary both by time horizon and geographical scope.

The starting point of the analysis are the main findings of the six TEN-T CNC studies crossing the Danube Macro-Region. The EC's CNCs studies of 2014 rendered qualitative-quantitative forecasts based on multimodal market studies, highlighting the demand potential of the infrastructures in the area of influence of the CNCs. Basically, the forecasts cover two decades (i.e., 2010-2030) comparing a do-nothing scenario against development scenarios and elaborating on projections of key socio-economic drivers (i.e., population and GDP, mainly drawing from the EC Reference Scenario 2013, the OECD long term scenario and country level studies).

The high level overview carried out suggests that the road mode is expected to keep the largest share for both passengers and freight modes. The potential gains of rail modal share are assumed depending on the implementation of TEN-T rail infrastructure measures by 2030. With respect to the Rhine-Danube, Orient/East-Med and Mediterranean CNCs (those crossing more extensively the Danube Macro-Region countries), the picture is relatively diversified. While the western side countries (e.g., Southern Germany and Austria) hold the majority of demand volumes but are projected to grow at a lesser pace compared to the past, the countries of the eastern side show lower demand volumes with a higher growth rate.

For the Member States, the picture proposed by the EU Reference Scenario 2016 (Capros et al., 2016) up to 2050 refreshes and corroborates the TEN-T CNC studies' findings and allows to render some high-level projections. In this respect, concerning the key socio-economic drivers and demand volumes of the countries of the Danube Macro-Region from 2015 to 2030, it can be observed that:

1. the population is expected to reduce from 90,9 to 89,3 million of inhabitants (i.e., -1,7%): the countries displaying the highest contractions are Bulgaria (i.e., -10,0%), Austria (i.e., -3,8%) and Romania (i.e., -4,7%). Positive trends are only for Austria (i.e., 8,4%) and Czech Republic (i.e., 2,2%);
2. the GDP is expected to increase by 24,5%: the countries showing rates markedly above the average are on the eastern side of the Danube Macro-Region (i.e., Slovakia +52,5%, Romania +35,2% and Bulgaria and Hungary +34,9%); the two German Laenders show the lowest increase (i.e., +16,8%), however the GDP accounts for 49% and 46% of the total, respectively in 2015 and 2030;

[21] See also the Interim Report on Multimodal Transport Overview by Functional Region (section 6).

3. passenger cars will remain the dominant mode, although with a modal share declining from 73% to 71%; modal shares will grow for rail (from 10% to 11%) and – more substantially – for air (from 6% to 8% with the highest annual growth rate of +3,6%);
4. road mode will be still dominant for freight; the slight reduction of its modal share from 65% to 64% will be in favour of the rail mode (up from 24% to 25%), again depending on the development plan of TEN-T networks; inland navigation is projected unchanged through time with a share of approximately 10%.

The transport trends regarding the Western Balkans countries rely on the updated REBIS study (IBRD, 2015). The study compared the "Full SEETO" network against the "do-nothing" scenario within two macroeconomic contexts (i.e., low/moderate and moderate/high). Projections of key socio-economic drivers provided the bases to elaborate demand forecasts of road and rail networks and at airports up to 2030. Population projections assumed both positive and negative variations in the interval -0,3%-+0,4%. The annual GDP growth was expected to develop at different paces. More pronounced for Montenegro and Bosnia and Herzegovina (i.e., 1,7%-3,3%) and slower for Serbia (i.e., 0,6%-1,1%).

The highest road traffic projections concern the sections extending the TEN-T CNCs towards the Western Balkans[22]. In particular, on the extensions of the Mediterranean CNC in Bosnia and Herzegovina (i.e., Pan-European Corridor Vc) and Orient/East-Med CNC in Serbia (i.e., Pan-European Corridor X) especially around Belgrade. The highest rail traffic projections are on the sections of the Mediterranean CNC between Zagreb and Belgrade. The airports of these cities are expected to handle the majority of the traffic in this region.

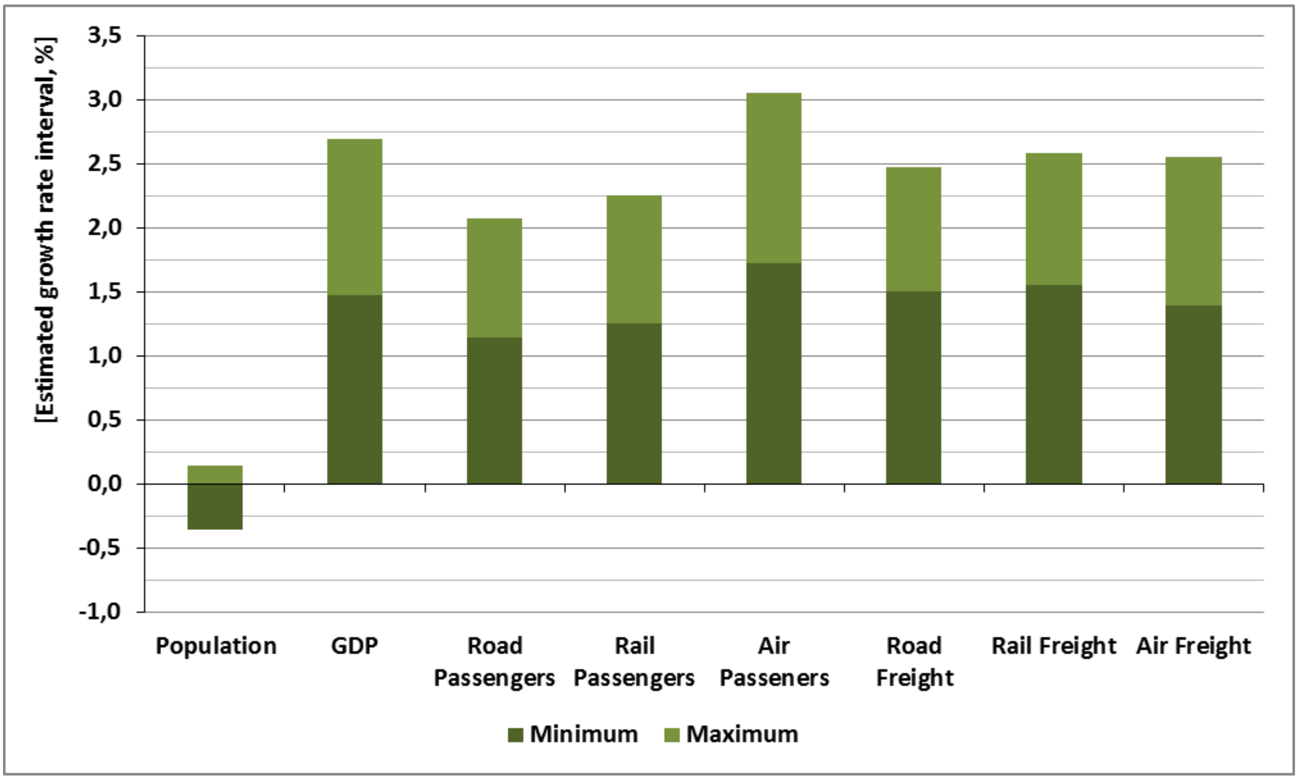
The estimations of future demand in the neighbouring countries draw from the Eastern Partnership regional transport study (TRT et al., 2015)[23]. The time period of the analysis extends up to 2030 assuming three development scenarios: business-as-usual (i.e., BAU), integration and stagnation, built upon IMF outlook and World Bank database. The key socio-economic drivers show similar variations for both Moldova and Ukraine, with respect to population (i.e., -0,4%) and GDP (i.e., 2%-5%). The demand trends of BAU and integration scenarios indicate a general increase, more visible on the rail sections Odessa-Ternopol and L'viv-borders with Hungary and Romania and on the road section Odessa-Uman-Kiev.

At national level the analysis screened transport plans and strategies of the countries of the Danube Macro-Region elaborated in the past[24]. The general picture obtained is markedly heterogeneous. Mostly developed through modelling exercises, the documents extend to a range of years from 2020 to 2050; they rely on usual key socio-economic drivers and present demand projections of transported volumes within the national borders according to different scenarios of growth.

The outlook elaborated on these sources provides with indicative ranges of projections for the Danube Macro-Region, regarding annual growth rates of population, GDP and demand volumes per transport mode (see Figure 2-7).

[22] See also the Interim Report on Current Transport Priorities and Developments (section 1.4.2).
[23] See also the Interim Report on Current Transport Priorities and Developments (section 1.4.3).
[24] See also the Interim Report on Current Transport Priorities and Developments (section 1.4.4).

Figure 2-7: Aggregate indicative projections of key socio-economic parameters and demand volumes of the Danube Macro-Region



Source: TRT elaborations on various sources

The population would either reduce or increase, possibly depending on migration patterns within the countries of the Danube Macro-Region or with the world outside. In general, the wealth of the countries is expected to improve at different paces. Higher improvements would be projected for countries of the Western Balkans and Eastern Europe (i.e., EU Member States and Accession countries) whereas the EU Member states of the Western Danube Macro-Region would improve at a slower pace.

With respect to the demand volumes, the road mode would be projected to remain the dominant one, both for passengers and freight. However, road share would decline through time in favour of rail depending on future infrastructures development. Where in competition with the land modes, transport by inland waterways, and especially on the Danube river, is not expected to grow significantly.

Air transport would increase appreciably on annual basis. Such projection can be corroborated analysing not only the demand trends. On the supply side, Eurocontrol (2010) foresees comparable growth rates of the air movements that again are more evident for countries of the Eastern EU Member States, Western Balkans and neighbouring countries. Due to limited information about air freight forecasts, the projection presented in the table has been estimated relying on demand elasticity with respect to GDP, building on literature review and concerning countries with a comparable socio-economic context (IATA, 2008; van de Riet et al., 2008; Wadud, 2014).

2.4 The transport network bottlenecks

In view to identify future transport projects, both physical and non-physical measures should ensure sufficient capacity according to current and future demand[25].

[25] See also the Interim Report on Multimodal Transport Overview by Functional Region (section 4).

Regarding the road mode, the TEN-T CNCs studies and the updated REBIS study indicate that physical bottlenecks are localised where infrastructures (i) are not compliant with technical standards and (ii) require rehabilitation, upgrading or widening measures. Capacity constraints may also occur in a specific time periods for high utilisation and nearby urban agglomerations, where traffic is mixed (i.e., long distance, regional and urban). The Eastern Partnership regional transport study concluded that Moldova and Ukraine have relatively balanced picture of volume to capacity ratio (TRT et al., 2015).

With respect to the rail networks of the TEN-T CNCs, basically bottlenecks depends on non-adequate technical characteristics that limits trains circulation (i.e. speed, length and axle load) and unevenness of adjacent sections (i.e., number of tracks and change of traction) (EC, 2014a;f). At cross-border sections, physical bottlenecks are also due to the difference of track gauge with Moldova and Ukraine. Major problems have been identified at national level for the networks of Eastern EU Member States[26], where circulation is also influenced by a generalised systems deterioration due to lack of maintenance, unfavourable geographical conditions and outdated rolling stock. A poor quality of rail infrastructures is visible also in Western Balkans (ACROSSEE, 2014; IBRD, 2015)[27] and Eastern Partnership countries (TRT et al, 2015).

The bottlenecks for air transport are mostly created by lack of airport and/or ATM capacity. Currently, these are less severe in the Western Balkans and EaP countries, where demand volume and air connectivity are low. However, these will need reconsideration in the light of the projected growth rates (Eurocontrol, 2010; IBRD, 2015). On the air side, bottlenecks delay air traffic causing sub-optimal allocations of slots for take-off and landing. On the land side, limitations exist at terminal buildings and aprons.

2.5 Environmental and safety aspects

Environmental issues related to air pollution of road transport mode have been considered to factor these aspects elaborating the study. According to ASTRA model and elaborations from KNOEMA database, not surprisingly, the cars – followed by the trucks – generate the largest share[28]. Concerning the geographical distribution the most developed Western EU Member States account for the majority.

According to figures from national statistics, the observed safety levels of the road mode show a generalised improvement (i) with respect to the number of accidents, (ii) the number of killed passengers and (iii) the number of injured passengers.

Despite the fact that rail infrastructures in the Eastern countries of the Danube Macro-Region in many cases suffer of shortage of investments and maintenance and are still not at the same level of efficiency of the rail networks of Western Europe, the safety level of the networks is still good (elaborating from figures of Eurostat database). However, there are specific black spots in Eastern countries of the Danube Macro-Region as a consequence of infrastructures' obsolescence, like: the excessive number of level crossings and ineffectiveness of their security systems (e.g., absence of barriers, inadequate optical and luminous signalling, etc.), the absence of pedestrian underpasses inside the stations and inadequate and out of standards platforms.

Air transport has very good safety records as well (ICAO, 2016). However, reported events are too few to infer on trends.

---

[26] See AECOM (2014), Hungarian Transport Administration (2013), Ministry of Transport, Information Technology and Communications of Bulgaria (2010), Ministry of Infrastructure of Slovenia (2014), Ministry of the Maritime Affairs, Transport and Infrastructure of Republic of Croatia (2012) and OPD (2013).

[27] See also the Framework Transport Strategy of Bosnia and Herzegovina (2016) Spatial Plan of the Republic of Serbia (2010).

[28] See also the Interim Report on Multimodal Transport Overview by Functional Region (section 5) and follow-up analysis in the Interim Report on Current Transport Priorities and Developments (section 2.2).

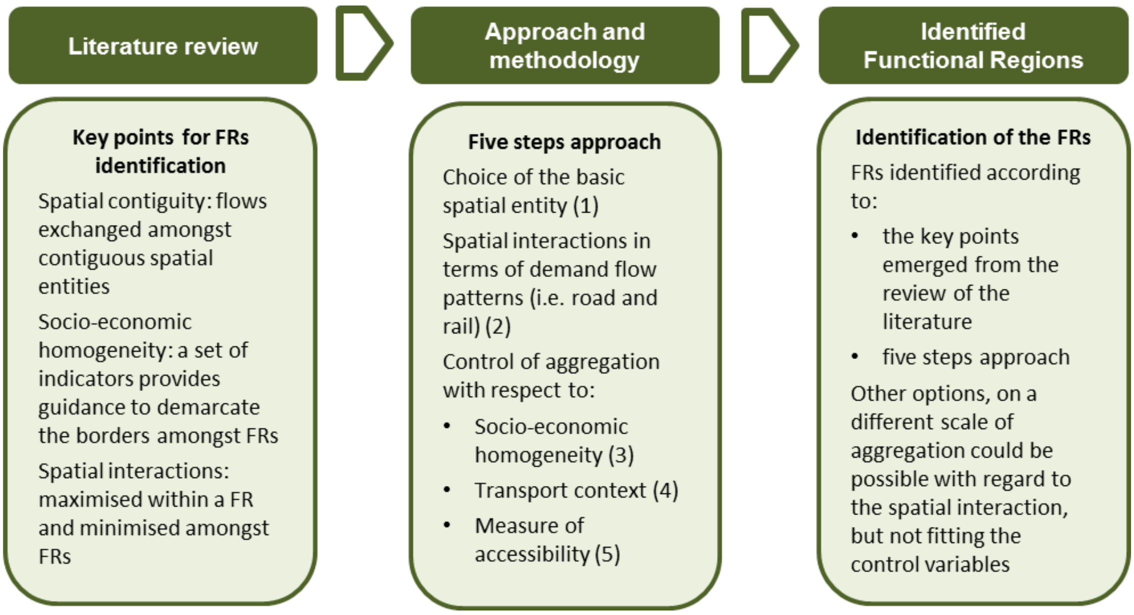
3 The Functional Regions of the Danube Macro-Region

This section presents the methodological approach developed to identify the Functional Regions (i.e., FRs) of the Danube Macro-Region. The FRs approach aims at creating an integrated multimodal transport study at regional scale within which factoring priorities and issues and localising future transport projects.

The FRs approach is a constructive way forward to analyse socio-spatial systems that may interact beyond the countries' borders. The rationale is to identify portions of a regional space, to better comply with actual interactions of the real world and fit the existing needs, like for example the bottlenecks of the transport networks.

To illustrate this approach, section 3.1 introduces the scientific literature investigated, section 3.2 presents the five steps that streamline the methodology and eventually section 3.3 presents the FRs identified.

Figure 3-1: The steps for FRs identification



3.1 Functional Regions in the scientific literature

The methodologies for delineation of the FRs are commonly based on the pattern flows of commuters and treated within the labour market context. Besides, the literature does not focus on FRs at the scale of analysis that fits this transport study, but rather to a much smaller scale (i.e., urban areas, metropolitan areas, counties, etc.).

Geographers and spatial, regional and social scientists introduced the first definitions of functional economic areas (Fox and Kumar, 1965; Brown and Holmes, 1971) as clusters of contiguous spatial entities, which display more travel-to-work interactions with each other than with other outside areas. Brown and Holmes (1971) define FRs as "*areas or locational entities which have more interaction or connection with each other than with outside areas*". OECD (2013) provides a more general definition of FR, namely a "self-contained" economic unit defined by economic and social integration rather than by administrative boundaries (e.g., NUTS) that does not reflect geographical particularities or historical events.

Considering the labour market context, Fox and Kumar (1965) found reasonable to identify functional economic areas of a territory with respect to commuting flows; Brown and Holmes (1971) and Karlsson and Olsson (2006) remarked that the FRs are characterised by high frequency of intra-regional interaction. The authors also delineated FRs in Sweden's labour market considering (i) the local labour market approach, (ii) the travel-to-work approach and (iii) the accessibility approach.

The research presented in OECD (2002) gives an extensive overview on a sample of 22 countries. The approaches used in identifying a FR mostly rely on the labour market context and the delineation of a FR is based on measures of interaction amongst spatial entities, in form of travel-to-work commuting conditions. The definition of the basic spatial entity emerges as not being univocally defined (i.e., urban areas, metropolitan areas, employment areas, commuting zones, and "self-sufficient" areas with limited interactions with other surrounding areas). Elaborating on the literature reviewed one can identify the following key points for FRs identification: (i) spatial contiguity (i.e., bordering), (ii) socio-economic homogeneity and (iii) spatial interactions.

3.2 Identification methodology

Starting from the spatial aggregation drafted in the technical proposal, the methodological approach to identify the FRs in the Danube Macro-Region followed the following five steps.

3.2.1 Step 1 - Choice of the basic spatial entity

With respect to the basic spatial entities, 26 units have been identified to disaggregate the EU Member States, the accession countries of the Western Balkans and the neighbouring countries (see Table 3-1).

Table 3-1: Basic spatial entities assumed in the Danube Macro-Region

Groups of countries	Classification	Basic spatial entity per country
EU Member States	NUTS1	• Austria: AT1, AT2, AT3 • Bulgaria: BG3, BG4 • Croatia: HR0 • Czech Republic: CZ0 • Germany: DE1, DE2 • Hungary: HU1, HU2, HU3 • Romania: RO1, RO2, RO3, RO4 • Slovakia: SK0 • Slovenia: SI0
Accession countries of the Western Balkans	NUTS1[29]	• Bosnia and Herzegovina: BA0 • Montenegro: ME0 • Serbia: RS0
Neighbouring countries	n. a.[30]	• Moldova: MD • Ukraine: Zakarpats'ka, Ivano-frankivs'ka, Chernivets'ka, Odes'ka

Source: TRT elaboration on Eurostat website

3.2.2 Step 2 - Spatial interactions

The spatial interactions amongst basic spatial entities have been analysed adapting the definition of FR as in Brown and Holmes (1971), namely: "*areas or locational entities which have more interaction or connection with each other than with outside areas*". In this respect, the variables used to analyse the

[29] The classification assumed with respect to Bosnia and Herzegovina, Montenegro and Serbia has been defined according to the official classification of these countries as displayed on the Eurostat website.

[30] The classification assumed with respect to Moldova and the 4 provinces of Ukraine have been checked against the principles and characteristics of the NUTS nomenclature. The NUTS regulation defines minimum and maximum population thresholds (i.e., NUTS1 3,00-7,00 million of inhabitants, NUTS2 0,80-3,00 million of inhabitants and NUTS3 0,15-0,80 million of inhabitants). According to latest official statistics on the population, Moldova can be classified as a NUTS1 spatial entity, and the 4 provinces of Ukraine as NUTS2 spatial entities.

spatial interactions amongst basic spatial entities relied on the intensity of the flows of freight and passengers of the land transport modes (i.e., road and rail).

To practically identify the FRs, a hierarchical clustering method has been implemented, inspiring from the FLOWMAP aggregation algorithm developed by the University of Utrecht (as mentioned in Feldman et al., undated). The algorithm was structured to provide a number of possible aggregations, relatively self-contained with regards to the spatial interaction patterns. Accordingly, in the macro-regional context of this study, two bordering basic spatial entities have been manually assembled together where a significant interaction is evident. This becomes the intra-regional interaction of the new resulting spatial entity. Then, the process was repeated in further attempts by adding other bordering spatial entities to the new resulting one. The aggregation process ends, and the border of the FRs is identified, where the intra-regional interactions soften, or *vice versa* where a minimisation of inter-regional interactions is evident[31].

The data on the spatial interactions amongst the basic spatial entities relied on two modelling exercises. The TRUST transport model (see also section 2.3) provided the flows of freight and passengers for road and rail of EU Member States, plus accession countries of the Western Balkans. Secondly, data of freight and passengers of Moldova and four provinces of Ukraine have been elaborated from the Eastern Partnership regional transport study (TRT et al., 2015).

The estimations of the two modelling exercises have been merged and assembled in form of a unique origin/destination matrix reflecting the assumed basic spatial entities (i.e., NUTS1). The flows exchanged have been analysed also considering the transport demand projections of the updated REBIS study (IBRD, 2015) and, where possible, integrated with considerations on the matrices of imports and exports on a country basis (and in monetary values) obtained from the UN Comtrade database[32].

3.2.3 Step 3 - Socio-economic homogeneity

The aggregations of the basic spatial units obtained in the previous step have been checked against a set of socio-economic characteristics and related trends. Specifically, the check considered (i) the surface extension, (ii) the demography patterns (e.g., total inhabitants and population density) and (iii) the basic socio-economic characteristics (e.g., GDP per capita, share of main sectors of the economy, inflation rate, unemployment rate and level of motorisation, etc.). This third step allows to control the degree of internal homogeneity and as well as the existing different levels of economic development emerged in section 2.1. Accordingly, the localisation of the borders amongst the FRs results where homogeneity variations occur.

3.2.4 Step 4 - Transport context

This fourth step of analysis allows to control to what extent the FRs identified are embedded in the context of the TEN-T CNCs and SEETO and Eastern Partnership transport networks (presented in section 2.2). To recap, the Danube Macro-Region is (i) crossed by six TEN-T CNCs and (ii) incorporates the SEETO network and Eastern Partnership strategic network. Elaborating with respect to the basic spatial entities assumed, the Rhine-Danube CNC displays the highest number of crossings (i.e., 12). The Orient/East-Med CNC ranks second (i.e., 9 crossings), followed by the Mediterranean and Baltic Adriatic CNCs (i.e., 5 crossings each). The Scandinavian and the Rhine-Alpine CNCs appear relatively marginal to this context, with 2 and 1 crossings, respectively.

[31] Typically, in the transport sector domain, the borders discourage international interaction. The demand flow depends on the generalised cost of transport and crossing a border may imply a sudden jump, for example due to differences in infrastructure charging and fiscal policies. International differences, but also cultural and language differences may exacerbate (Rietveld, 2012).

[32] UN Comtrade is a repository of official international trade statistics (see http://comtrade.un.org/).

3.2.5 Step 5 - Measures of accessibility

In order to corroborate the analysis to identify the FRs, an additional check has been performed against the accessibility indicators and outcomes for both passengers and freight as per the outcomes of the research of ESPON (2015a; 2015b). In particular, the indicator of the Multimodal European potential accessibility of freight transport classified the spatial entities according to their proximity to the higher levels of economic activity (i.e., measured in terms of accessibility potential to GDP). This means that basic spatial entities displaying a high potential accessibility also have (i) more opportunities to arrange a spatially distributed value chain, (ii) more alternatives in terms of supply and (iii) demand market and so on. The outcomes on this measure of accessibility are shown in Figure 3-1 in Annex I.

3.3 The identified Functional Regions

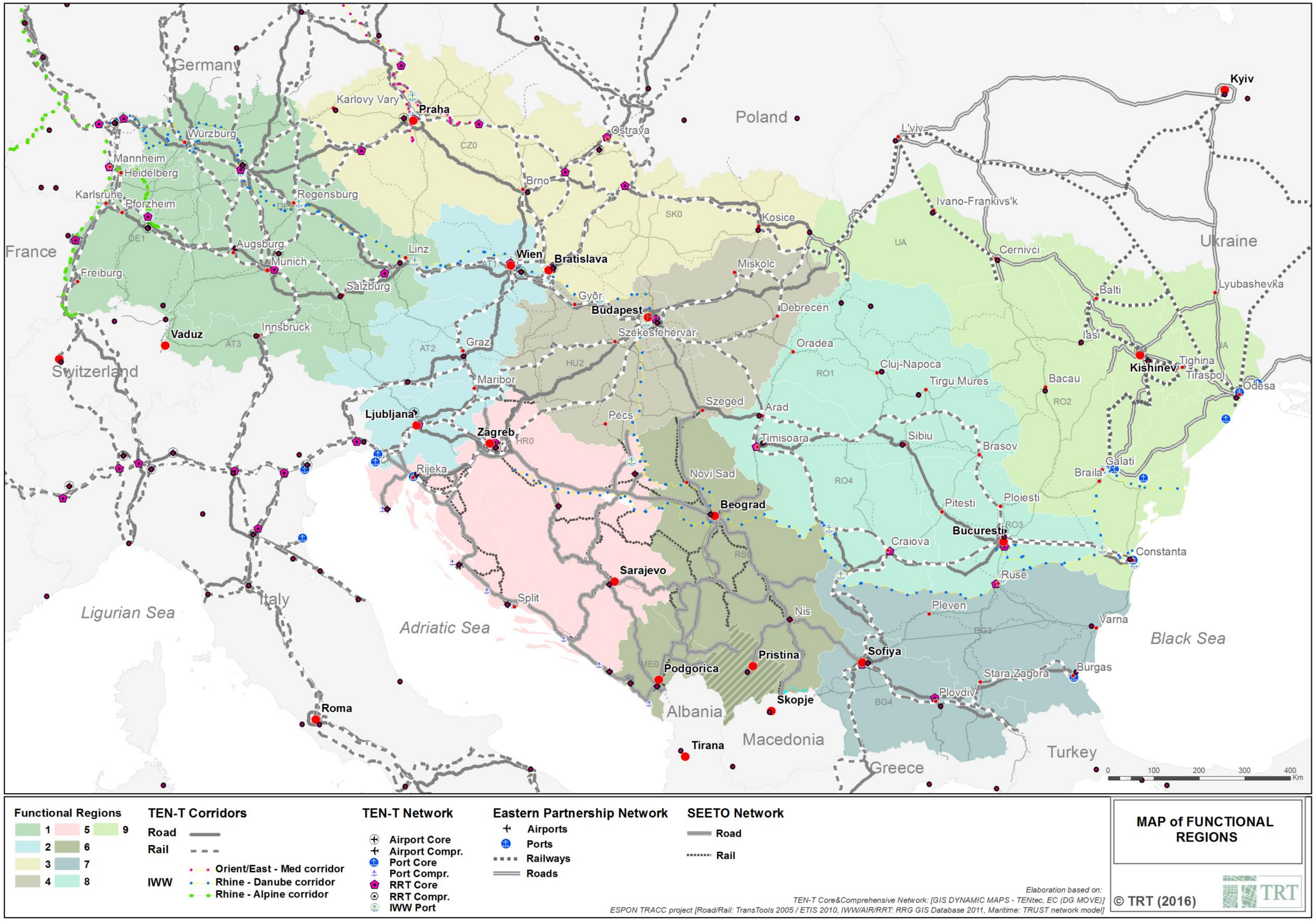
Based on the findings emerged from the literature review and following the five steps presented in the previous section, 9 FRs have been obtained as summarised in Table 3-2 and displayed in Figure 3-2.

Table 3-2: The FRs of the Danube Macro-Region

Nr.	Functional Region	Aggregation of the basic spatial entities
1	Southern Germany and Western Austria	DE1, DE2, AT3
2	Eastern Austria and Slovenia	AT1, AT2, SI0
3	Czech Republic and Slovakia	CZ0, SK0
4	Hungary	HU1, HU2, HU3
5	Croatia and Bosnia and Herzegovina	HR0, BA0
6	Montenegro and Serbia	ME0, RS0
7	Bulgaria	BG3, BG4
8	Western Romania	RO1, RO3, RO4
9	Eastern Romania, Moldova and provinces of Ukraine	RO2, MD, UA

Source: TRT elaborations

Figure 3-2: The FRs of the Danube Macro-Region

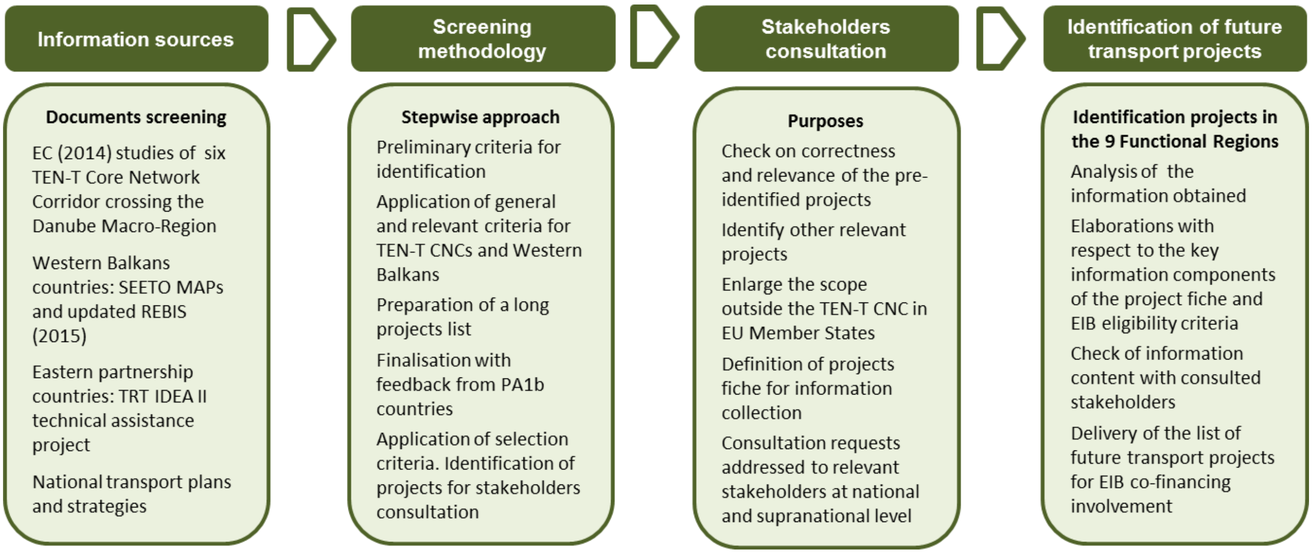


Source: TRT elaboration

4 Screening methodology for identification of future transport projects

The prime objective of the study is to identify a minimum of 20 transport projects that are financially and economically viable, technically sound and relevant for the Danube Macro-Region. The secondary objective is to select such promising projects to achieve a sound geographical coverage within the framework of the 9 FRs. The screening methodology to identify the future transport projects started from a broad scope of information sources presented in section 4.1[33] and is based on the criteria described in section 4.2. The future projects identified are listed in section 5.

Figure 4-1: Steps for identification of future transport projects



4.1 Information sources

To cover the broad heterogeneous geographical area of the Danube Macro-Region and to factor all the objectives of the study, several information sources - both at supranational and national level - have been screened.

4.1.1 TEN-T CNC studies

Concerning the EU Member States, the main starting points were the EC studies of the six TEN-T CNCs crossing the Danube Macro-Region (EC, 2014a; EC, 2014b; EC, 2014c; EC, 2014e; EC, 2014f). In particular, the attention focussed on the work plans elaborated in 2014 and listing the priority projects identified. The main objective of the TEN-T CNCs studies was the preparation of elements serving as a guideline for implementation and development of the CNCs by 2030. The studies contain the analyses developed to elaborate the work plans and ended identifying the necessary measures.

4.1.2 Western Balkans countries

The information of transport projects in Western Balkans countries have been obtained from two sources. On the one hand, the SEETO Multi Annual Plans (i.e., the MAPs) and, on the other hand, the updated Regional Balkans Infrastructure Study (i.e., the updated REBIS) (IBRD, 2015).

[33] See also the Interim Report on Multimodal Transport Overview by Functional Region (section 2).

The SEETO MAPs are issued on yearly basis. The projects are categorised in two groups, namely (i) the priority projects eligible for funding – with a completed feasibility study – and (ii) the priority projects for preparation – which require full project preparation. To obtain a comprehensive overview of the evolution of the pipeline, the SEETO MAPs have been scrutinised over a 6-year period (SEETO, 2010; SEETO, 2011; SEETO, 2012; SEETO, 2013; SEETO, 2014; SEETO, 2015).

The updated REBIS (IBRD, 2015) has been built upon from the previous version of EC (2003) and developed a priority action plan for enhancing the efficiency of the indicative extension of the TEN-T comprehensive network to the Western Balkans. The study analysed the main corridors/routes and identified key measures to alleviate both physical and non-physical barriers at improving the operation of the transport network. The updated REBIS reports as most urgent interventions those addressing the road transport network. The railway network is deemed sufficiently addressed with preservation operations. With respect to the airports, the existing air services emerged being adequate to meet the demand in short and medium terms.

The information sources analysis also considered the agreement reached by the WB6 and regarding the integration with the Mediterranean, Orient/East-Med and Rhine-Danube CNCs. In this respect, a Connectivity Agenda has been agreed between the Western Balkans countries and the EU for priority projects identification (EC, 2015; EC, 2016a) (see also section 2.2.2).

4.1.3 Eastern Partnership countries and extension of the TEN-T network

With respect to the neighbouring countries of Moldova and the 4 provinces of Ukraine, the information of transport projects relied on the data collected from the Eastern Partnership regional transport study (TRT et al., 2015). This study developed a prioritisation exercise to deliver a pipeline of transport and logistics infrastructure projects having regional or sub-regional significance. Notably, the projects were identified according to their degree of contribution to the Eastern Partnership initiative in view to obtain a balanced and sustainable extension of the TEN-T network. In this respect, the transport network of strategic interest for the extension of the TEN-T in this region were agreed with the concerned countries developing the Eastern Partnership regional transport study.

4.1.4 National transport plans and strategies

At national level, all the current national transport plans/transport strategies have been checked. The documents are heterogeneous in terms of approach and content, but give a fair description to get a high-level picture at national level in the context of the Danube Macro-Region. All in all, the documents have been issued in recent years and extent the analyses of future scenarios and projects prioritisation to mid and long term horizons (i.e., 2030 and 2050).

4.2 The screening methodology

The above mentioned information sources gave guidance to identify the projects. A stepwise screening methodology was elaborated to develop a starting list on which initiate a stakeholders consultation and end up with a minimum of 20 future transport projects. The five steps are displayed in Figure 4-2.

Figure 4-2: Stepwise approach of projects screening methodology

Step	Information source	Screening methodology	Number of projects by transport mode		
1 Preparation of the long list	• TEN-T CNCs Studies • SEETO MAPs • updated REBIS • IDEA II Project • National plans and strategies	**Application of preliminary criteria for identification:** • Not yet financed • Estimated investment costs > € 25 million • Completed projects removed (end date before 2016 or close to present) • Merge adjacent sections	**279**	Road Rail Air Port	165 103 5 6
2 Preliminary selection from existing studies	• TEN-T CNCs Studies • SEETO MAPs • updated REBIS • IDEA II Project • National plans and strategies	**Application of general criteria for identification:** • Available information of investment costs and timing • Estimated investment costs > € 50 million • Estimated starting date before 2023 **Application of relevant criteria specific for projects of TEN-T CNCs and Western Balkans countries**	**85**	Road Rail Air Port	35 43 6 1
3 Preliminary stakeholder consultation	• PA1b countries responses • New projects identified by key experts (6 rail, 6 roads)	**List of pre-identified projects adapted with:** • 20 new projects added from PA1b countries • 12 projects added on professional judgment • 3 projects removed • Merge other adjacent sections	**108**	Road Rail Air Port	48 51 6 3
4 Projects list screening	TRT elaboration on criteria for selection	**Application of criteria for selection:** • Addressing bottlenecks • Sections where TEN-T CNCs overlap • Estimated investment costs > € 50 million • Relevance for the Danube Macro-Region • Part of national transport plans • Estimated starting date before 2023 • Maximum geographic coverage and modal balance	**51**	Road Rail Air Port	21 21 6 3
5 Stakeholders consultation	Identified stakeholders • Check correctness and relevance • Identify other relevant projects • Enlarge the scope outside the CNCs • Collect documents	**Adaptation of the pre-identified projects with stakeholders' consultations:** • 6 new suggested projects added • Completed or unviable projects removed • Projects documentation collected • Final projects identification	minimum **20**	Road Rail Air Port	tbd tbd tbd tbd

Source: TRT elaboration

1. Checking all the information sources, 691 projects were identified as potential candidates for selection. The first step set up a preliminary screening exercise reducing the initial number to 279 projects.
2. Relevant identification criteria were introduced for further elaborations and specifically for projects on sections of the TEN-T CNCs and in the Western Balkans countries.
   a. The projects on TEN-T CNCs were selected if (i) reporting physical bottlenecks, (ii) on cross-border sections and (iii) localised where the sections of the CNCs overlap[34].
   b. The projects in Western Balkans countries were selected if (i) displaying a high level of current priority of the road interventions listed in the updated REBIS, (ii) eligible for funding in SEETO MAPs and (iii) for preparation in the SEETO MAPs mentioning bottlenecks.

   By the application of such general and relevant criteria per specific group, a preliminary list of 85 projects was assembled.
3. Before the application of the selection criteria, additional project were added to the list: 20 projects emerged from a preliminary stakeholders consultation with PA1b countries[35] and 12 from other sources (6 for the road mode and 6 for the rail mode).
4. The application of the selection criteria, which was not homogenous across the FRs and required adaptations to address specific situations, led to a list of 51 projects, of which 34 part of a main list and additional 17 projects meant as reserves.

   The choice of projects to be included in the main list compared to those to be included in the list of so-called reserves, is due to the following criteria (i) the geographic coverage amongst the FRs and (ii) the mode distribution. In facts, these criteria have produced the list of the main projects with regard to air mode and substantially defined the projects of FRs, particularly those of the Western Balkans and Eastern Europe. Section 4.2 of Annex I summarises the allocation of the projects by FRs and modes.
5. Starting from these 51 projects, the team of experts started the consultation with the relevant stakeholders (i.e., national transport ministries, infrastructure managers of the three PA1b transport modes, the regional organisation of SEETO, PA1b Steering Group members, JASPERS and TEN-T CNCs advisers – see the full list of consulted stakeholders in Annex I).

The purpose to bring the identified projects to the attention of the stakeholders was manifold. Firstly, to check on the correctness and relevance of the projects for the country. This step has been necessary to validate the projects and eliminate those no longer in the pipeline (and identify the reason). Secondly, to identify other projects not emerged during the screening exercise, but deemed relevant at country level. Thirdly, to enlarge the scope of the research also outside the TEN-T CNCs (i.e., to all the comprehensive network). Finally, to obtain and collect suitable documentation, in view of presenting the projects.

The presentation of the projects has been streamlined according to a fiche template structured through eight key components and embracing: (i) the general description, (ii) the technical description, (iii) the project implementation timeline, (iv) the transport demand analysis, (v) the financial analysis, (vi) the economic analysis, (vii) the environmental analysis and (viii) the safety levels.

[34] It is worth remarking that the three relevant criteria have been applied in the order displayed. This means that the identified projects regarding physical bottlenecks can be also cross-border sections and/or located where TEN-T CNCs overlap. To the group obtained, the projects that are cross-border sections have been added. And finally, the group of projects located where the TEN-T overlap have been added to the previous two.

[35] 5 from Austria, 2 from Bulgaria, 3 from Hungary, 2 from Serbia and 8 from Bosnia and Herzegovina, respectively.

The consultation has been carried out by the team of experts in form of meetings and phone conference calls. Communication lines with the stakeholders have been kept also afterwards to complete and/or improve the information.

5 The identified future transport projects

Developing upon the screening methodology described in the previous section, 23 future transport projects have been identified in the context of the Danube Macro-Region, of which 13 for the road mode, 6 for the rail mode and 4 for the air transport sector.

With respect to this outcome of the study, it is worth remarking that during the consultation process 36 out of 51 pre-identified projects were dropped. As regards the motivations that led to take the decision to eliminate the projects from the pre-identified list, these are quite diverse: (i) non-revenue generating, (ii) implementation phase already started, (iii) EIB or other IFIs or third countries are already involved, (iv) projects financed through other funding sources (i.e., private, CEF grants or Cohesion Fund), (v) insufficient or not disclosed information and (vi) not a priority at country level.

Table 5-1 summarises the identified future transport projects by FRs and mode. Additional information on the right hand side illustrates the new projects emerged consulting the stakeholders and highlights those identified during this process not on sections of the CNCs. The short version of the fiches of the selected transport projects is presented in each dedicated section of the FRs (see from section 5.1 to 5.9).

Table 5-1: Summary of identified future transport projects by FRs and modes

Functional Region				Total	of which	
					new	non CNCs[36]
Southern Germany and Western Austria	0	1	0	**1**	0	0
Eastern Austria and Slovenia	0	3	1	**4**	1	1
Czech Republic and Slovakia	1	0	0	**1**	0	0
Hungary	0	2	0	**2**	2	2
Croatia and Bosnia and Herzegovina	1	1	0	**2**	0	0
Montenegro and Serbia	1	3	1	**5**	2	Not app.
Bulgaria	2	1	0	**3**	1	1
Western Romania	1	0	1	**2**	1	1
Eastern Romania, Moldova and Ukraine	0	2	1	**3**	1	Not app.
Total	**6**	**13**	**4**	**23**	**8**	**5**

Source: TRT elaboration on projects screening and stakeholders consultation

Table 5-2 shows a high-level overview of the main information and the Figure 5-1 illustrates the localisation of the projects. Annex II presents the long versions of the project fiches. It is important to underline that the information reported in these fiches has been obtained from the consulted documents and that the Consultant did not perform additional checks or further investigations on the original content and specifications.

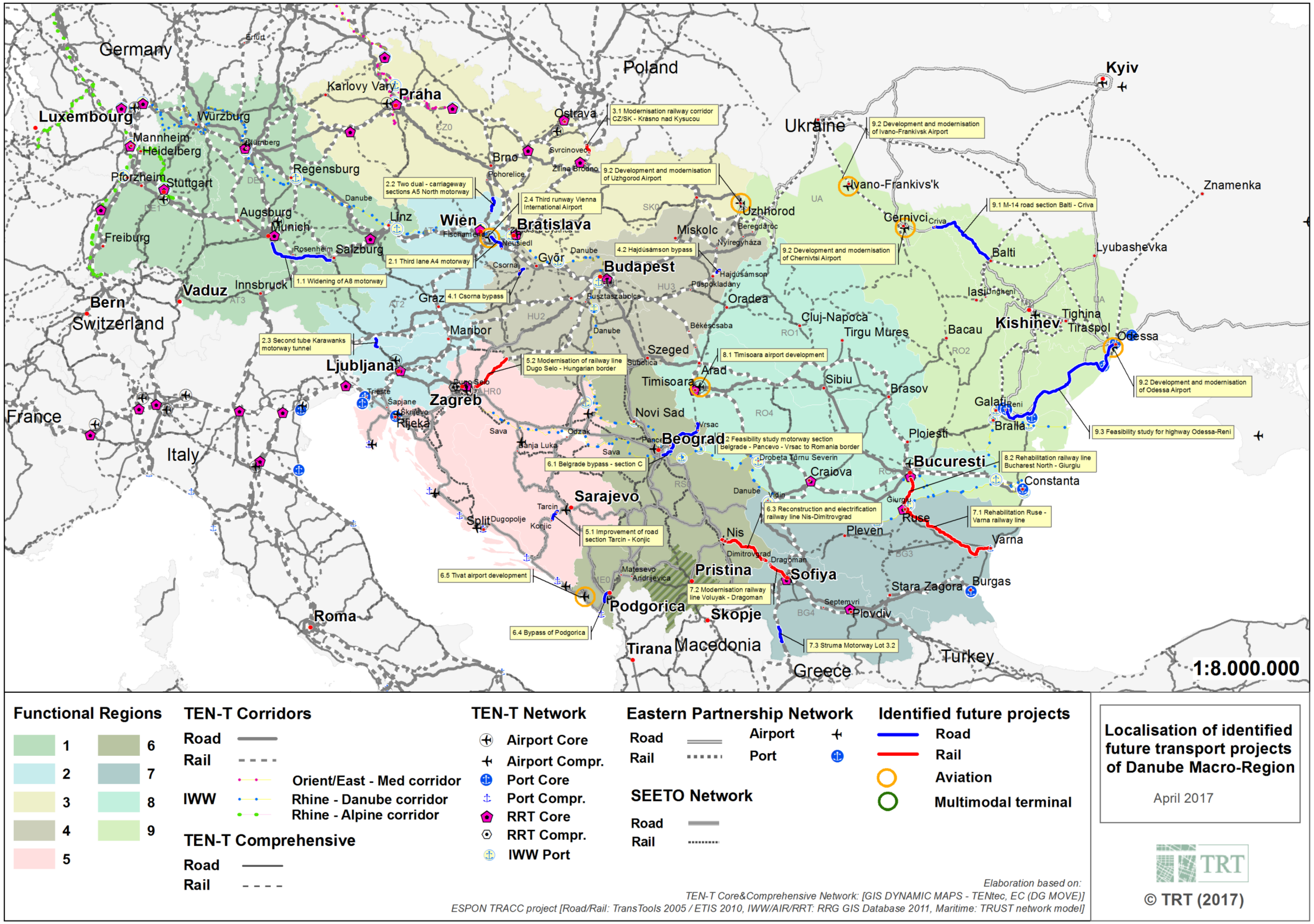
[36] This category is not applicable for projects in Bosnia and Herzegovina, Montenegro, Serbia, Moldova and Ukraine. According to the assumed allocation of FRs, the territory of Eastern Romania is not crossed by TEN-T CNCs.

Table 5-2: High level overview of the identified future transport projects

Functional Region	Project	Transport mode	Pre-identified or new	Transport network	Type of project	Critical issue	Estimated cost
1 - Southern Germany and Western Austria	1.1 - Widening of A8 motorway South of Munich to the German-Austrian border	Road	Pre-identified	Rhine-Danube CNC	Widening	Bottleneck	€ 1,36 billion
2 - Eastern Austria and Slovenia	2.1 - Construction of the third lane on the A4 motorway (sections Fischamend-West Bruck and West Bruck-Neusiedl)	Road	Pre-identified	Rhine-Danube and the Orient/East-Med CNCs	Widening	Safety	€ 244,7 million
	2.2 - Construction of two dual-carriageway sections as continuation of the A5 North motorway	Road	Pre-identified	Baltic-Adriatic and the Orient/East-Med CNCs	New construction	Missing link	€ 444 million
	2.3 - Construction of a second tube for the Karawanks motorway tunnel	Road	New (suggested by stakeholder)	Comprehensive network (connecting Baltic-Adriatic and Mediterranean CNCs)	Construction of the second road tube of the tunnel	Bottleneck and safety	€ 317,1
	2.4 - Construction of the third runway of the Vienna International Airport	Air	Pre-identified	Baltic-Adriatic CNC	Construction of the third runway	Bottleneck	€ 1,2 billion
3 - Czech Republic and Slovakia	3.1 - Modernisation of the railway corridor State Border of the Czech Republic/Slovak Republic-Čadca-Krásno nad Kysucou	Rail	Pre-identified	Rhine-Danube CNC	Modernisation	Bottleneck (speed limitation due to strong slope)	€ 5,48 million for project design
4 - Hungary	4.1 - Construction of Csorna bypass section, motor road M86-M85	Road	New (suggested by stakeholder)	Comprehensive network	New construction	Missing link	€ 47,6 million
	4.2 - Construction of Hajdúsámson bypass section, road 471	Road	New (suggested by stakeholder)	National network	New construction	Access to underdeveloped region	€ 33 million
5 - Croatia and Bosnia and Herzegovina	5.1 - Improvement of the road section Tarčin-Konjic of Corridor Vc	Road	Pre-identified	SEETO Corridor Vc (on extension of Mediterranean CNC)	Improvement	Corridor development	€ 469 million
	5.2 - Modernisation of the railway line Dugo Selo-Hungarian border (sections Dugo Selo-Križevci and Križevci-state border)	Rail	Pre-identified	Mediterranean CNC	Improvement	Bottleneck and missing link	€ 492,11 million
6 - Montenegro and Serbia	6.1 - Construction of the Belgrade bypass - section C	Road	Pre-identified	SEETO Corridor X (on extension of Orient/East-Med CNC)	New construction	Missing link	€ 282 million
	6.2 - Feasibility study of the motorway section Belgrade-Pancevo-Vrsac to Romania border	Road	Pre-identified	SEETO network	New construction	Missing link	Not defined
	6.3 - Reconstruction and electrification of the railway line Niš-Dimitrovgrad	Rail	New (suggested by stakeholder)	SEETO Corridor Xc (on extension of Orient/East-Med CNC)	Reconstruction and electrification	Bottleneck	€ 143,4 million
	6.4 - Construction of the bypass of Podgorica	Road	New (suggested by stakeholder)	SEETO Route R4 (on extension of Orient/East-Med CNC)	New construction	Missing link	€ 280 million
	6.5 - Tivat airport development	Air	Pre-identified	SEETO network	Modernisation	Operational capacity	€ 55 million
7 - Bulgaria	7.1 - Rehabilitation of the Ruse-Varna railway line	Rail	New (suggested by stakeholder)	Comprehensive network	Rehabilitation	Bottleneck	€ 383 million
	7.2 - Modernisation of the railway line Volujak-Dragoman	Rail	Pre-identified	Orient/East-Med CNC	Modernisation	Bottleneck	€ 168 million
	7.3 - Construction of the Struma Motorway Lot 3.2	Road	Pre-identified	Orient/East-Med CNC	Construction	Low technical standards and congestion	Depending on the alignment alternative Do-minimum € 39 million Project alternatives € 283-812 million
8 - Western Romania	8.1 - Timisoara airport development	Air	New (updated CNC work plan)	Orient/East-Med CNC	Improvement	Operational capacity	€ 78,3 million
	8.2 - Rehabilitation of the railway line Bucharest North-Giurgiu	Rail	Pre-identified	Comprehensive Network	Rehabilitation	Bottleneck (bridge collapsed)	€ 113 million
9 - Eastern Romania, Moldova and Ukraine	9.1 - Construction of the M-14 road section from Balti to Criva	Road	Pre-identified	Strategic Eastern Partnership	Improvement	Poor conditions and safety	€ 133,6
	9.2 - Development and modernisation of four airports	Air	New (suggested by stakeholder)	Not applicable	Development and modernisation	Operations efficiency, reliability and safety	€ 60,37 million
	9.3 - Feasibility study of the construction of the highway Odessa-Reni	Road	Pre-identified	Strategic Eastern Partnership	New construction and reconstruction	Poor conditions	To be properly defined

Source: TRT elaboration

Figure 5-1: Geographical localisation of the identified future transport projects

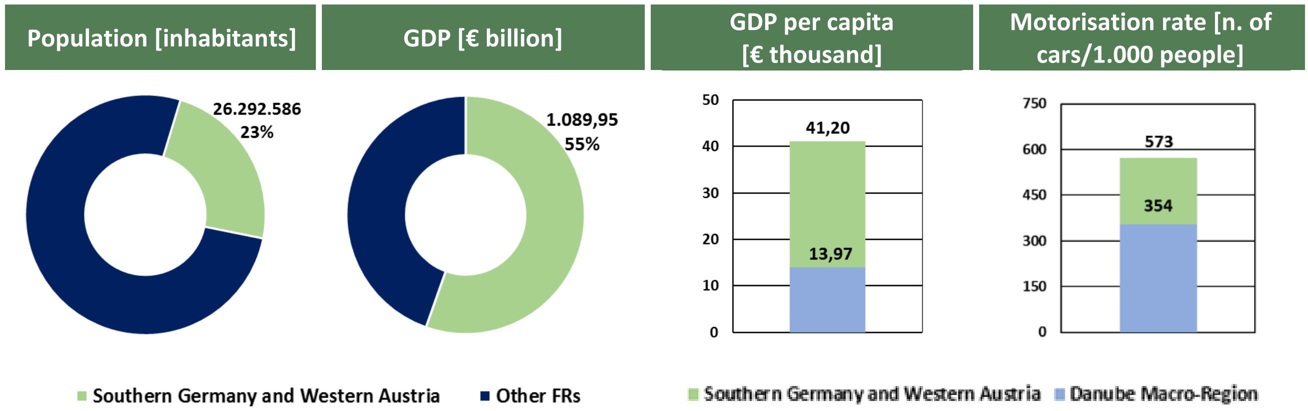


Source: TRT elaboration

5.1 FR 1 – Southern Germany and Western Austria

The FR1 assembles three basic spatial entities, namely the two German Laender of Baden-Württemberg and Bayern, with the bordering territory of Western Austria.

5.1.1 Socio-economic characteristics

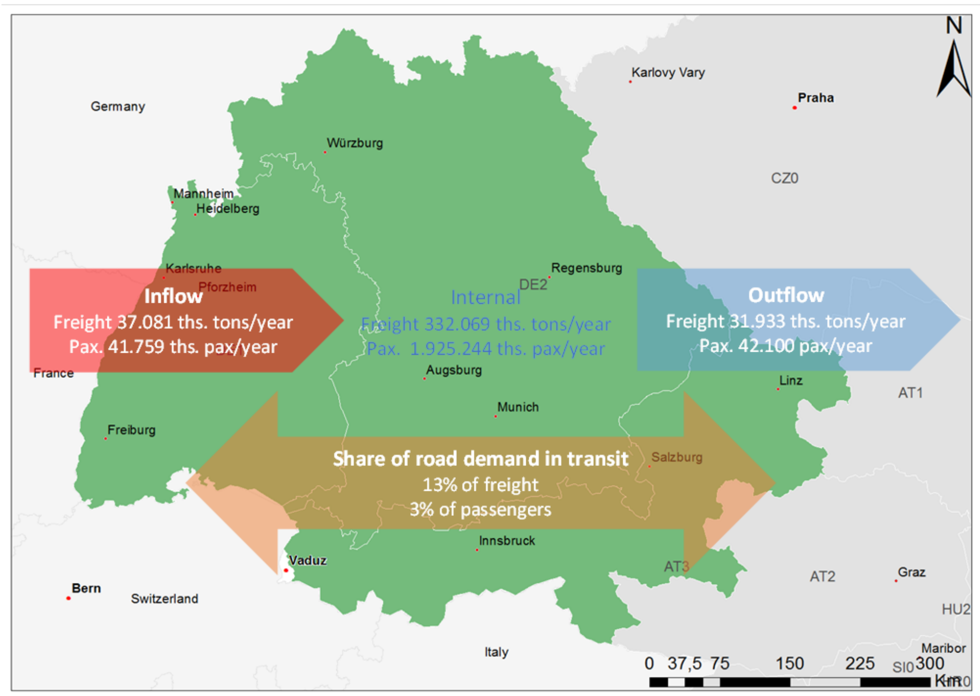


Source: Eurostat (2016), World Bank (2016) and National Statistics (2016)

5.1.2 Transport demand and infrastructures

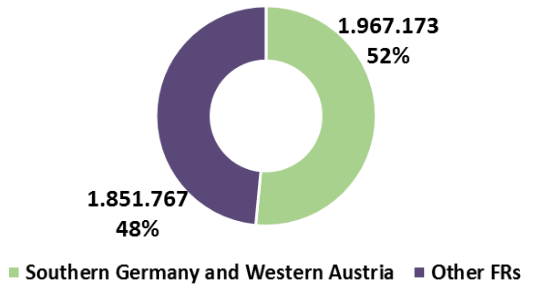
The road and rail demand volume of the FR1 gathers a significant share of the total estimated of the Danube Macro-Region. In this respect, the freight and passengers volumes account for 32% and 52% of the total, respectively. More specifically, the road and rail freight demand exchanged internally accounts for 28,7% of the total of the Danube Macro-Region, while the passengers transport demand holds 50,4% of the total. As regards the estimated road volumes in transit, they account for 13% of the total road demand generated by the FR for freight and 3% for passengers (see Figure 5-2).

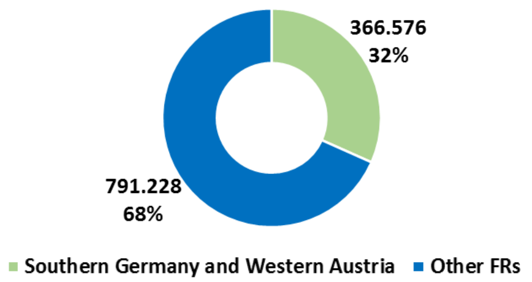
Figure 5-2: Road and rail transport flows of FR1



Source: TRT elaborations on TRUST (2016) and Eastern Partnership models (2016)

Passengers [thousand passengers/year]	Freight [thousand tonnes/year]





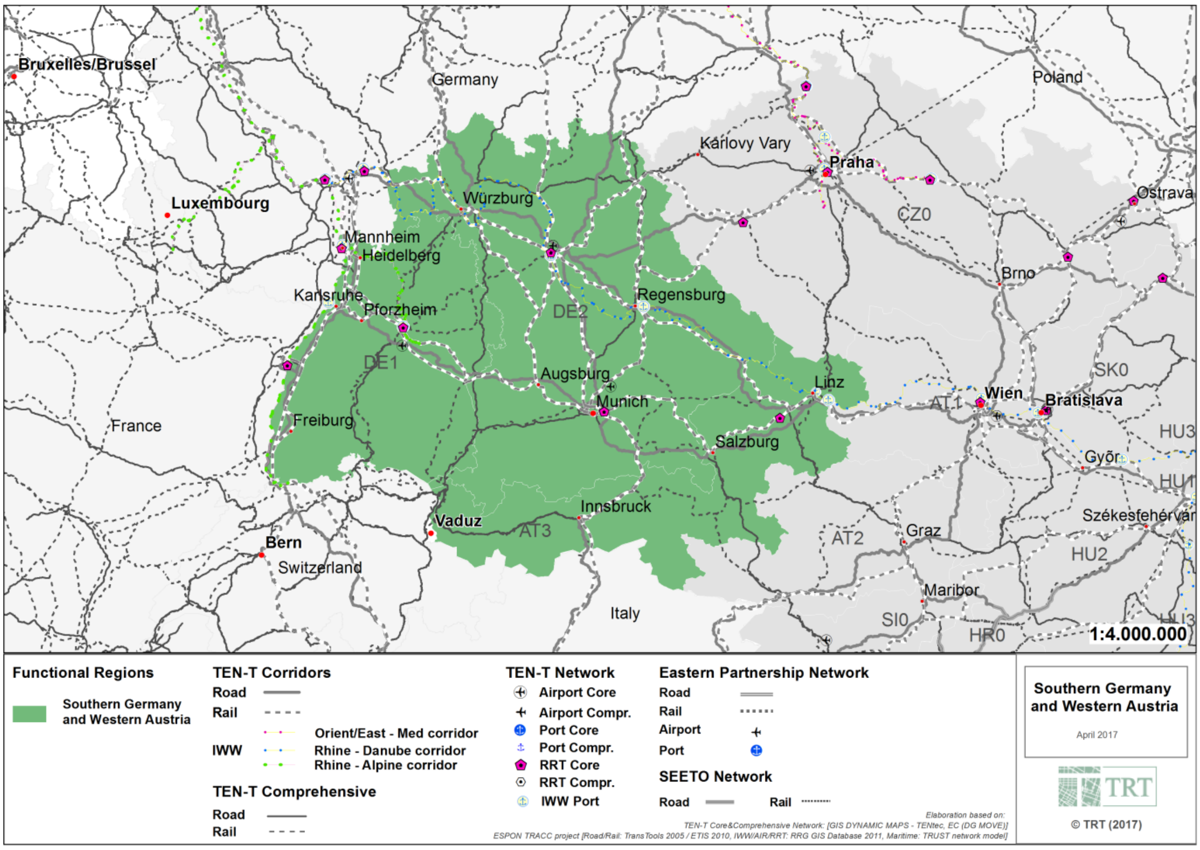
O/D	FR1	Other FRs	Total
FR1	1.925.244	42.100	**1.967.344**
Other FRs	41.759	1.809.838	**1.851.597**
Total	**1.967.003**	**1.851.938**	**3.818.941**

O/D	FR1	Other FRs	Total
FR1	332.069	31.933	**364.003**
Other FRs	37.081	756.721	**793.802**
Total	**369.150**	**788.654**	**1.157.804**

Source: TRT elaborations on TRUST (2016) and Eastern Partnership models (2016)

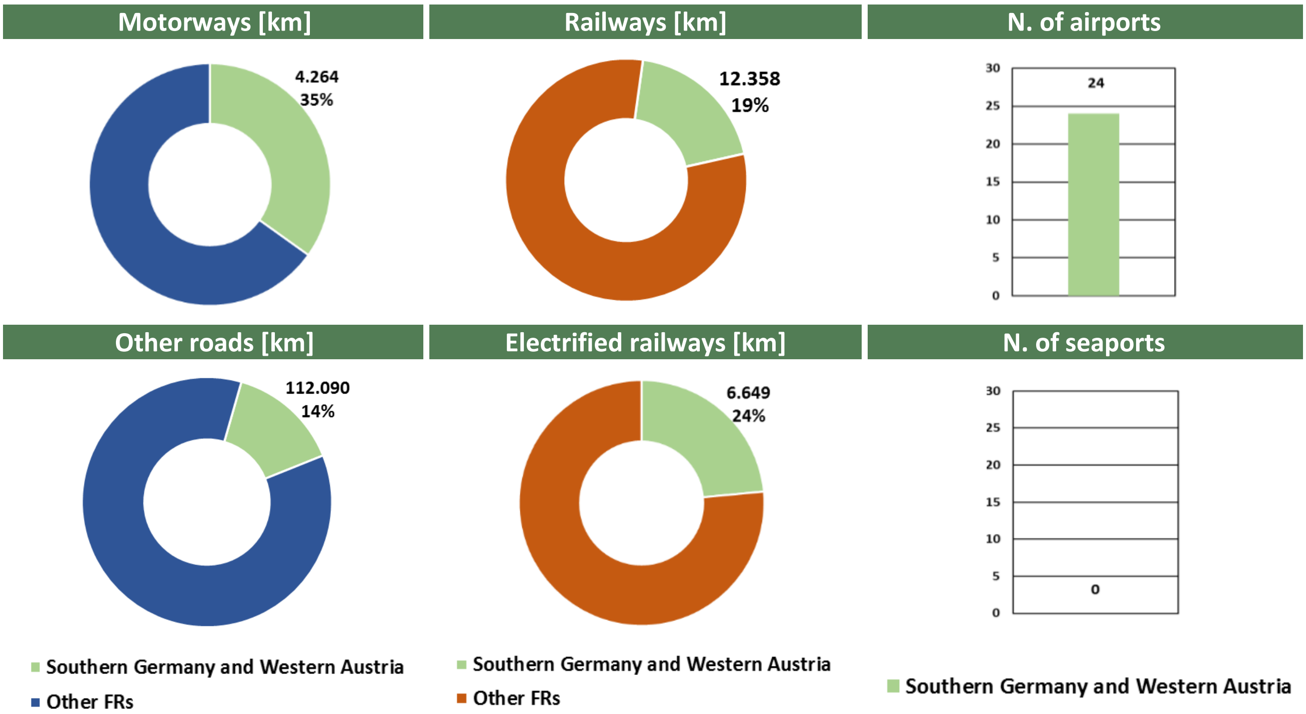
Regarding the air transport sector, in 2015, the passengers accounted for a 41% and freight volumes for a 47% of the Danube Macro-Region (i.e., 60 million passengers and 426 thousand tonnes), mostly concentrated in the German hub of Munich. Compared to 2010, the air transport of FR1 rose by 6% for passengers and 9% for freight, below the average of the Danube Region, namely 11% for passengers and 23% for freight. With respect to inland navigation on the Danube river, the port of Regensburg in Bavaria, and the port of Linz in western Austria, are the main river ports of the FR, with an annual throughput in 2014 of 2,2 and 4,3 thousand tonnes, respectively (i.e., 18% of the total handled in the ports of the Danube Macro-Region). With respect to the transport infrastructures, two TEN-T CNCs cross the FR1, namely the Rhine-Danube and the Scandinavian-Mediterranean CNCs (see Figure 5-3).

Figure 5-3: Transport network localisation of FR1



Source: TRT elaborations (2017)

With respect to transport infrastructures, both the motorway and railway networks of FR1 represent a significant share of the total networks of the Danube Macro-Region. Approximately one-third of the airport of the Danube Macro-Region is concentrated in the FR1 (i.e., 24).



Source: Eurostat (2016), National Statistics (2017), Bosnia and Herzegovina (2016), Ministry of Infrastructure of Ukraine (2017), TRT (2017)

5.1.2.1 Bottlenecks

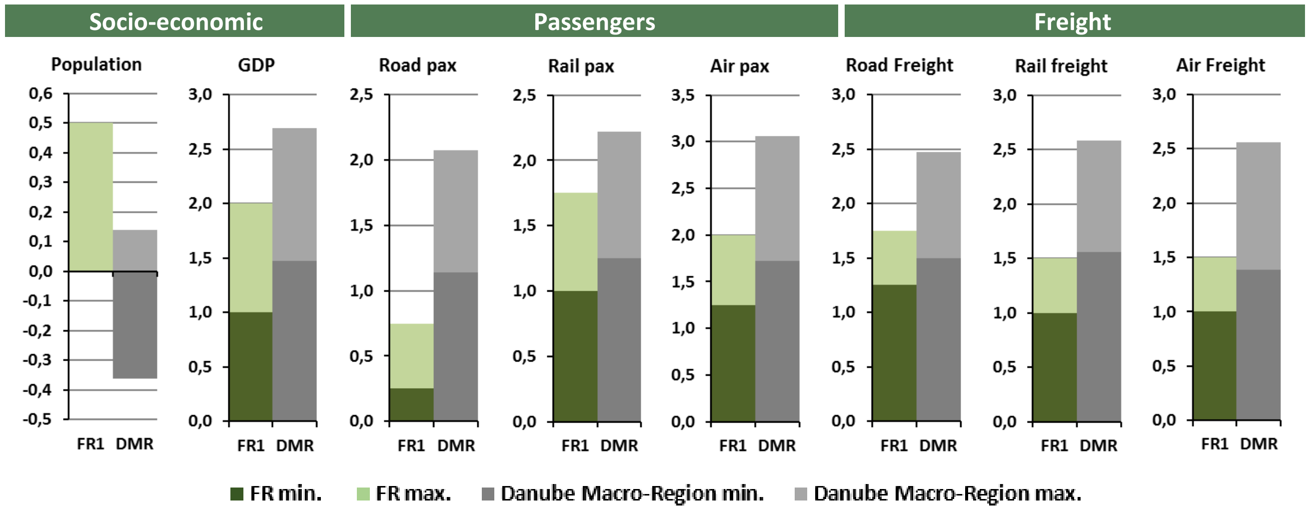
As regards the road network, congestion is localised around the urban agglomerations along the motorways and a limited truck parking capacity have been identified. Notably, on the Rhine-Danube CNC, the section from Munich to Salzburg[37] is considered a major bottleneck (EC, 2014d).

With respect to the railway network, capacity bottlenecks were identified for the multimodal terminals in Karlsruhe and Mannheim. Interoperability constraints from different electrification systems and a few non-electrified sections resulted in Germany on the Munich-Mühldorf-Salzburg line and on the cross-border sections with the Czech Republic. Capacity constraints exist on the line Ingolstadt-Munich, Munich-Kufstein and in the node of Munich (EC, 2014d). On the Rhine-Alpine CNC, the deployment of ERTMS is at an early stage of development, with only 12,3% of sections equipped (EC, 2014e).

5.1.2.2 Indicative projections of key socio-economic parameters and demand volumes

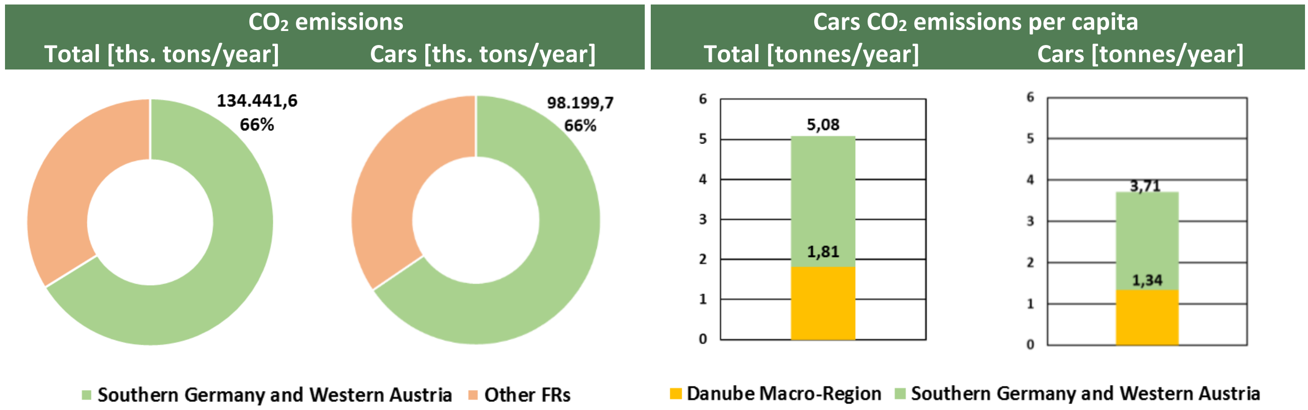
Except for the projected positive rate of change of the population, the annual projected rates of GDP and demand volumes could be expected below the average of the whole Danube Macro-Region. Migration patterns could maintain a positive population balance. Both GDP and demand volumes would growth slowly, given the current level of development of the economy and transport activities.

[37] The project "Widening of A8 Motorway from South of Munich to the German-Austrian state border" has been identified as a future transport project and the fiche has been developed.



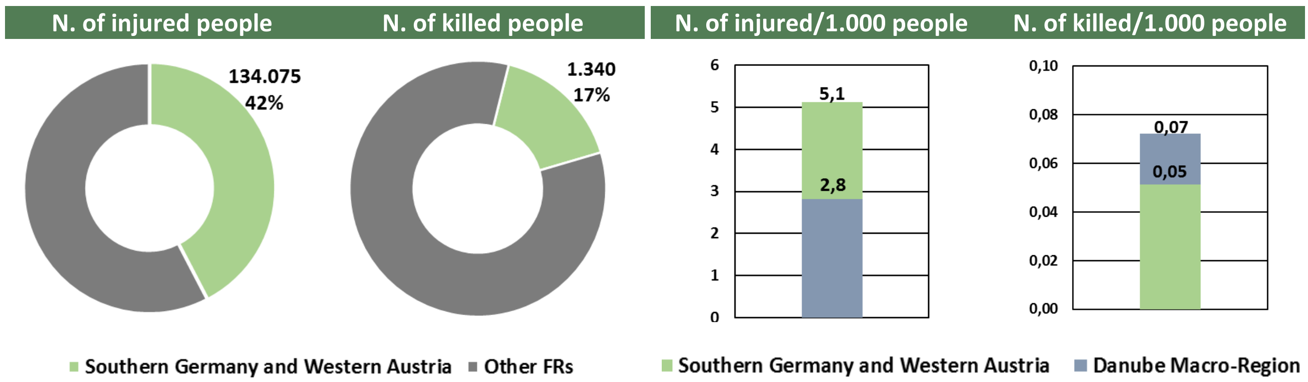
Source: TRT elaborations on Capros et al. (2016), EC (2014), National Transport Plans and Strategies

5.1.3 Environmental aspects



Source: TRT elaborations on the ASTRA and PRIMES models (2016) and the KNOEMA database (2016)

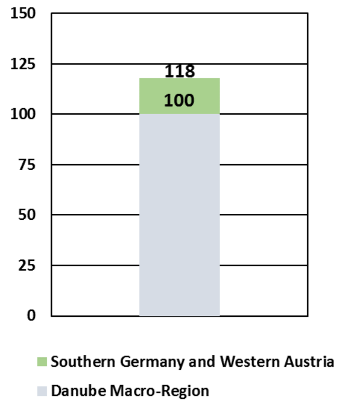
5.1.4 Safety aspects



Source: TRT elaborations on the OECD (2016), Eurostat (2016) and National Statistics (2016)

5.1.5 Accessibility

In terms of accessibility, the FR1 is on the top of the ranking, showing an index 18% higher than the average of the Danube Macro-Region.



Source: TRT elaborations from ESPON TRACC (2012)

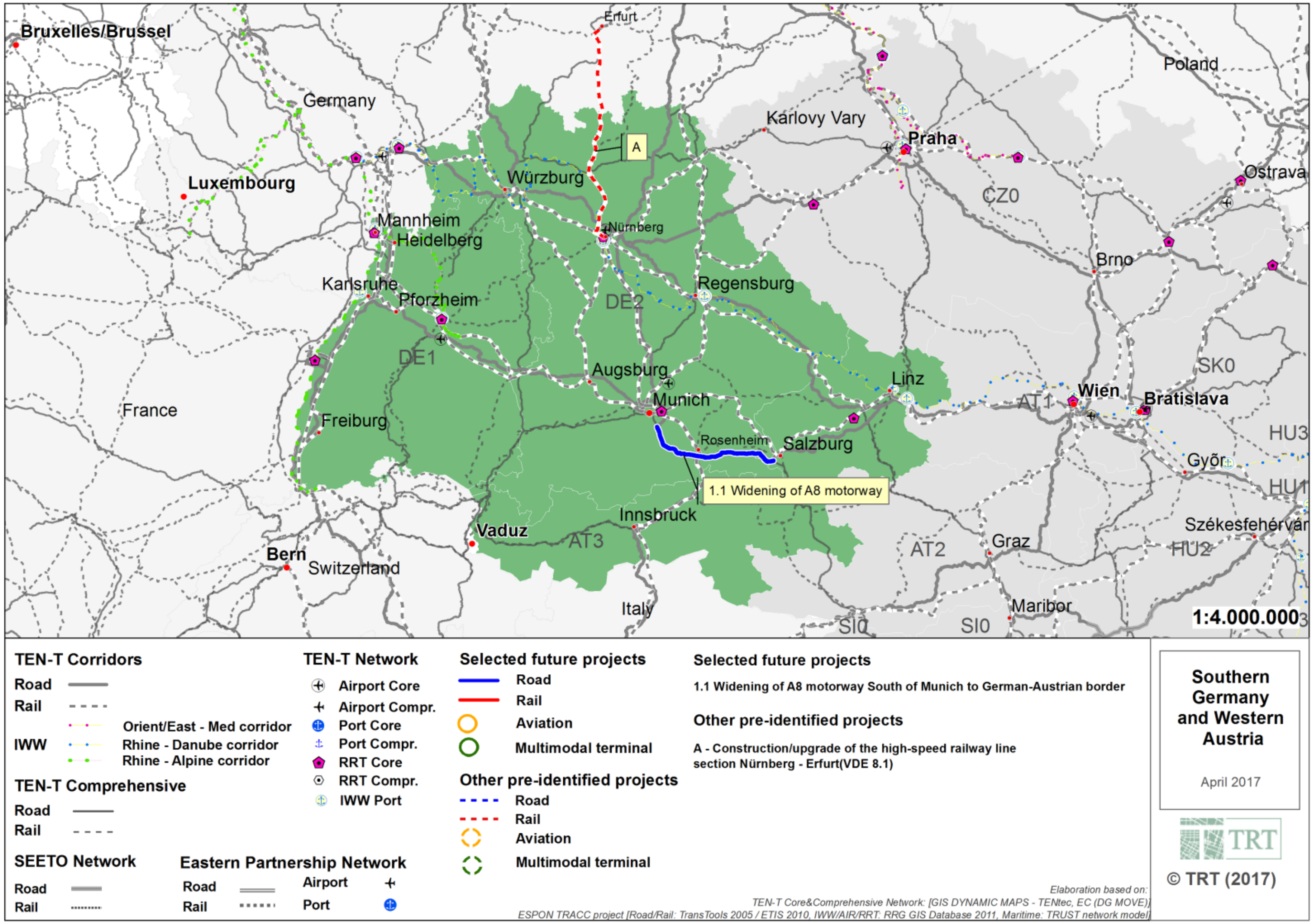
5.1.6 Key elements

- The FR1 is the most economically developed of the Danube Macro-Region.
- The road and rail demand volumes are a significant share of the total estimated of the Danube Macro-Region. Freight and passengers volumes account for 32% and 52% of the total. Internal freight demand accounts for 28,7% of the total, while the passengers transport demand holds 50,4% of the total. Road volumes in transit accounts for 13% of the total generated freight and 3% for passenger.
- Air passengers account for a 41% and freight volumes for a 47% of the Danube Macro-Region, mostly concentrated in the hub of Munich.
- Two TEN-T CNCs cross the FR1, namely the Rhine-Danube and the Scandinavian-Mediterranean.
- Both the motorway and railway networks are a significant share of the total of the Danube Macro-Region, namely 35% of motorways and 19% of railways.
- Road network congestion is localised around the urban agglomerations and along the motorways.
- Railway network bottlenecks are: multimodal terminals, interoperability constraints for different electrification systems and non-electrified sections. ETRMS deployment is at an early stage of development.
- The FR1 accounts for the largest share of the emissions of the Danube Macro-Region.
- The index of accessibility potential to GDP is higher than the average of the Danube Macro-Region.

5.1.7 Identified future transport projects

- Widening of A8 motorway South of Munich to the German-Austrian border

Figure 5-4: Map of identified projects in FR1



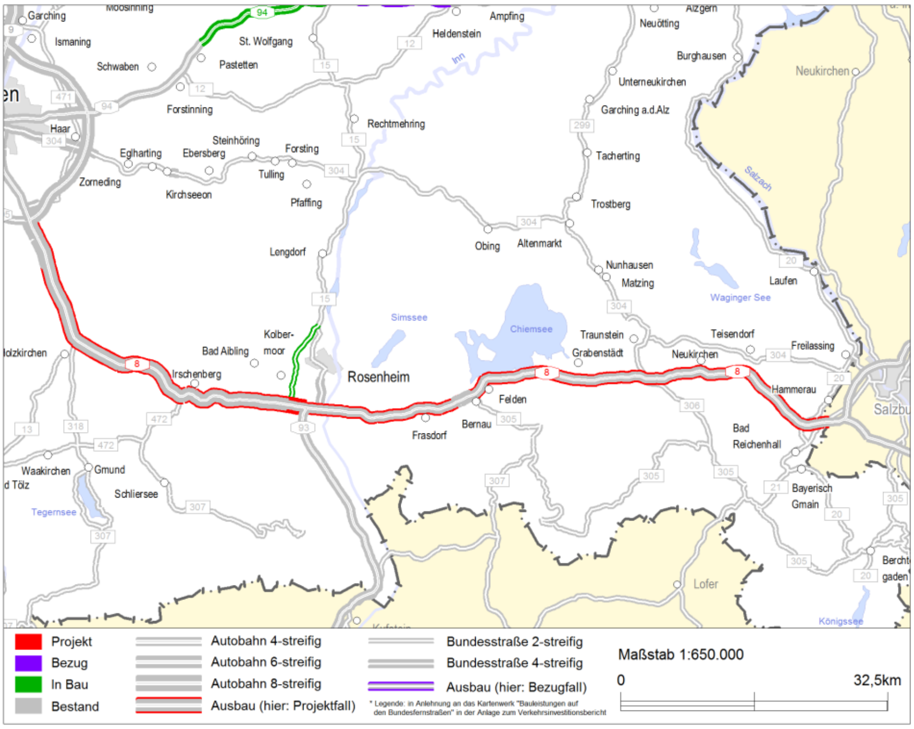
Source: TRT elaborations

5.1.7.1 FR1 Project 1.1 – Widening of A8 motorway South of Munich to the German-Austrian border

General information: this project regards the widening of the transversal section to 6/8 lanes of the A8 motorway, a section of the Rhine-Danube CNC from South of Munich to the German-Austrian border. The project is divided in four sections, for a total length of 116 km. The Figure 5-5 provides with the geographical localisation.

The project has been identified as a priority project in the 2030 Federal Transport Infrastructure Plan. The project promoter is the Ministry of Transport and the Free State of Bavaria. The project is meant to solve 17,3 km of bottlenecks and to improve traffic safety, transport quality and environmental protection (e.g., dewatering[38] and noise).

Figure 5-5: Alignment of A8 and widening project design (in red)



Source: BVWP website (2016)

Technical description: the A8 motorway is in poor conditions. The width is below the standards, the alignment elements do not meet current requirements in terms of position and height. Lateral lanes are missing, the central separation of the carriageways is too narrow and the acceleration lanes are too short. The route is without clothoids[39], with excessive longitudinal and transverse inclinations. Drainage is not assured by the poor quality of the pavement and, generally, there is no noise protection barriers. The total estimated investment cost accounts for approximately € 1,36 billion. There is no information available regarding construction costs breakdown by category.

Project implementation: the construction phase is expected to last 61 months but there is no complete information available with respect to the start/end date of the project. The only timing available refers to the sections Rosenheim-Achenmühle (i.e., 2016-2021) and Achenmühle-Bernau (i.e., 2017-2023).

38 Recovering of contaminated water.

39 The transition curves placed between a straight section and a turn with constant radius of curvature.

Transport demand: information on the transport demand is available for year 2030, with respect to both reference and project scenarios. There is no information on assumptions for the key drivers used to elaborate the trends. There are no specific indications regarding the composition of the demand in terms of segments (i.e., short or long distance). The share of trucks is expected to remain equal to 18% in both reference and project scenarios. The forecasts of project scenario at 2030 do not envisage a significant variation of daily traffic volumes compared with the reference scenario. The average volume from Munich to the state border with Austria is approximately 70 thousand vehicles per day in the reference scenario and 72 thousand in the investment scenario, respectively (i.e., a difference of 2,6%). The section with the most significant traffic growth is on the east side of Rosenheim, where the volume is expected to increase by 3 thousand vehicles per day.

Financial analysis: the financial analysis has not been carried out. It is worth remarking that the motorway network in Germany is free of charge, except for trucks of weight above 7,5 tonnes. Details are not provided for the financing mechanism.

Economic analysis: the economic analysis has been carried out drawing on the methodology for the Federal Transport Master Plan. The appraisal period assumed 5 years for the construction phase plus 32 years for the operating phase. The economic performance indicator shows that the project is viable, as the benefit/cost ratio is equal to 1,2[40]. The largest share of benefits derives from time savings (i.e., 68%), followed by savings of vehicle operating costs (i.e., 19%) and safety (i.e., 19%).

Environmental analysis: the environmental analysis concluded that impacts are in the low/medium range and in specific points (see Table 5-3).

Table 5-3: Description of the environmental effects of A8 widening project

Section	Estimated level of the impact[41]	Type of expected impact
Munich–Holzkirchen	Low	The excavations are carried out moving terrain between Brunnthal and Sauerlach, mainly through forest areas (Hofoldinger Forst). Natura 2000 sites are not affected.
Holzkirchen–Inntal	Medium	The project runs over strongly moved terrain with forest and agricultural areas, crossing 2 flora and fauna habitats (i.e., FFH).
Inntal–Traunstein/Siegsdorf	Medium	This section is located in a hilly landscape with grassland and wooded areas. Two overlaying FFHs and bird protection area on the Chiemsee lake are intersected. In order to improve ecological continuity, five new underpasses will be constructed.
Traunstein/Siegsdorf–border AT	Medium	To address environmental issues, a northern bypass variant in the municipality of Piding is deemed to be more cost-effective for nature protection. Both variants cross the FFH area of Marzoller Au and lead to considerable impairments.

Source: TRT elaboration from BVWP website (2016)

New noise protection facilities will be installed during project implementation according to noise protection legislation. New active measures (e.g., noise barriers and walls) will be accompanied by strict speed limits in the vicinity of the populated areas.

Safety levels: there is no specific information on safety issues and black spots, before and after project implementation. However, the socio-economic analysis highlights a significant amount of benefits derived from safety.

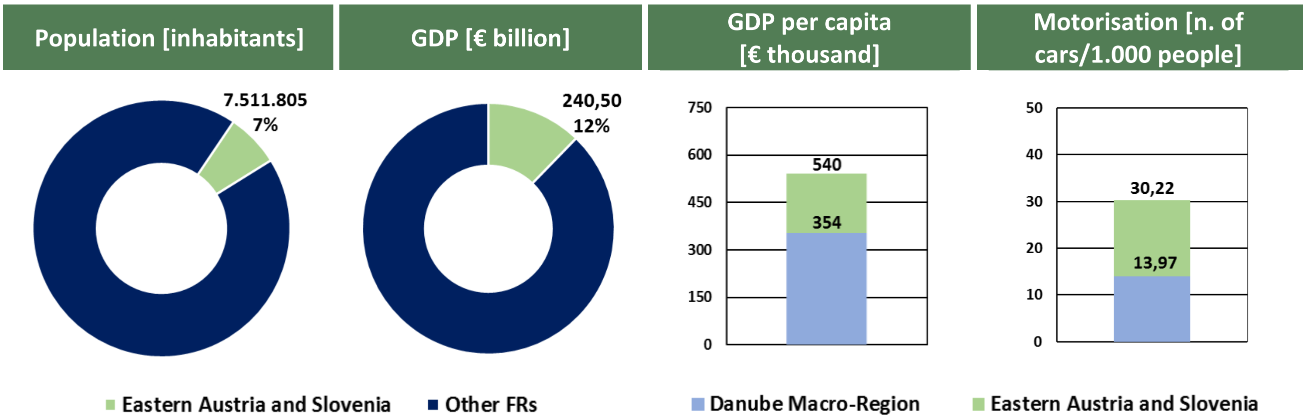
[40] According to the documents consulted, the ENPV and the EIRR are not calculated, there are no indications on a sensitivity analysis of the economic appraisal, on conversion factors from financial to economic inputs, nor for assumptions on the residual value of the investment.

[41] The reference source does not provide explanation regarding the basis of the qualitative scale of assessment.

5.2 FR 2 – Eastern Austria and Slovenia

The FR2 assembles three basic spatial entities, namely the Eastern and Southern territories of Austria with the bordering country of Slovenia.

5.2.1 Socio-economic characteristics

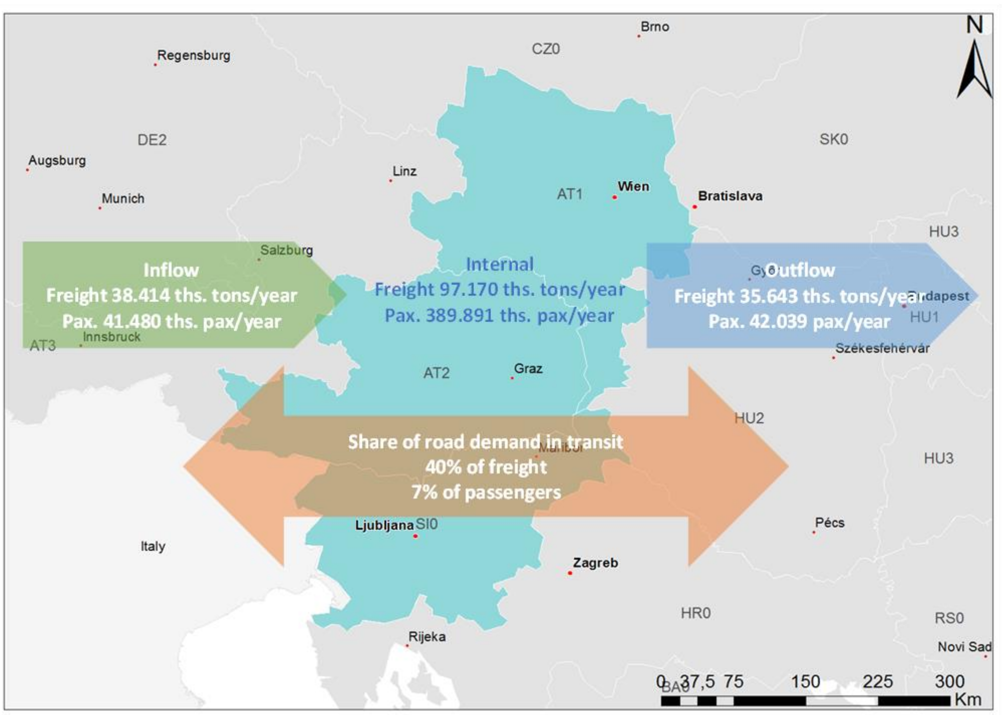


Source: Eurostat (2016), World Bank (2016) and National Statistics (2016)

5.2.2 Transport demand and infrastructures

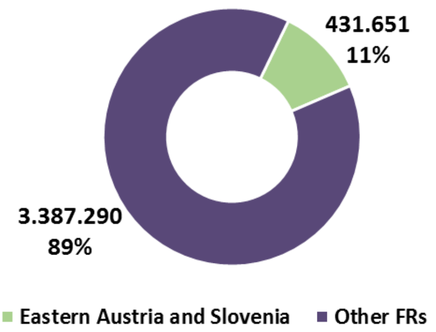
The estimated passengers and freight demand of road and rail modes represent the 11% and 12% of the total of the Danube Macro-Region. The estimated internal demand represents 57% of the total, while inflows and outflows hold approximately the same share, namely 22% and 21%, respectively. The internal demand rises to 82,4% regarding passengers transport, inflows and outflows holding 8,7% and 8,9% of the total. The estimated road transport volume in transits account for a 40% of freight and a 7% of passengers of the total road demand generated (see Figure 5-6).

Figure 5-6: Road and rail transport flows of FR2



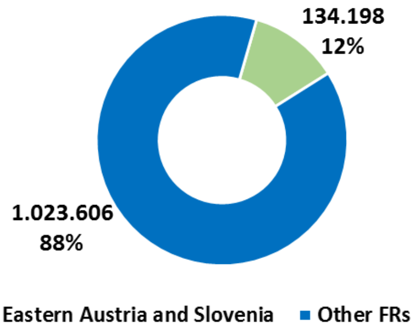
Source: TRT elaborations on TRUST (2016) and Eastern Partnership models (2016)

Passengers [thousand passengers/year]



O/D	FR2	Other FRs	Total
FR2	389.891	42.039	**431.930**
Other FRs	41.480	3.345.530	**3.387.011**
Total	**431.371**	**3.387.569**	**3.818.941**

Freight [thousand tonnes/year]



O/D	FR2	Other FRs	Total
FR2	97.170	35.643	**132.813**
Other FRs	38.414	986.578	**1.024.991**
Total	**135.584**	**1.022.221**	**1.157.804**

Source: TRT elaborations on TRUST (2016) and Eastern Partnership models (2016)

According to the available data for 4 airports of the FR2, in 2015, the passengers and freight volumes accounted for respectively 17% and 27% of the total of the Danube Macro-Region (i.e., 25 million passengers and 245 thousand tonnes). Compared with 2010, air transport of FR2 rose by 7% for passengers and 2% for freight (i.e., from 22,4 million passengers and 259 thousand tonnes, respectively), an increment significantly below the average of the Danube Region, 11% for passengers and 23% for freight. Within the FR2, 90% of passengers and 96% of freight transit through the hub of Vienna.

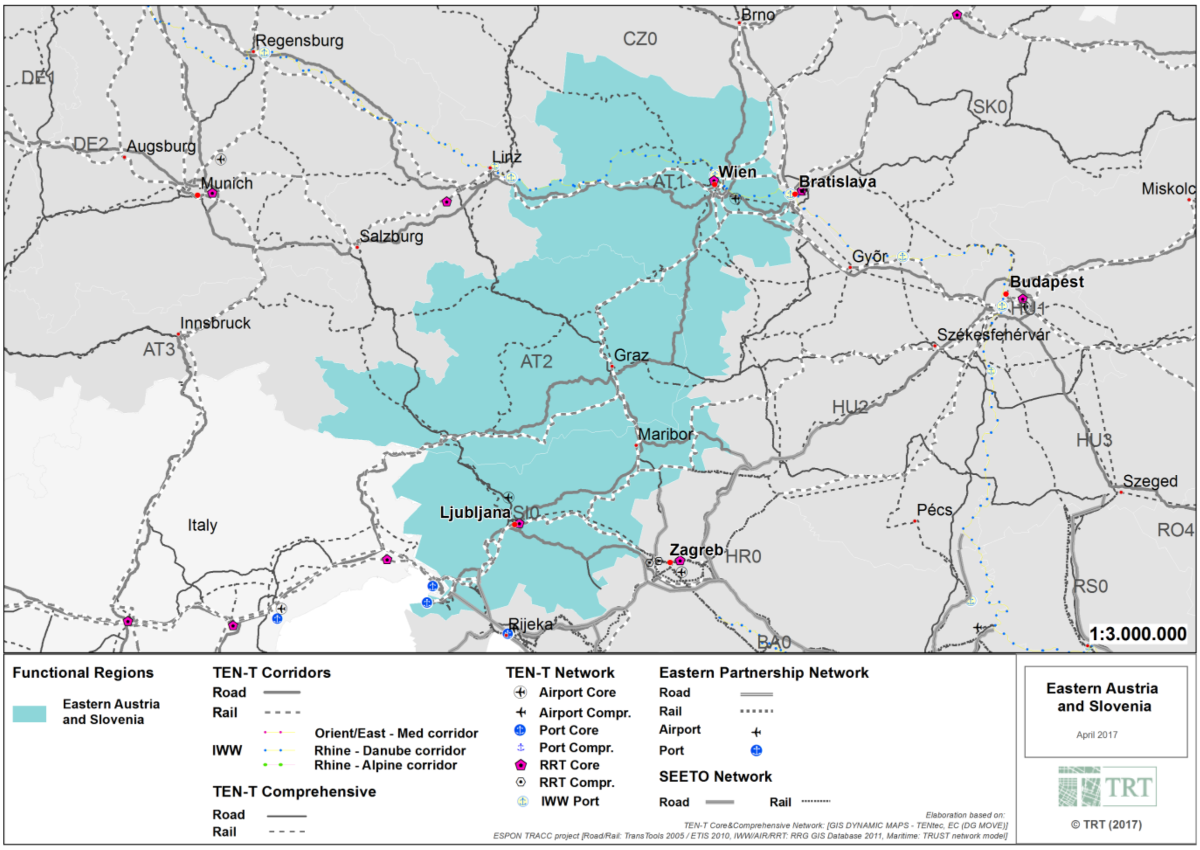
The Slovenian port of Koper is the only freight gateway to the sea of the hinterland of FR2 and towards a wide area of central Europe. The total throughput of 2015 accounted for 19,9 million tonnes, representing 13% of the total volumes handled in the sea ports of the Danube Macro-Region.

The passengers maritime transport of FR2 displays a marginal volume. With respect to the inland waterways transport on the Danube river, the port of Vienna is the only river port of the FR2, handling 1.372 thousand tonnes in 2014, or 4% of the total of the Danube Macro-Region.

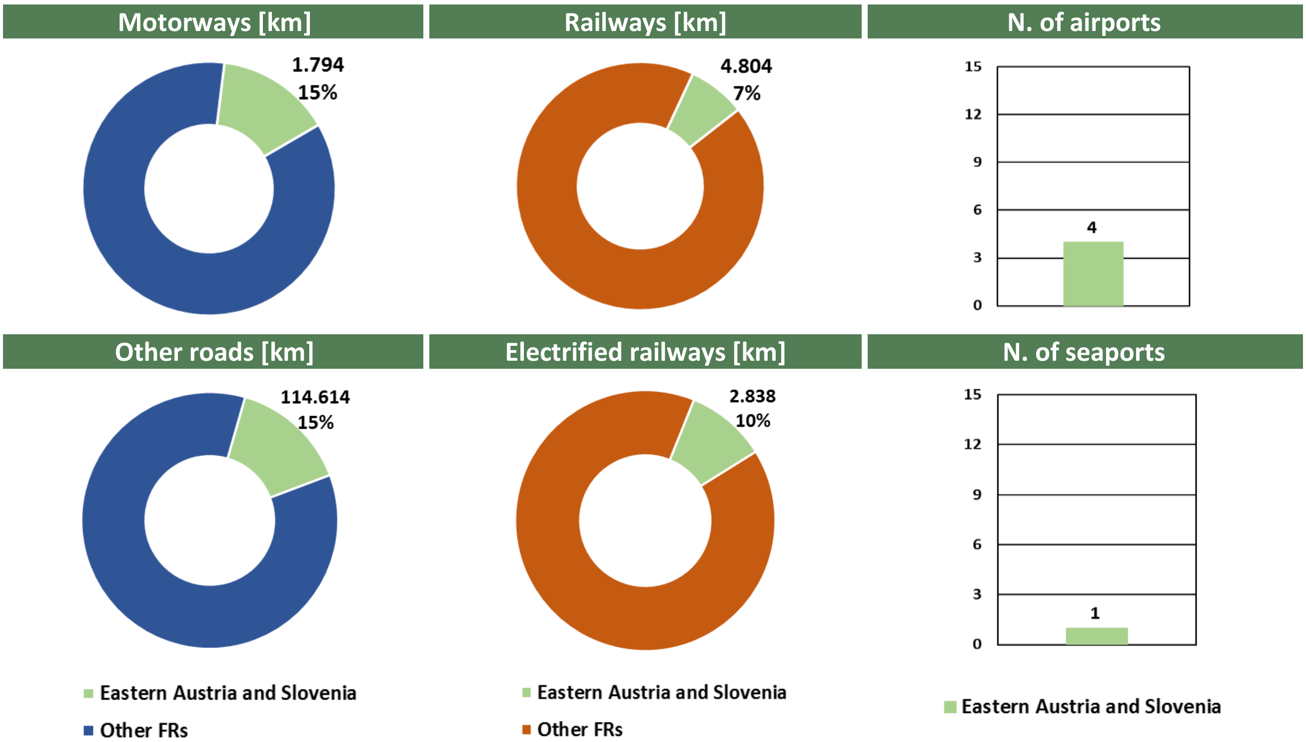
On the transport networks side, four TEN-T CNCs cross the FR2, the Baltic-Adriatic, the Mediterranean, the Orient/East-Med and the Rhine-Danube CNCs.

The largest share of the road and rail networks concentrates in Eastern and Southern Austria. Slovenia has a high motorway density, although this is influenced by the relatively small size of the country and its location at the crossroads of Baltic-Adriatic and Mediterranean CNCs. With respect to the status of the railway network of Slovenia, this is reported outdated, mostly due to insufficient investments (Ministry of Infrastructure of Slovenia, 2014).

Figure 5-7: Transport network localisation of FR2



Source: TRT elaborations (2017)



Source: Eurostat (2016), National Statistics (2017), Bosnia and Herzegovina (2016), Ministry of Infrastructure of Ukraine (2017), TRT (2017)

5.2.2.1 Bottlenecks

As regards the road network, physical bottlenecks have been identified on:

- the cross-border sections of Bratislava-Vienna, Devínska Nová Ves (SK)-Marchegg (AT), Brno (CZ)-Vienna (Schwechat)[42], Spielfeld-Straß (AT)-Sentilj (SI) (EC, 2014a) and at the Slovenian state-border via Letenye (HU) and Pince (SI) (EC, 2014b); and
- the alpine road crossings of Semmering and Koralm, in Austria (EC, 2014a).

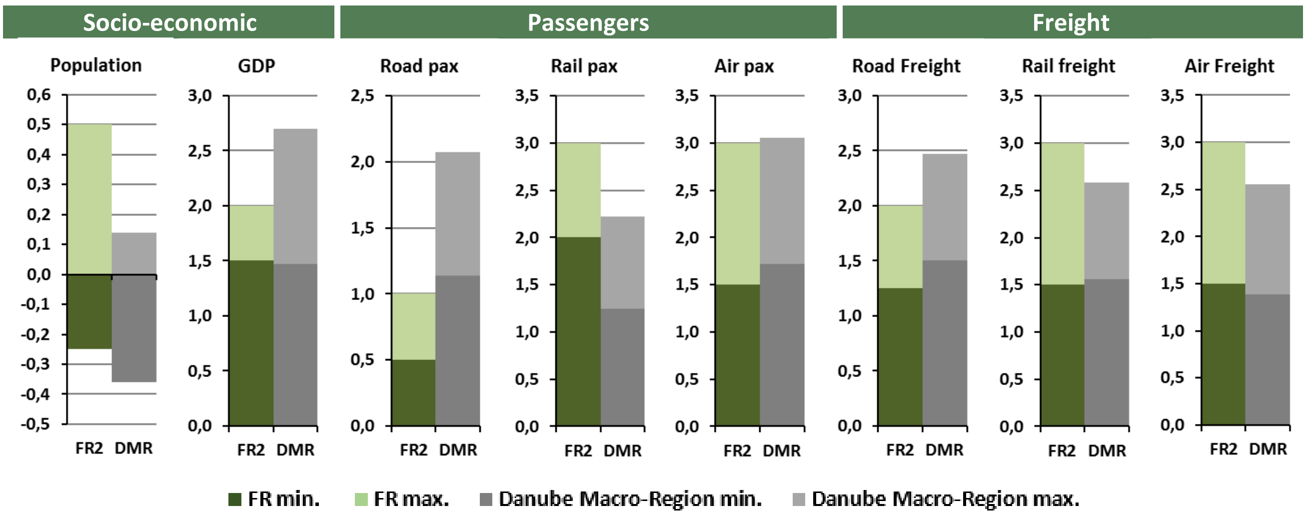
As regards the railway network, the physical bottlenecks have been identified:

- in Slovenia, on the cross-border line Pragersko (SI)-Hodos (HU) (EC, 2014b), on the single-track railway line Divača-Koper (EC, 2014a) and on some sections not compliant with the TEN-T CNCs requirements;
- in Austria, on the sections from Graz to Wettmannstätten and from Grafenstein to Klagenfurt, where capacity problems require upgrading works (i.e., single track, not electrified lines) (EC, 2014a).

The runway configuration of the airport of Vienna[43] and the terminal modernisation at the airport of Ljubljana are the two major bottlenecks of the air transport mode.

5.2.2.2 Indicative projections of key socio-economic parameters and demand volumes

As regards the socio-economic dimension, the population of FR2 is projected either to grow or slightly reduce depending on migration patterns and fertility rates. The GDP growth rate could stand below the average, considering the status of development of the economy. With respect to the transport demand projections, the FR2 could experience a weaker growth rate than that of the Macro-Region in terms of road transport, while for the rail and air modes, the growth rates could be higher or in line with the average of the Danube Macro-Region.



Source: TRT elaborations on Capros et al. (2016), EC (2014), National Transport Plans and Strategies

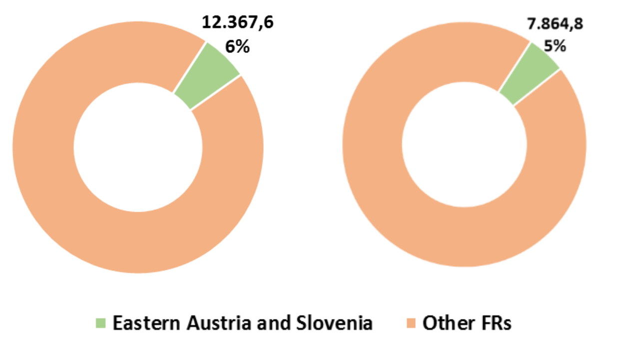
---

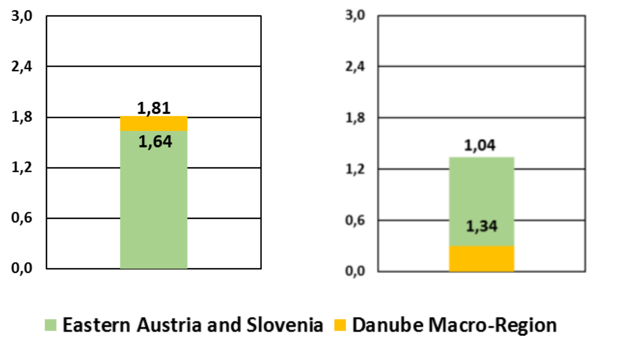
[42] The project "Construction of two dual-carriageway sections as continuation of the A5 North Motorway" has been identified as a future transport project and the fiche has been developed.

[43] The project "Construction of the third runway of the Vienna airport" has been identified as a future transport project and the fiche has been developed.

5.2.3 Environmental aspects

CO_2 emissions		Cars CO_2 emissions per capita	
Total [ths. tons/year]	Cars [ths. tons/year]	Total [tonnes/year]	Cars [tonnes/year]

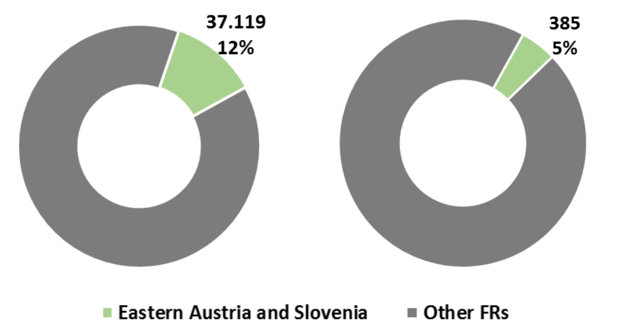


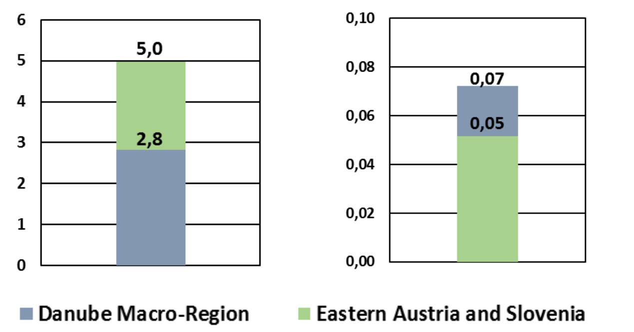


Source: TRT elaborations on the ASTRA and PRIMES models (2016) and the KNOEMA database (2016)

5.2.4 Safety aspects

N. of injured people	N. of killed people	N. of injured /1.000 people	N. of killed/1.000 people

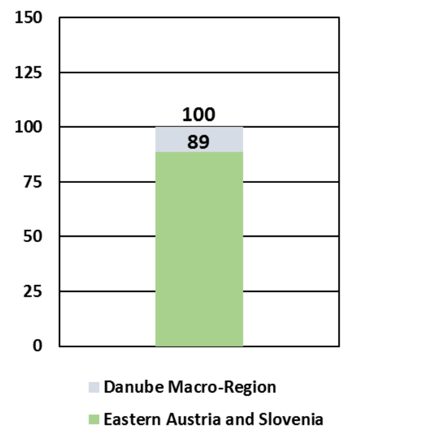




Source: TRT elaborations on the OECD (2016), Eurostat (2016) and National Statistics (2016)

5.2.5 Accessibility

With an index of 89, FR2 shows a lower locational advantage than the average of the Danube Macro-Region as a whole (i.e., -11%).



Source: TRT elaborations from ESPON TRACC (2012)

5.2.6 Key elements

- The FR2 is one of the healthiest areas of the Danube Macro-Region.
- The estimated passengers and freight demand of road and rail modes represent the 11% and 12% of the total of the Danube Macro-Region. The internal demand of freight is 57% of the total of the FR2,

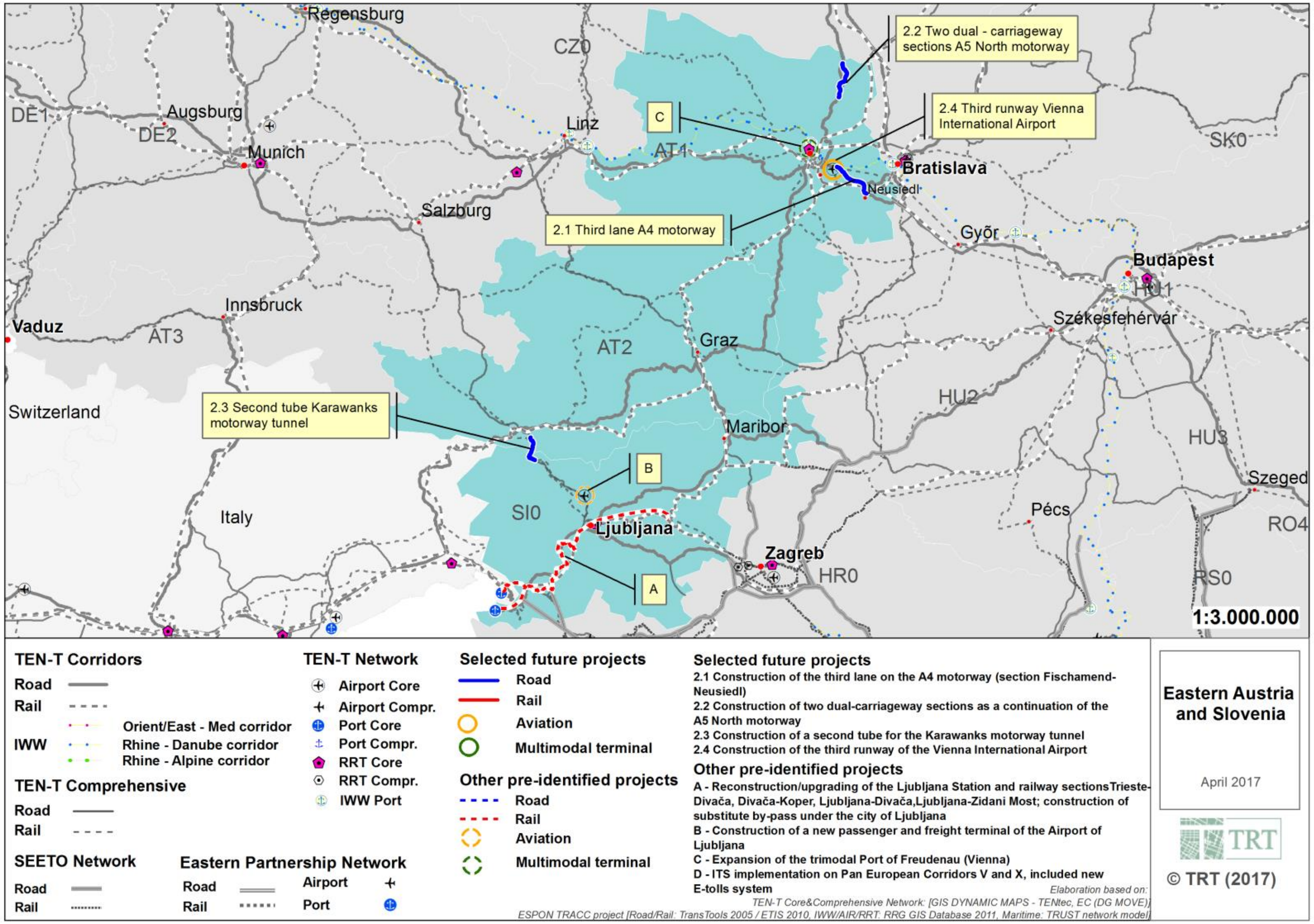
while inflows and outflows are 22% and 21%, respectively. The internal demand rises to 82,4% regarding passengers transport.

- Regarding air transport, 90% of passengers and 96% of freight transit through the hub of Vienna.
- The Slovenian port of Koper is the only freight gateway towards the hinterland and Central Europe.
- Four TEN-T CNCs cross FR2, namely the Baltic-Adriatic, the Mediterranean, the Orient/East-Med and the Rhine-Danube CNCs.
- Road and rail networks concentrate in Eastern and Southern Austria. Slovenia has a high motorway density, but this is influenced by the relatively small size of the country and its location at the crossroads of Baltic-Adriatic and Mediterranean CNCs.
- The status of the railway network of Slovenia, this is reported outdated, mostly due to insufficient investments.
- The estimated CO_2 emissions of FR2 account for 6% of the total of the Danube Macro-Region.
- The index of accessibility potential to GDP shows a lower locational advantage compared to the rest of the Danube Macro-Region.

5.2.7 Identified future transport projects

- Construction of the third lane on the A4 motorway (sections Fischamend-West Bruck and West Bruck-Neusiedl)
- Construction of two dual-carriageway sections as continuation of the A5 North motorway
- Construction of a second tube for the Karawanks motorway tunnel
- Construction of the third runway of the Vienna International Airport

Figure 5-8: Map of identified projects in FR2



Source: TRT elaborations

5.2.7.1 FR2 Project 2.1 – Construction of the third lane on the A4 motorway (sections Fischamend-West Bruck and West Bruck-Neusiedl)

General information: the project regards the construction of the third lane on the A4 motorway sections Fischamend-West Bruck (i.e., 15,9km) and West Bruck-Neusiedl (i.e., 10,6km), in the region of Lower Austria, for a total length of 26,5km (see Figure 5-9).

The A4 motorway is a major axis of the Rhine-Danube CNC, connecting Vienna to Budapest. Given the steadily growing traffic volume, ASFINAG – the project promoter – aims to improve the level of service and traffic safety of the section. It is also expected that the increased capacity will relief the frequent congestions and improve the connection of Eastern Austria to the nearby airport of Vienna.

Figure 5-9: Localisation of the adjacent sections Fischamend-West Bruck and West Bruck-Neusiedl of the A4

Source: ASFINAG (2016)

Being part of the motorway network of Austria, the A4 is a tolled road. A time-based tolling system (i.e., vignette) is applied for vehicles up to 3,5 tonnes. A distance-based tolling system is applied for trucks and buses, with surcharges calculated depending on the pollutant emissions (i.e., according to engine EURO class) and noise (i.e., day and night time periods).

Technical description: apart from the construction of the third lane, the project will also include adaptation works of the acceleration and deceleration lanes. The estimated construction costs accounts for a total of € 244,7 million, notably € 151,64 million for the section Fischamend−West Bruck and € 93,06 million for the section West Bruck−Neusiedl. There is no available information regarding the costs breakdown by category.

Project implementation: the works started in January 2017 from the site of Fischamend. From February to June 2017, the bridges on the intersection between the A4 and the B9 Hainburgerstraße and between Fischamend and Hainburg will be refurbished in order to accommodate the additional lane, while the construction of the third lane will take place between 2018-2020. The implementation period for the section West Bruck−Neusiedl is 2020-2022. Consultations with the concerned municipalities (i.e., Fischamend, Raststation Göttlesbrunn and Bruck) have been started and the field reconnaissance for the archaeological excavations has been almost completed.

During the construction of the third lane, also general rehabilitation works of the existing roadway will be carried out[44].

Transport demand: the Table 5-4 shows the data of the observed daily vehicles (i.e., cars and trucks) of 2012 and the forecasted values for 2025. Information is not provided on how the forecast has been elaborated and regarding the evolution through time of the vehicles without the additional lane.

Table 5-4: Traffic figures in the status quo (two lanes) and in the investment scenarios (three lanes) [vehicles/day]

Section	2012 (two lanes)	2025 (three lanes)
Fischamend-West Bruck	54.000	67.000
West Bruck-Neusiedl	37.000	44.000

Source: TRT elaboration on ASFINAG (2016)

On average, it can be observed that the daily traffic is expected to increase by 1,65% on yearly basis. This is in line with the annual growth rate of the GDP for Austria for the period 2010-2025 (i.e., 1,67%), according to projections of EC Reference scenario 2016 (Capros et al., 2016). The elasticity of traffic with respect to GDP is approximately equal to 1.

The modal share of trucks[45] is estimated in the interval 16-17%, both with and without the construction of the third lane.

On the consulted documents, there is no information available with respect to the assumed values of key drivers of traffic growth. There is no additional information on the demand components (i.e., long and short distance, induced and diverted) and indications are not provided on the evolution of level of service or capacity according to project implementation.

Financial analysis: there is no available information on the financial analysis. It is worth reminding that the A4 is a tolled motorway. As far as the sources of financing are concerned, the project will be financed with road infrastructure manager's own revenues, together with the financial support of the region of Lower Austria. The documents made available do not provide information on application for CEF grants.

Economic analysis: for this project ASFINAG did not carry out the cost-benefit analysis. Indeed, cost-benefit analysis is not mandatory in Austria for infrastructure projects which do not apply for grants. Furthermore, due to the urgency of the project caused by the high number of accidents, a political decision of anticipating the construction phase was adopted, hence restraining the project preparatory stage.

Environmental analysis: the EIA was originally scheduled for submission in 2018. However, ASFINAG is still verifying with the Ministry of Transport whether the legal circumstances for which the EIA is mandatory occur or not.

As regards the environmental issues, during the construction of the third lane, the road drainage will be adapted to the current requirements of water protection and the noise protection facilities will be re-established in accordance with the current regulations on health protection of the residents.

Safety levels: according to consulted stakeholders, this project is meant to improve safety levels and the implementation of the project has been anticipated to address this issue. However, specific indications and localisation of the black spots have not been provided. Data on accidents and trends are not provided in the documents made available.

[44] Furthermore, specific measures as not to interrupt traffic flows during the construction works are envisaged.

[45] There is no available data for trucks modal share of the section West Bruck-Neusiedl.

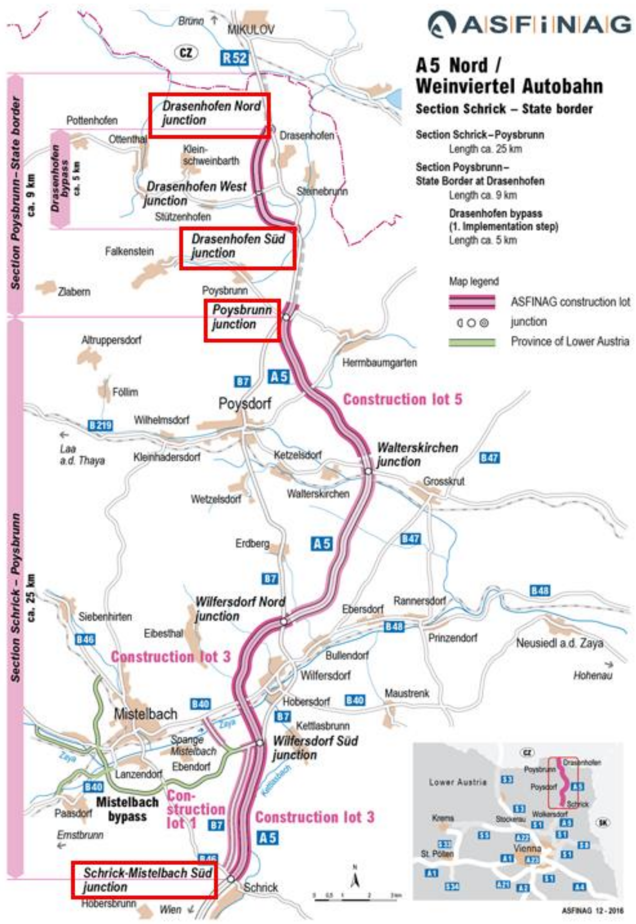
5.2.7.2 FR2 Project 2.2 – Construction of two dual-carriageway sections as continuation of the A5 North motorway

General information: the project concerns the construction of two dual-carriageway sections as a continuation of the A5 North motorway. Two sections involved (i.e., Schrick-Poysbrunn and Poysbrunn-state border with Czech Republic, including the bypass of Drasenhofen), for a total length of 33 km.

The A5 North motorway would ensure a high-quality accessibility to Vienna and, together with the expressway R52 in the Czech Republic, it will become the main route between Vienna and Brno. As regards the relevance of the project, the construction of the A5 North motorway is also identified as a priority transport project in the General Transport Plan up to 2025. The A5 North is considered a missing link of the two Baltic-Adriatic and the Orient-East/Med (see Figure 5-10).

According to ASFINAG, the project promoter. Diverting most of the traffic from the B7, the project will reduce polluting emissions, congestions, noise and road accidents.

Figure 5-10: Localisation of A5 motorway



Source: ASFINAG (2017)

Being part of the motorway network of Austria, the A5 is a tolled road. A time-based tolling system (i.e., vignette) is applied for vehicles up to 3,5 tonnes. A distance-based tolling system is applied for trucks and buses, with surcharges calculated depending on pollutants (i.e., according to engine EURO class) and noise (i.e., day and night time periods) emissions.

Technical description: the transversal section of the new motorway assembles two dual-carriageways, a central separation and emergency lanes. The motorway will be built *ex-novo* except for the short sections on the road B7 between Poysbrunn and Drasenhofen South and from Drasenhofen North to the state border that will be widened and adapted to the designed motorway standards. The construction of 56 bridges is envisaged, namely 48 on the section Schrick-Poysbrunn and 8 on the section Poysbrunn-state border.

The total estimated investment costs amount to € 444 million, of which € 304 million for the section Schrick-Poysbrunn (i.e., 24,7km) and € 140 million for the Poysbrunn-state border (i.e., 8,7 km - of which 4,9 km to bypass the Drasenhofen)**.** Information is not provided regarding costs breakdown or incidence of the civil structures (i.e., bridges) of this project.

Project implementation: the section Schrick-Poysbrunn is scheduled to be completed by the end of 2017. As regards the section Poysbrunn-state border, the construction works have been divided into two phases. The first concerns the construction of the Drasenhofen bypass (2017-2018) and the second phase regards the widening of the road B7 to a four-lane motorway configuration (2025-2027).

Transport demand: the estimation of transport demand is based on the findings of traffic surveys. The Table 5-5 shows the demand of 2010 and forecasts on each section both with respect to the B7 (i.e., the do-nothing) and assuming the completion of the project (i.e., the project scenario)[46].

Table 5-5: Traffic figures of do-nothing and project scenarios [number of vehicles per day]

Road section	Scenario	2010	2025	Annual growth rate [%]
Schrick-Poysbrunn	via B7 (do-nothing)	13.000	17.000-21.000	2,05-4,10
	via A5 (project)	-	20.000-35.000	3,59-11,28
Poysbrunn-state border	via B7 (do-nothing)	7.500	15.000	6,67
	via A5 (project)	-	17.000	8,44
Drasenhofen bypass	via B7 (scenario)	5.600-6.000	14.400-15.400	9,33-10,44
	via A5 (project)	-	14.400-19.700	9,33-15,22

Source: TRT elaboration on ASFINAG (2016)

It is worth observing that, comparing with the projected annual GDP growth rate for Austria for the period 2010-2025 (i.e., 1,67%) (Capros et al., 2016), the demand growth rates are markedly higher, probably due to the expected share of diverted or generated demand from B7 to the new sections.

Financial analysis: the project has been evaluated in terms of financial profitability for ASFINAG[47]. The assumed time frame is from 2010 to 2050. The cost items include investments, renovation works and operating maintenance. With respect to the revenues, additional income has been considered from induced trucks subject to distance-based tolls, while no additional income from cars' vignettes was assumed. The FNPV is approximately € -300 million, (i.e., at 5%). Besides, the financial performance of the project is never expected to turn positive and hence it is not possible to determine a FIRR.

Concerning sources of financing, for the section Schrick-Poysbrunn, € 21 million are from CEF. With respect to the section Poysbrunn-state border, where almost € 50 million are allocated for the construction of the Drasenhofen bypass, the contribution of the region of Lower Austria is equal to € 4,5 million.

Economic analysis: the economic analysis has been carried out according to the national methodology, ASFINAG guidelines and CEF requirements. The appraisal period of the economic analysis covers 41 years in total (i.e., from 2010 to 2050), including planning and construction phases. The ENPV accounts for € 4.357 million, the EIRR is equal to 32,3% and the B/C ratio is equal to 9,46. The 57% of the benefits derives from time savings, followed by vehicle operating costs savings (i.e., 22%) and safety (i.e., 19%).

The sensitivity analysis demonstrates that the benefit-cost ratio remains higher than 1 (i.e., 7,03) even in the event of increments in the construction costs.

Environmental analysis: for the construction of the Schrick-Poysbrunn section, the EIA was completed in 2006. For the section Poysbrunn-state border a revised EIA was approved in 2013 and adopted − after municipality consultations − in 2015.

Safety levels: there is no specific information related to safety levels and black spots on the concerned road section. The socio-economic analysis highlights some significant benefits from safety improvements.

In order to reduce the number accidents caused by wrongly loaded, overloaded or badly equipped trucks, a traffic control centre in the section Schrick-Poysbrunn has been planned for construction.

[46] There is no available information regarding the socio-economic drivers and the assumed interval of traffic growth annual rates.

[47] The documents made available do not provide with information regarding the financial sustainability analysis.

5.2.7.3 FR2 Project 2.3 – Construction of a second tube for the Karawanks motorway tunnel

General information: the project regards the construction of a second tube for the Karawanks motorway tunnel on the cross-border section between Austria and Slovenia (see Figure 5-11).

Figure 5-11: Localisation of the Karawanks tunnel

Source: EC (2016b)

The Karawanks motorway tunnel connects the A2 motorway in Slovenia and the A11 motorway in Austria[48] and it is part of the TEN-T comprehensive network, linking the Baltic-Adriatic and the Mediterranean CNCs (see Figure 6-6). The Karawanks motorway tunnel is single-tube and two-lane of approximately 8 km, of which 44% in Slovenia and 56% in Austria. It represents an important transport connection for major economic areas, linking two hubs of the comprehensive and core transport networks (i.e., Villach-Klagenfurt and Ljubljana).

In summer months, long queuing on both sides is observed and traffic diversion may be necessary. This has consequences for the subordinate road network and are often the cause of serious traffic accidents. The main goals of the project are (i) to improve capacity and traffic safety levels and (ii) to reduce the environmental impacts on the adjacent areas.

Regarding the relevance of the project, the construction of a second tube is in line with the Directive 2004/54/EC, it is envisaged in the Transport Development Strategy of the Republic of Slovenia (2015) and it is listed in the annex to the Austrian Federal Roads Act.

The Austrian Federal Ministry of Transport, Innovation and Technology and the Slovenian Ministry of Infrastructure are the promoters, ASFINAG and DARS the implementing bodies.

Technical description: the Karawanks tunnel has a total of 16 breakdown bays at intervals varying between 749 and 1.060 metres. There are no escape routes or emergency exits. With the project, a two-lane unidirectional traffic will be established[49] with a design speed of 100 km/h and the existing tube will be subject to refurbishment works. Emergency turn-offs will be arranged and transversal passages will be regulated for the passage of users and ventilation.

Technical alternatives have been analysed for compliancy with Directive 2004/54/EC, the Austrian legislation on road tunnel safety and the technical standards and requirements for road tunnel design in Slovenia. Alternatives were taken into consideration and risk assessments carried out. The total estimated cost of the chosen alternative is € 317,1 million[50]. Maintenance costs for double-tube tunnel have been estimated at € 1,8 million year (Snizek + Partner, 2017).

---

[48] Between the toll stations of Rosenbach (Austria) and Hrušica (Slovenia).

[49] According to project design, the tubes will be connected through cross cuts.

[50] There is not information available to break out the costs and the amount of contingency included. This cost component could be high to address cost overruns expected for a tunnel project.

Project implementation: in Austria, all prerequisites and authorisations are already in place. For Slovenia, the governmental Decree on National Spatial plan has been adopted and the preparation of detailed designs is in the final stage. The conclusion of the building permit is foreseen in June 2017. The date foreseen to start the works is 1 January 2018. Construction works are expected to last three years. Information on the schedule of the preparatory activities and procedures before the start of the construction works is available in the consulted documents.

Transport demand: limited information exists on demand. The average daily volume is around 10.000 vehicles/day, (15% are HGVs). On summer weekends, during the peak tourism, traffic increases up to 34.000 vehicles/day, exceeding the threshold for which the double-tube is necessary (i.e., 20.000 vehicles/day). Additional information on specific counts, forecasted trends and evolution of demand components (i.e., diverted from alternative paths and modes or induced) is not available.

Financial analysis: the financial performance of the project has been carried out in terms of financial profitability. The documents made available do not report on financial sustainability analysis.

As regards profitability, the appraisal period is 95 years (from 2021 to 2115) and a discount rate of 4% was applied. Concerning the revenues, tolls charged at the Karawanks tunnel are expected to remain unchanged. The FNPV obtained is equal to € -196,4 million. The FIRR cannot be determined. The elaborations do not present additional information on sensitivity and risks analyses carried out.

The funding mechanism foresees that ASFINAG and DARS provide own resources for 90% of the costs from tolls, commercial loans and other sources. The possibility of EIB loans is envisaged. A CEF grant of € 24,97 million has been requested through application to the annual programme of 2016.

Economic analysis: in terms of appraisal period, the economic analysis relied on the assumption of the financial analysis. With regards to the reference and investment scenarios, the single-tube tunnel served as the reference scenario, but it incorporated also the construction of a new escape tunnel, in compliance with the minimum safety requirements of Directive 2004/54/EC (EC, 2004). The investment scenario added the second tunnel tube.

The economic analysis (i.e., at 4%) shows an ENPV is equal to € 82,9 million and the EIRR is equal to 5,8%.

Environmental analysis: with respect to the EIA procedure, (i) in Austria it is reported that this is not necessary[51] and in Slovenia the EIA procedure was carried out and adopted on 16 May 2016. In order to keep the environmental impact as minimal as possible, extensive geological and hydrogeological investigations have been carried out.

Safety levels: basically, the implementation of the second tube is expected to have a beneficial effect on safety.

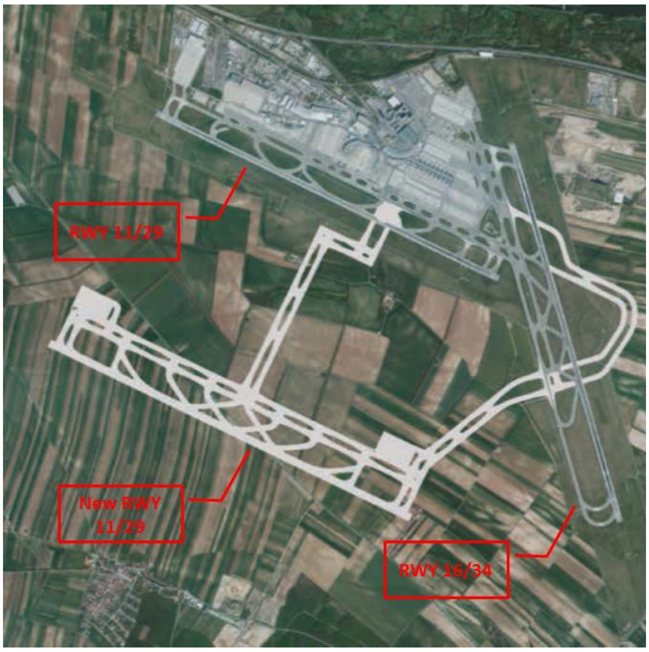
[51] According to section 4 of the Federal Roads Act.

5.2.7.4 FR2 Project 2.4 – Construction of the third runway of the Vienna International Airport

General information: this project regards the construction of the third runway of the Vienna International Airport (i.e., VIA). The VIA is a core node of the Baltic-Adriatic CNC. Currently, there are two intersecting runways. This configuration is considered a bottleneck. The capacity is not equal 2, but only 1,6. The project layout for the construction of the third runway is shown in Figure 5-12.

The peak hour capacity is an issue also for air traffic controllers that have to direct landing aircrafts to low level holding patterns. Lack of runway capacity often results in 10-15-minute delays for queued aircrafts. The third additional runway would increase the capacity from 74 to 95 slots per hours (i.e., +32%) and reduce delays, fuel consumption and noise. The project promoter is the VIA.

Figure 5-12: Localisation of the third runway of VIA



Source: VIE (2013)

Technical description: VIA manages aircrafts traffic operating the existing two runways, namely RWY 16/34 (3.600m long and 45m wide) and RWY 11/29 (i.e., 3.500m long and 45m wide). The two runways handle both narrow and wide body aircrafts, however not independently.

The new runway will have similar parameters as the existing ones (i.e., RWY 11/29 right and left). It will be located in such way that independent parallel operations can be applied, as well as take-offs and landings, for any kind of aircraft. The full project also consists of all constituent parts (i.e., the taxiways and airside traffic links).

There are also three other major airport development components:

- cargo centre development (both new planning and ongoing);
- new railway connections for international trains;
- airport city development (i.e., offices, parking areas, hotel, etc.).

There is no counterfactual scenario regarding the third runway project.

The estimated investment cost is equal to € 1,2 billion. Although, the above 3 projects can be implemented as separate activities, the construction of the third runway is the most complex and expensive one.

Project implementation: in 2014, a study[52] was developed to assess the impact of the implementation of the third runway and analyse the future traffic mix, also in view of developments of the Austrian Airlines network. The study concluded that the third runway will be required at the latest by 2025.

At present, the project is blocked by a court decision due to environmental consideration[53]. According to consulted stakeholder, the project has strong capacity, safety, economic and even environmental

[52] Study ordered by Bundesministerium fur Verkehr, Innovation und Technologie dated 7th December 2012 and 12th June 2014.

[53] On February 2017 the Austrian Federal Administrative Court has ruled that plans for the third runway at VIA should be rejected on climate change grounds. The court found the increase of CO_2 emissions from an extra

arguments. All technical and project organization plans have been prepared. The VIA is committed to drive this implementation plan and ready to start up the planned activities. As soon as the project will obtain green light, an open international tender will be issued[54]. Assuming mid of 2017 as a starting point for implementation, the opening year of the third runway is foreseen by 2023-2025.

Transport demand: VIA is a major hub in Europe. The demand volume of passengers is illustrated in Table 5-6 for the period from 2006 to 2016. After the crisis of the economy, the demand has been recovering and the number of passengers increased by 16% from 2010 to 2015. According to estimations, 30 million passengers are expected in 2021, (i.e., + 29% from 2016 or 5,7% on annual basis).

Table 5-6: Demand volumes of passengers (thousand) and cargo (thousand tonnes) of the VIA

Variable	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2021
Passengers	16.808	18.719	19.687	18.045	19.617	21.106	22.198	22.042	22.474	22.740	23.352	*30.000*
transit	5.674	5.992	5.937	5.450	5.920	6.521	7.053	6.795	6.531	6.296	6.173	n. a.
transit [%]	33,8	32,0	30,2	30,2	30,2	30,9	31,8	30,8	29,1	27,7	26,4	n. a.
Cargo	228,3	226,3	222,0	215,1	250,7	232,0	210,0	211,6	239,4	235,8	282,7	n. a.
Movements	237,5	254,9	266,4	243,4	246,1	246,2	244,7	231,2	230,8	226,8	226,4	n. a.

Source: TRT elaborations from VIA statistics

As regards cargo, volumes are significant but rather volatile. After a peak of 250 thousand tonnes recorded in 2010, it is growing again after the drop of 2013, which is seen as a positive signal of recovery.

Financial analysis: information of the financial analysis has not been provided by the consulted stakeholder. The project may involve different financing sources, but the final financing arrangement has not yet been agreed on.

Economic analysis: information of the economic analysis has not been provided by the consulted stakeholder.

Environmental analysis: regarding environmental issues, the ongoing court case is expected to delay the development of the project.

Since the final approval of the project is crucial for project development, a strong environment case − including consultation process − has been developed. In this respect, an important step was made with the local communities, with the decision of not allocating any new land for housing in the noise zone over 54 dB. In return, VIA assured that the noise zones around the airport will not become larger and only Category III aircrafts are accepted to land.

Safety levels: the project has an important impact on safety levels. If ATC was pushed to handle the maximum number of aircrafts, it would increase the probability for separation minima to be violated. In this respect, EUROCONTROL statistics indicate that, amongst safety items, runway incursion and separation infringement between departure and arrival traffic are critical aspects.

The mixture of different aircrafts is always a challenge for ATC. The use of two fully independent parallel runways will allow ATC to manage the sequencing of wide body aircrafts for the most convenient runway and to narrow body for the other. In this way, capacity can be increased and wake turbulence and other safety issues minimised.

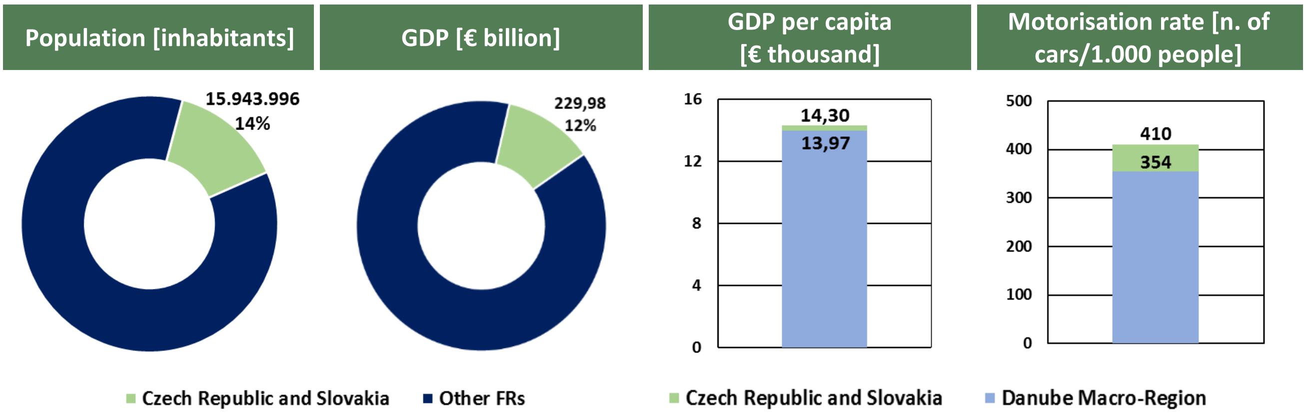
runway was at odds with the country's 2020 transport sector reduction target. The VIA intends to file an extraordinary appeal with the Austrian Supreme Administrative Court. The outcome of the extraordinary appeal is not available.

[54] The project is in line with the EUROCONTROL Gate to Gate performance concept and with the objectives and KPIs of the Single European Sky programme.

5.3 FR 3 – Czech Republic and Slovakia

The FR3 aggregates two countries, namely the Czech Republic and Slovakia.

5.3.1 Socio-economic characteristics



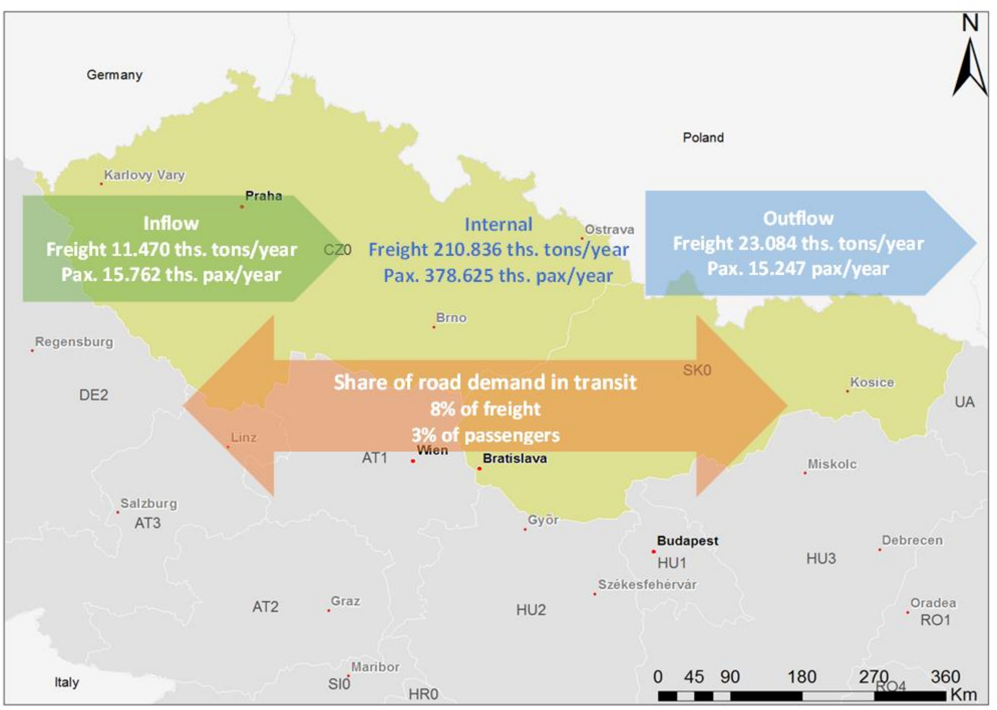
Source: Eurostat (2016), World Bank (2016) and National Statistics (2016)

5.3.2 Transport demand and infrastructures

Compared with the total volumes of the Danube Macro-Region, the estimated road and rail transport demand of FR3 accounted for a 20% of freight and a 10% of passengers, respectively.

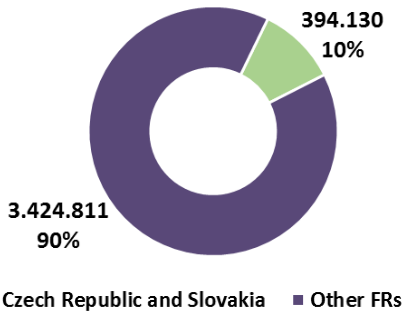
For freight transport, the estimated internal demand represents the 85,9% of the total of this FR, while the inflows and the outflows weigh for 4,7% and 9,4%, respectively. The internal demand share of passengers transport is even higher, amounting to the 92,4%. Passengers inflows and outflows represent a minor share, namely 3,8% and 3,7% of the total of the FR. With respect to the estimated road transits, they account for 8% of the total road demand generated by the FR for freight and 3% for passengers (see Figure 5-13).

Figure 5-13: Road and rail transport flows of FR3



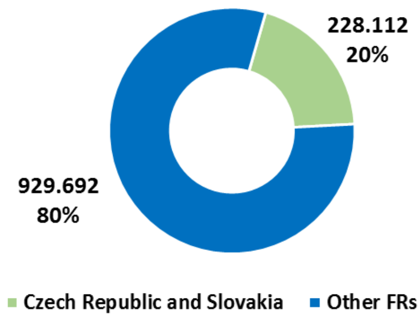
Source: TRT elaborations on TRUST (2016) and Eastern Partnership models (2016)

Passengers [thousand passengers/year]



O/D	FR3	Other FRs	Total
FR3	378.625	15.247	**393.873**
Other FRs	15.762	3.409.306	**3.425.068**
Total	**394.387**	**3.424.553**	**3.818.941**

Freight [thousand tonnes/year]



O/D	FR3	Other FRs	Total
FR3	210.836	23.084	**233.919**
Other FRs	11.470	912.415	**923.885**
Total	**222.305**	**935.499**	**1.157.804**

Source: TRT elaborations on TRUST (2016) and Eastern Partnership models (2016)

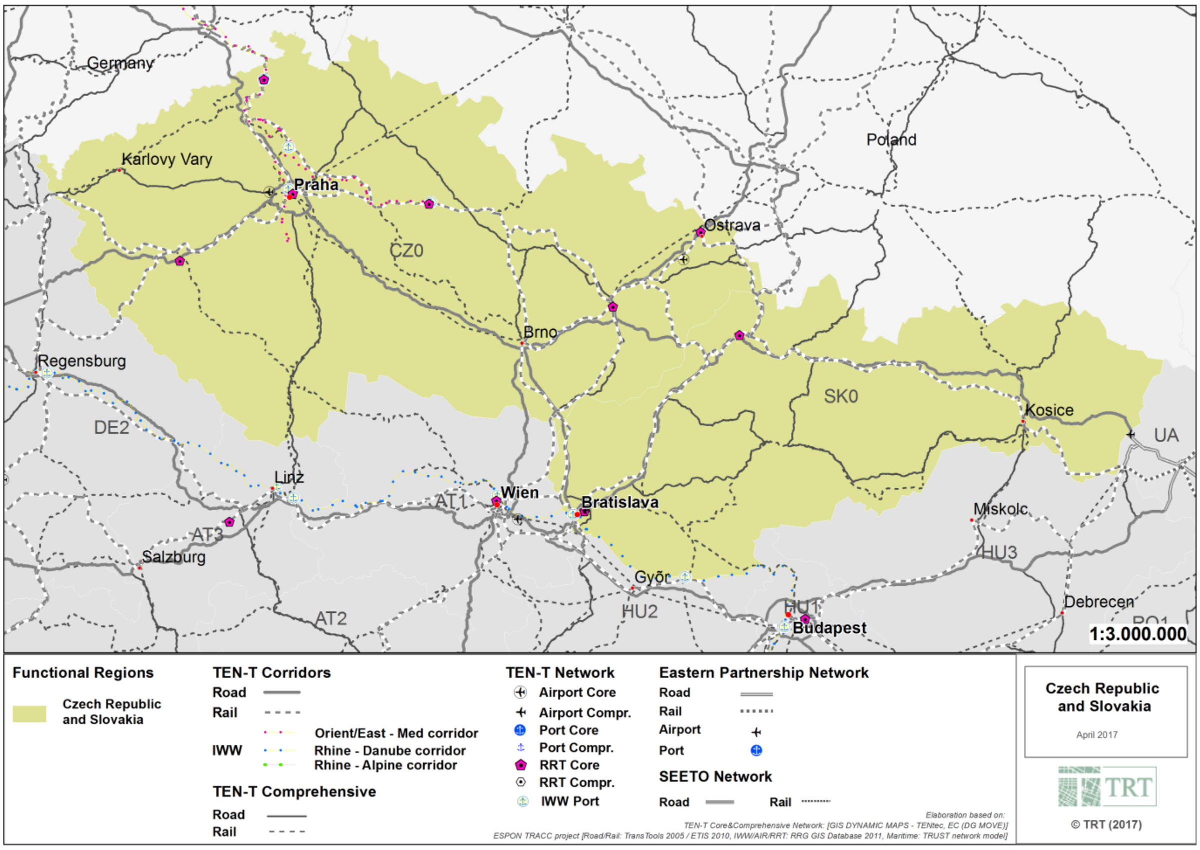
According to the latest figures of 2015, the air traffic in transit through the 8 airports analysed within this FR consists of more than 14,6 million passengers and 80 thousand freight tonnes (i.e., 10% and 9% of the total passengers and freight moved in the Danube Macro-Region). The main node of the FR3 is the airport of Prague, with a freight throughput of 50,4 thousand tonnes and 11,8 million passengers transited (i.e., 63% and 81% of the air demand of the entire FR).

As regards inland waterways on the Danube river, the port of Bratislava is the main node of the FR3. The freight throughput recorded in 2014 was nearly equal to 1,8 million tonnes (i.e., 5% of the total of the Danube Macro-Region).

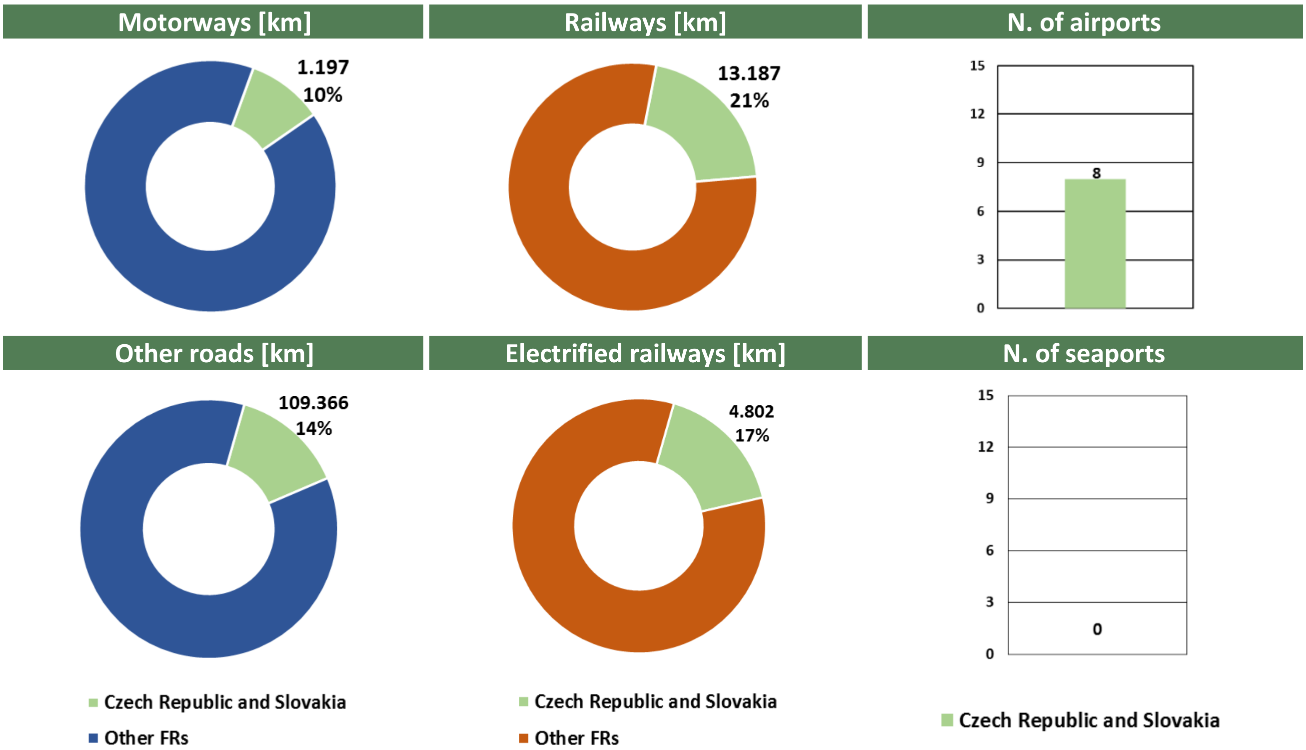
With respect to the transport network infrastructures, three TEN-T CNCs cross the FR3, namely the Rhine-Danube, the Orient/East-Med and the Baltic-Adriatic (see Figure 5-14).

Concerning networks distribution, the motorways are more developed in the Czech Republic (i.e., 776 against 421 km), accounting for a 6,3% of the total of the Danube Macro-Region. The extension of the network of other roads is fairly comparable (i.e., around 55 thousand km for both countries). The extension of the rail network is higher in the Czech Republic (i.e., 9.560 against 3.627 km) and the same occurs for the electrified lines (i.e., 3.216 km against 1.586).

Figure 5-14: Transport network of FR3



Source: TRT elaborations (2017)



Source: Eurostat (2016), National Statistics (2017), Bosnia and Herzegovina (2016), Ministry of Infrastructure of Ukraine (2017), TRT (2017)

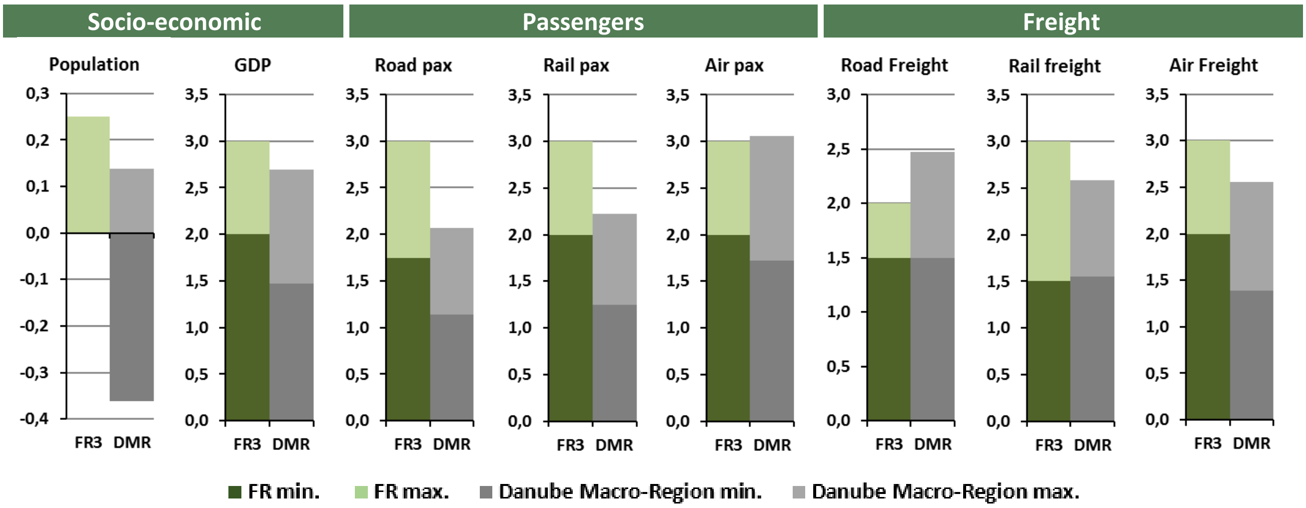
5.3.2.1 Bottlenecks

As regards the road network, a recurring reported issue is congestion due to capacity issues. Bottlenecks are localised on the motorway bypasses of Bratislava and Žilinav (i.e., road I/18 through Žilina) and on the cross-border sections Bratislava (SK)-Vienna (Stadlau) (AT), Devínska Nová Ves (SK)-Marchegg (AT) and Brno (CZ)-Vienna (Schwechat)[55] (EC, 2014a). Other capacity bottlenecks are localised along the Czech motorway D1, which is the main road artery of the country (EC, 2014c).

With respect to the railway network, the overall quality is generally low due to the outdated technology. The infrastructure shows missing links and tracks in densely populated urban areas. More specifically, capacity and speed bottlenecks exist at the Ostrava, Brno and Bratislava nodes[56] and on the section Přerov-Brno, which is also not compliant with TEN-T standards due to speed, train length and axle load limitations. Also the Praha-Česká Třebová line faces capacity issues. Other critical cross border bottlenecks are on many sections of the Eastern part of the Brno-Győr line (i.e., Czech Republic-Austria/Slovakia-Hungary) (EC, 2014c).

5.3.2.2 Indicative projections of key socio-economic parameters and demand volumes

From a socio-economic perspective, the projections elaborated for FR3 suggest an annual growth rate higher than the average, for both population and GDP. This assumptions seem realistic also in view of the migration patterns reported for the Czech Republic and recent trends of the economies at country level. With respect to demand volumes, except for road freight transport – estimated to grow to a slower pace than that of the average of the Macro-Region – and air passengers transport – with approximately the same growth rate of the Danube Region –, the growth rates of all the other modes could be projected above the average annual rates.



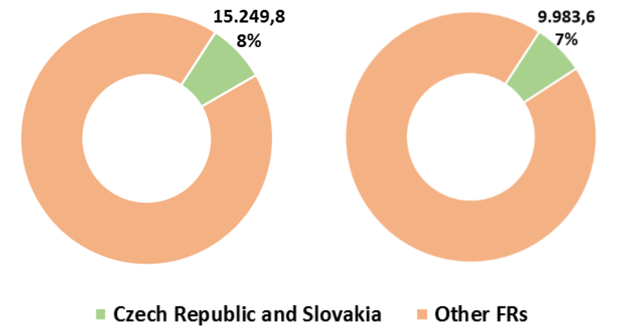
Source: TRT elaborations on Capros et al. (2016), EC (2014), National Transport Plans and Strategies

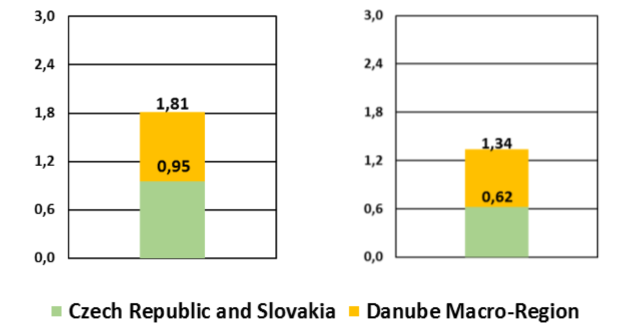
[55] The project “Construction of the R52 Expressway section Pohořelice-Czech-Austrian state border” has been identified as relevant project.

[56] The project “Brno junction modernisation and new main station” has been identified as relevant project.

5.3.3 Environmental aspects

CO_2 emissions Total [ths. tons/year]	CO_2 emissions Cars [ths. tons/year]	Cars CO_2 emissions per capita Total [tons/year]	Cars CO_2 emissions per capita Cars [tons/year]

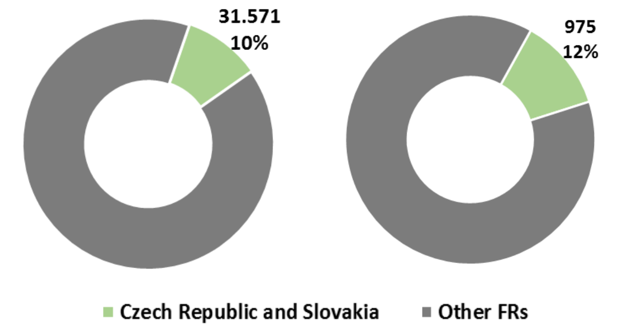


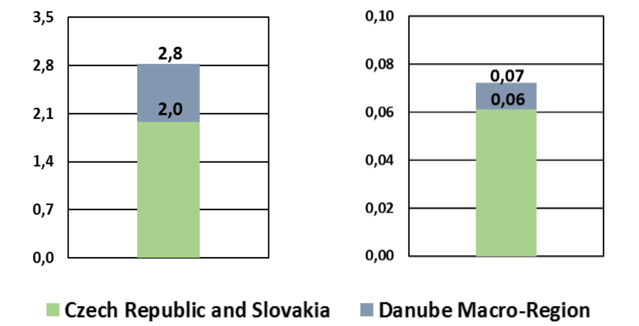


Source: TRT elaborations on the ASTRA and PRIMES models (2016) and the KNOEMA database (2016)

5.3.4 Safety aspects

N. of injured people	N. of killed people	N. of injured /1.000 people	N. of killed/1.000 people

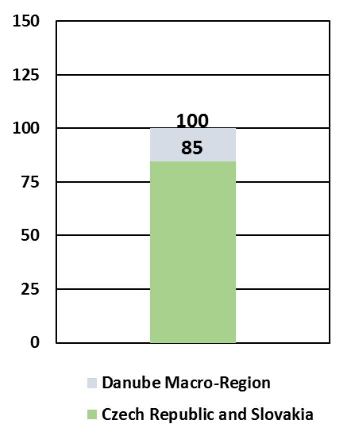




Source: TRT elaborations on the OECD (2016), Eurostat (2016) and National Statistics (2016)

5.3.5 Accessibility

With a rate of 85, the accessibility of FR3 is 16% lower than the average of the Danube Macro-Region.



Source: TRT elaborations from ESPON TRACC (2012)

5.3.6 Key elements

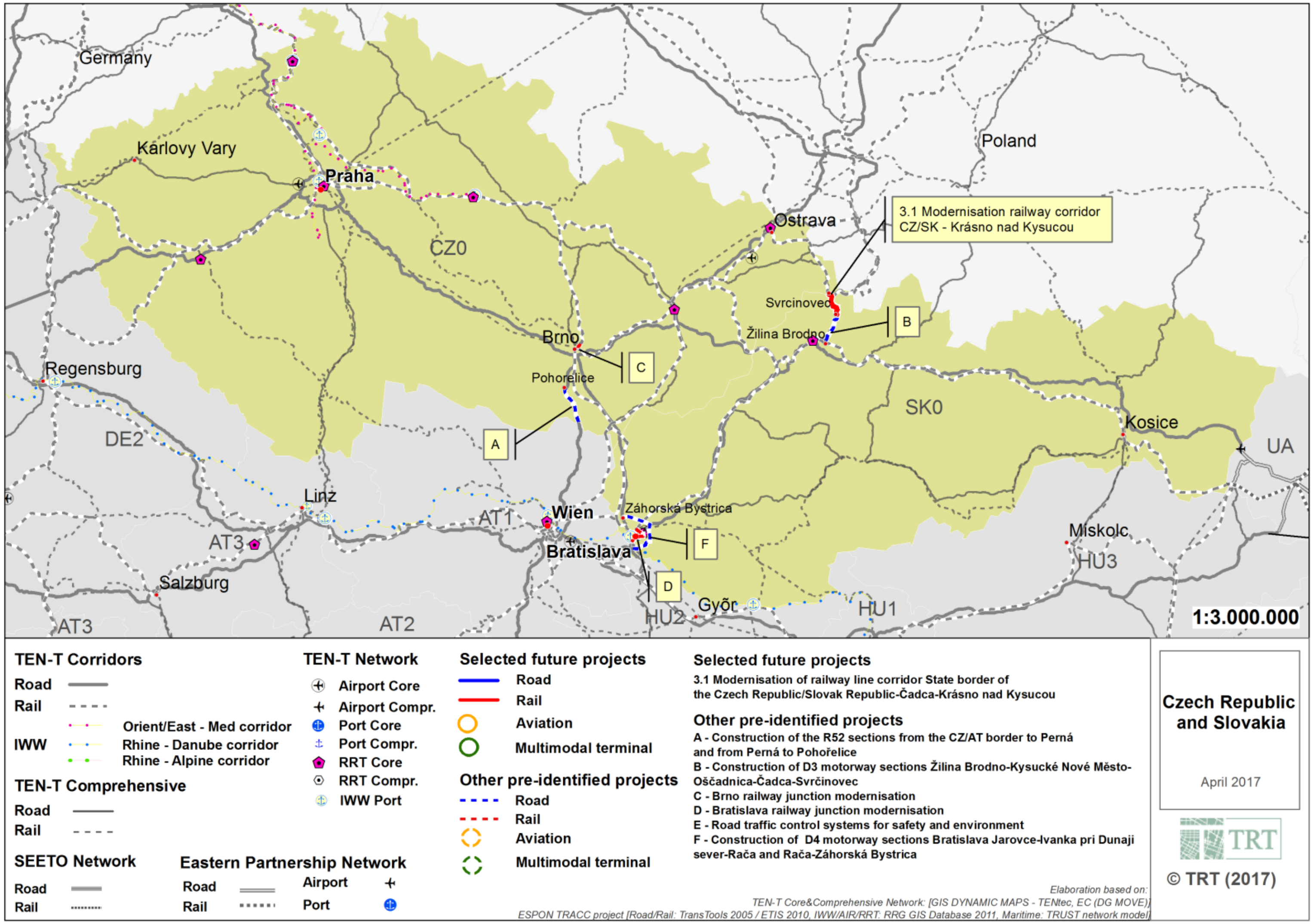
- The FR3 is the third economy in the Danube Macro-Region, with a relatively growing population.
- The estimated road and rail demand volumes account for 20% of freight and 10% of passengers of the Danube Macro-Region. Demand volumes are mostly related to internal activities. The demand through the FR3 is 8% of the total road volume generated for freight and 3% for passengers.

- Air traffic consists of 14,6 million passengers and 80 thousand freight tonnes, or 10% and 9% of the total of the Danube Macro-Region. The main node is the airport of Prague.
- Three TEN-T CNCs cross the FR3, namely the Rhine-Danube, the Orient/East-Med and the Baltic-Adriatic.
- The motorway network is 10% of the total of the Danube Macro-Region. The railway network is the 21%. Concerning distribution, the motorways are more developed in the Czech Republic, while the extension of the other roads is fairly comparable. The extension of the rail network is higher in the Czech Republic.
- A recurring issue of the road network is congestion due to lack of capacity. The overall quality of the rail network is generally low due to the outdated technology. The infrastructure shows missing links and tracks in densely populated urban areas.
- Road safety issues are less severe in FR3, compared with the average of the Danube Macro-Region.
- CO_2 emissions per capita are approximately the half of the average of the Danube Macro-Region.
- The index of accessibility potential to GDP is 16% lower than the average of the Danube Macro-Region.

5.3.7 Identified future transport projects

- Modernisation of the railway corridor State Border of the Czech Republic/Slovak Republic-Čadca-Krásno nad Kysucou

Figure 5-15: Map of identified projects in FR3

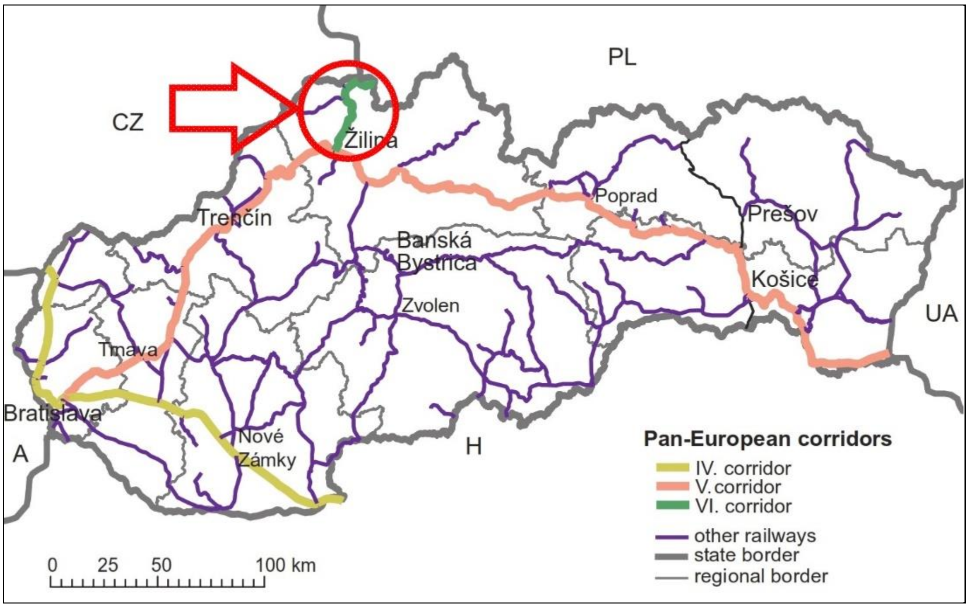


Source: TRT elaborations

5.3.7.1 FR3 Project 3.1 – Modernisation of the railway corridor State Border of the Czech Republic/Slovak Republic-Čadca-Krásno nad Kysucou

General information: The project comprises elaboration of complete project design documentation for railway track modernisation in the concerned section. The project also comprises building of interlocking ETCS with extension to Žilina and building of GSM-R with extension to Bratislava. The beneficiary is ŽSR, the rail infrastructure manager in Slovakia.

Figure 5-16: Localisation of the railway corridor State Border of the Czech Republic/Slovak Republic-Čadca-Krásno nad Kysucou



Source: Michniak D. (2015)

Technical description: The railway section is approximately 17 km long, connecting the state border between Czech Republic and Slovak Republic with Čadca and Krásno nad Kysucou. It is part of the Rhine-Danube CNC, section Ostrava/Prerov-Žilina-Košice-UA border. It is also part of the Pan-European Corridor VI and part of Rail Freight Corridors 5 and 9. The estimated cost for project design is € 5,48 million.

Project implementation: on the basis of the available information from the Operational Programme Transport of Slovakia, the estimated date of project implementation was June 2015.

Transport demand: The Feasibility Study for the section Nové Mesto to Váhom-Žilina-Čadca of February 2008 presents forecasts for the section Žilina-Čadca that is partially overlapped to the State Border-Čadca-Krásno nad Kysucou. At year 2030 the estimated passenger traffic volume will be 48,5 million passengers·km, against 35,6 million passengers·km of year 2005 (i.e., 36,2% or +1,45% on annual basis). With respect to freight transport the estimated volume at 2030 will be 723,9 million tonnes·km, against 552,0 million tonnes·km observed in 2005 (i.e., 31,1% or +1,25% on annual basis).

Financial analysis: the information obtained regards only the total design costs (i.e., € 5,48 million), as indicated on the Operational Programme Transport. The financing sources are distributed between EU Cohesion Fund (85%) and State budget of the Slovak Republic (15%).

Economic analysis: there is not information available for the economic performance of the project.

Environmental analysis: on the basis of what was indicated by the TEN-T Implementation Agency on March 2013 the EIA was delivered at the end date of the first implementation stage (August 2012).

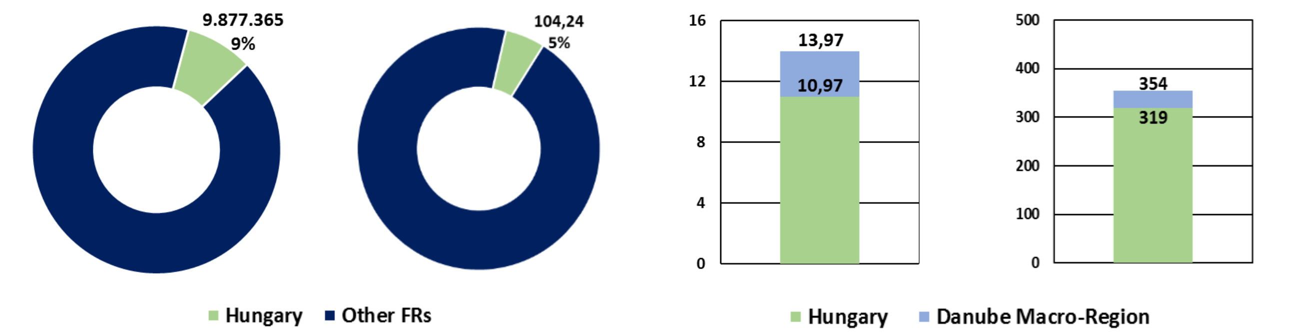
Safety levels: a general improvement of the safety level for both section will be obtained with the implementation of a more advanced signalling system (ERTMS level 2) that will replace the existing one.

5.4 FR 4 – Hungary

The FR4 coincides with Hungary.

5.4.1 Socio-economic characteristics

Population [inhabitants]	GDP [€ billion]	GDP per capita [€ thousand]	Motorisation [n. of cars/1.000 people]

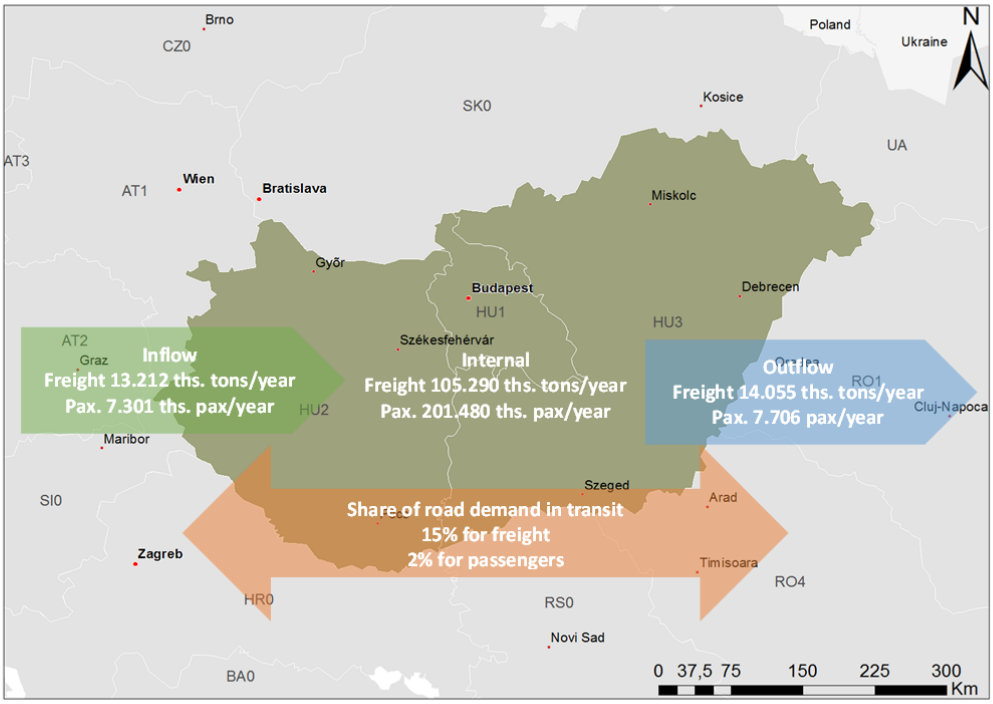


Source: Eurostat (2016), World Bank (2016) and National Statistics (2016)

5.4.2 Transport demand and infrastructures

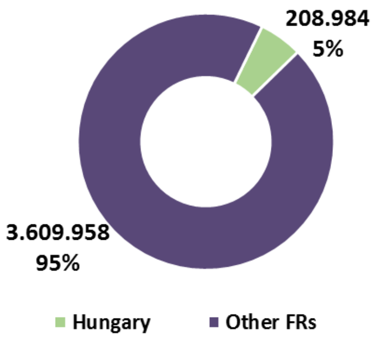
The transport demand volume of FR4 is a relatively small share of the total estimated of the Danube Macro-Region. Freight and passengers volumes are 10% and 5%, respectively. More specifically, the internal freight demand accounts for 79,4% of the total demand of this FR, while freight inflow and outflow are both around 10% of the internal demand. Similarly, the internal demand of passengers represents the 93% of the total volume, while both inflow and outflow a 3,5% each (see Figure 5-17). As regards the estimated road demand in transit through the FR4, it accounts for 15% of the total road demand generated by the FR for freight and 2% for passengers.

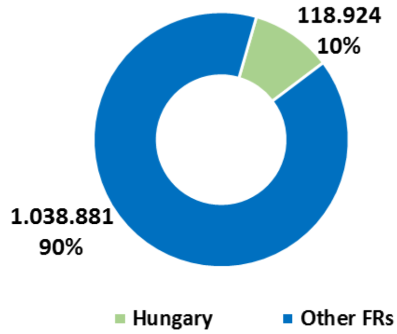
Figure 5-17: Road and rail transport flows of FR4



Source: TRT elaborations on TRUST (2016) and Eastern Partnership models (2016)

Passengers [thousand passengers/year]	Freight [thousand tonnes/year]





O/D	FR4	Other FRs	Total
FR4	201.480	7.706	**209.186**
Other FRs	7.301	3.602.454	**3.609.755**
Total	**208.781**	**3.610.160**	**3.818.941**

O/D	FR4	Other FRs	Total
FR4	105.290	14.055	**119.345**
Other FRs	13.212	1.025.248	**1.038.459**
Total	**118.502**	**1.039.302**	**1.157.804**

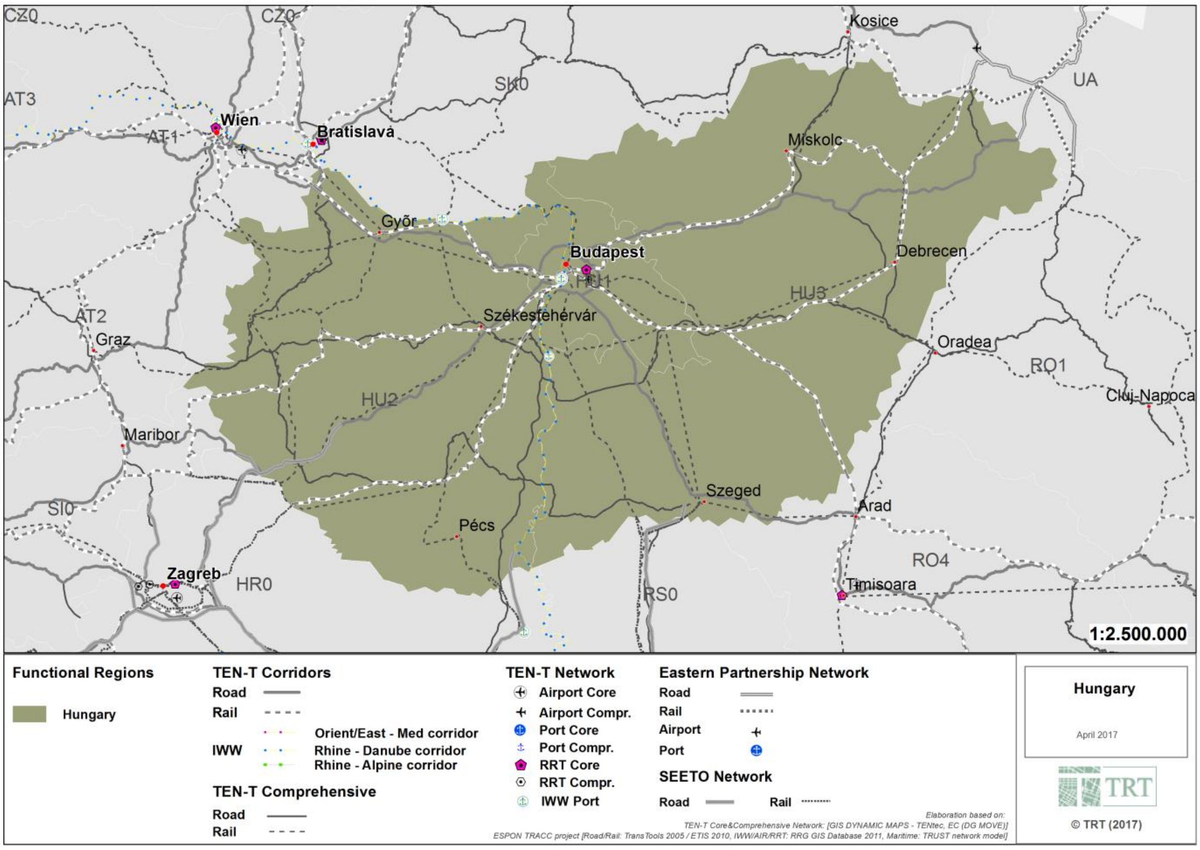
Source: TRT elaborations on TRUST (2016) and Eastern Partnership models (2016)

The latest figures of 2015 about air transport indicate that the demand of FR4 concentrates in the airport of Budapest and show a flow of 10,2 million passengers and 65,7 thousand tonnes. This represents 7% of the total demand of the Danube Macro-Region both for passengers and freight. Over the last decade the air demand increased by nearly 2 million passengers, while air freight demand remained relatively stable.

As regards inland navigation, the river ports of Dunaujvaros and Budapest handled a 6% of the total freight demand of the Macro-Region of 2014, with a throughput of 1.046 and 1.109 thousand tonnes, respectively. Concerning infrastructure networks, the FR4 is crossed by three TEN-T CNCs, namely the Rhine-Danube, the Orient/East-Med and the Mediterranean CNCs (see Figure 5-18).

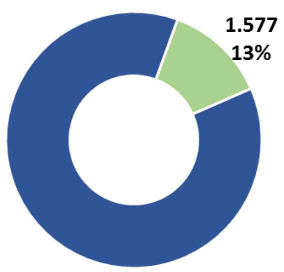
The motorway and railway networks of FR4 represent respectively the 13% and 12% of the total of the Danube Macro-Region. Analysing with respect to the density of the networks, both rail and road infrastructures are more dense in central Hungary, especially the capital city if Budapest and reflecting a radial configuration.

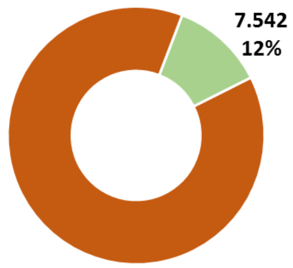
Figure 5-18: Transport network of FR4

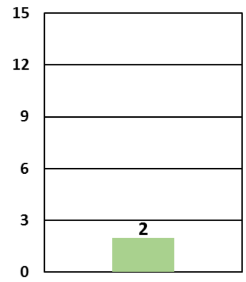


Source: TRT elaborations (2017)

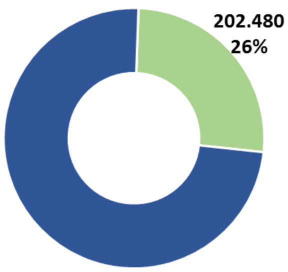
Motorways [km]	Railways [km]	N. of airports

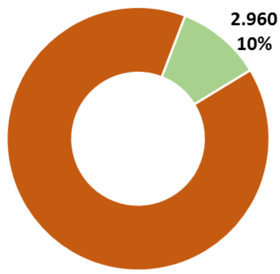


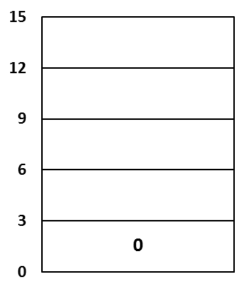




Other roads [km]	Electrified railways [km]	N. of seaports







Hungary Other FRs   Hungary Other FRs   Hungary

Source: Eurostat (2016), National Statistics (2017), Bosnia and Herzegovina (2016), Ministry of Infrastructure of Ukraine (2017), TRT (2017)

5.4.2.1 Bottlenecks

Regarding the road network, the main bottlenecks are due to non-adequate design standards (i.e., single carriageway without level-free junctions), degraded surface and congested sections close to urban nodes. Cross-border bottlenecks are localised at the Slovenian border via Letenye (HU) and Pince (SI) and the Hungarian-Ukrainian border, where the motorway connection to Ukraine is missing (EC, 2014b).

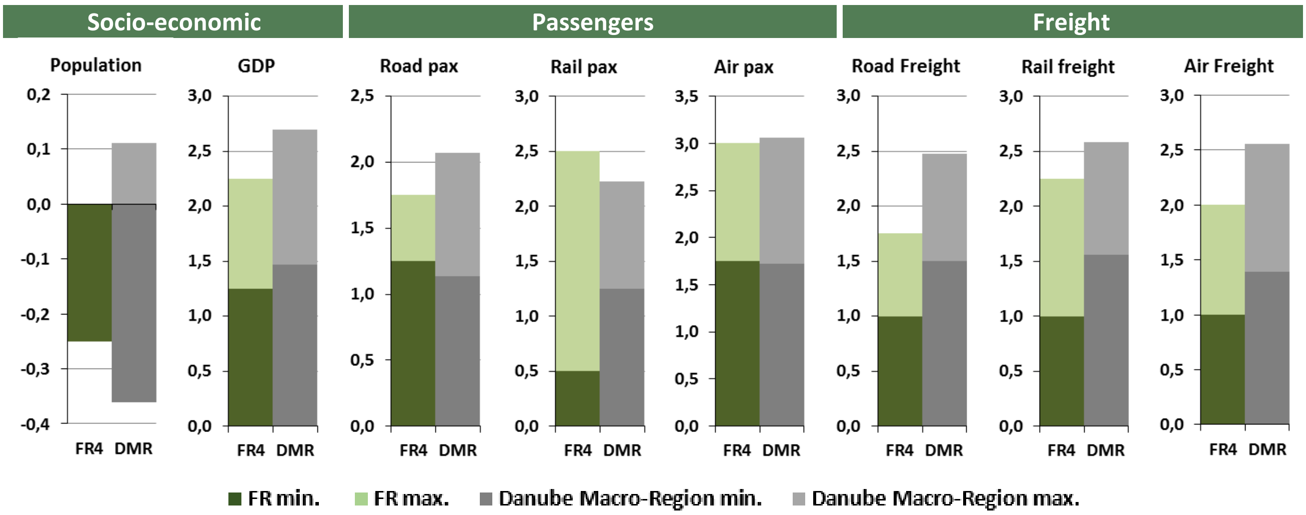
An important non-physical bottleneck is the missing interoperability of on-board units for freight road tolling in Hungary.

The deficiencies of the railway network mostly concern the age of the bridges. This has an impact on the admissible axle load and allowed speed. The low level of deployment of ERTMS is another issue. Specific bottlenecks have been identified on the rail node of Budapest (i.e., capacity issues due to increasing traffic) and at the cross-border section of Brno-Győr (EC, 2014c).

Specific issues exist on the sections: Rákos-Hatvan (Budapest-Miskolc-UA border), Boba-Székesfehérvár, Kelenföld-Pusztaszabolcs, Budapest-Szajol-Debrecen-Nyiregyhàza and Puspokladàny-Debrecen (EC, 2014b).

5.4.2.2 Indicative projections of key socio-economic parameters and demand volumes

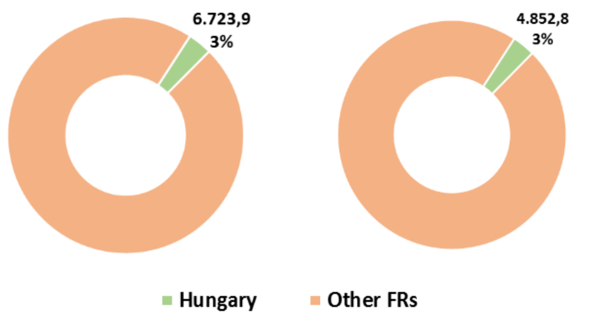
The population of FR4 could follow a negative trend, in continuity with the observed demographic pattern. The GDP is projected to grow, but at a pace slightly below that of the Danube Macro-Region. As regards the passengers, rail and air demand could be envisaged to growth even above the average, while road mode could growth in line. Freight transport could improve across all modes, but different patterns analysed suggest a projected growth below the average of the Danube Macro-Region.

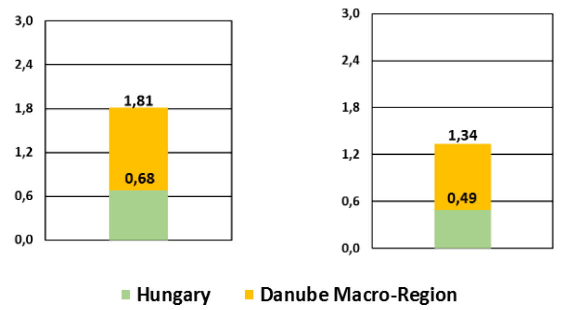


Source: TRT elaborations on Capros et al. (2016), EC (2014), National Transport Plans and Strategies

5.4.3 Environmental aspects

CO_2 emissions		Cars CO_2 emissions per capita	
Total [ths. tons/year]	Cars [ths. tons/year]	Total [tons/year]	Cars [tons/year]

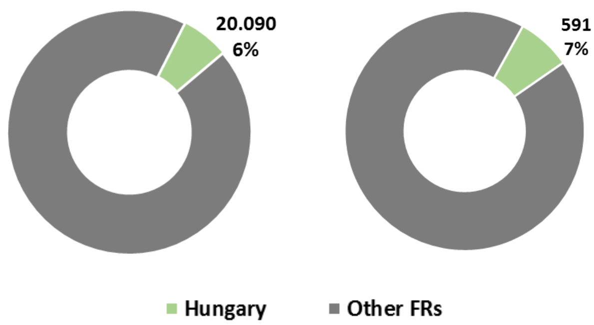


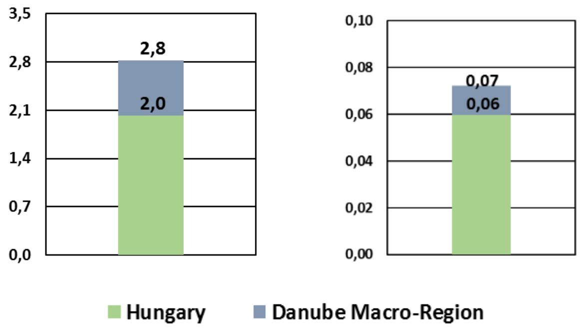


Source: TRT elaborations on the ASTRA and PRIMES models (2016) and the KNOEMA database (2016)

5.4.4 Safety aspects

N. of injured people	N. of killed people	N. of injured /1.000 people	N. of killed/1.000 people

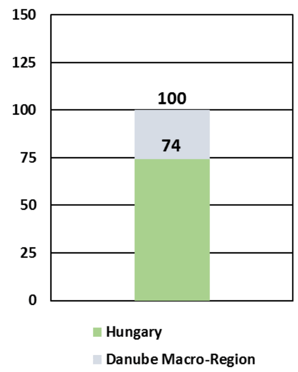




Source: TRT elaborations on the OECD (2016), Eurostat (2016) and National Statistics (2016)

5.4.5 Accessibility

With an index of 74, accessibility of FR4 is lower than the average by 26%.



Source: TRT elaborations from ESPON TRACC (2012)

5.4.6 Key elements

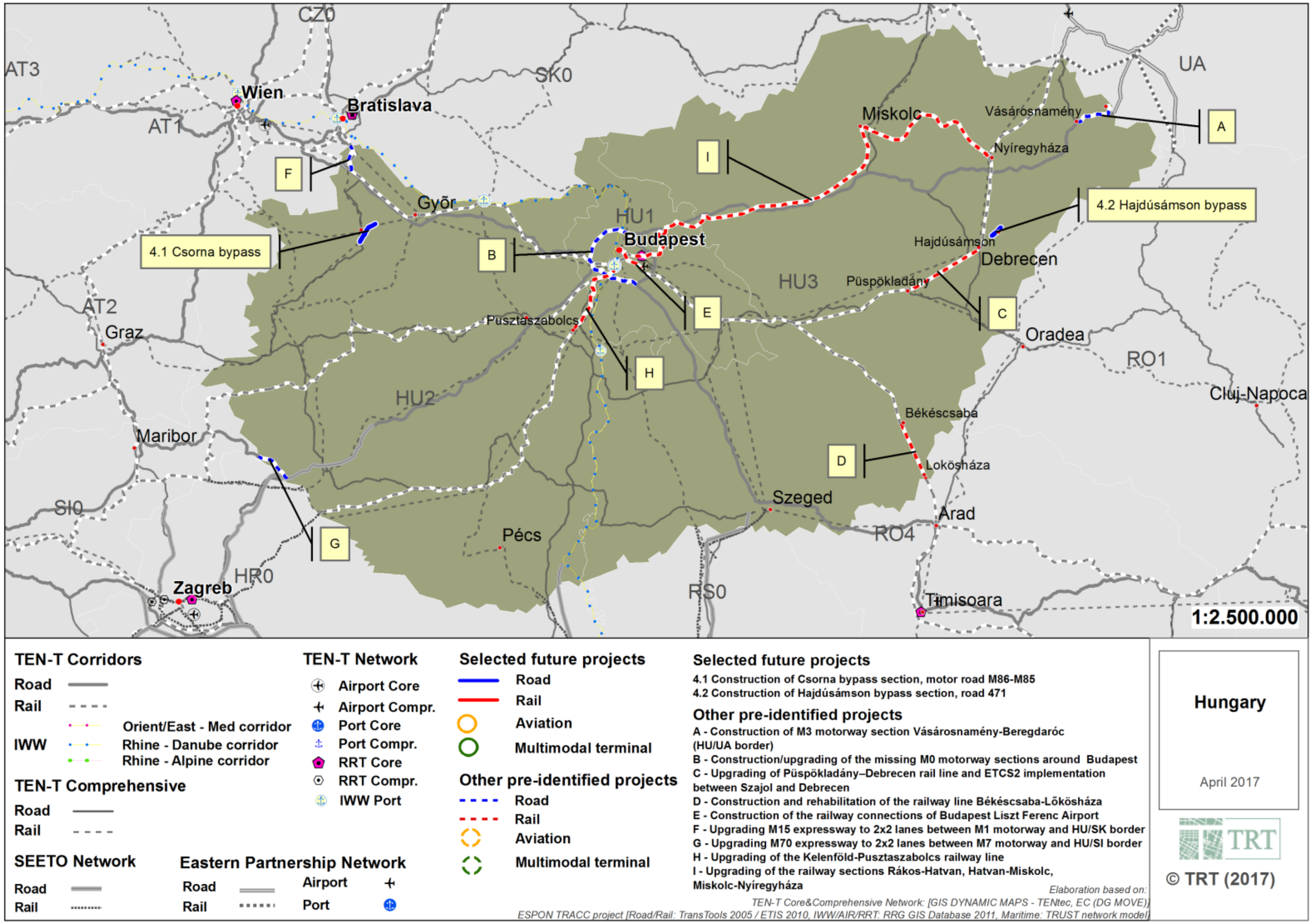
- The economy of FR4 is still compensating the negative impact of the global crisis and the demography patters show a constant reduction of the population.
- The transport demand volume of FR4 is a relatively small share of the total of the Danube Macro-Region. The internal demand of passengers is significantly high, being the 93% of the total.
- Air transport indicates that the demand concentrates in the airport of Budapest. During the last decade the demand increased by nearly 2 million passengers.

- Three TEN-T CNCs cross the FR4, namely the Rhine-Danube, the Orient/East-Med and the Mediterranean.
- The motorway and railway networks represent the 13% and 12% of the total of the Danube Macro-Region. The density of the networks, both for rail and road infrastructures is more dense in central Hungary, reflecting a radial configuration around the capital city.
- Main bottlenecks of the road network are due to non-adequate design standards, degraded surface and congested sections close to urban nodes. Deficiencies of the railway network concern the age of the bridges, which impacts on trains operations.
- The emissions of CO_2 are a small share of the Macro-Region.
- The index of accessibility potential to GDP is below the average of the Danube Macro-Region.

5.4.7 Identified future transport projects

- Construction of Csorna bypass section, motor road M86-M85
- Construction of Hajdúsámson bypass section, road 471

Figure 5-19: Map of identified projects in FR4



Source: TRT elaborations

5.4.7.1 FR4 Project 4.1 – Construction of Csorna bypass section, motor road M86-M85

General information: This project regards the construction of the second stage of the Csorna bypass, which is part of the development project of road M85.

The road M85 Győr-Csorna-Nagycenk is the East-West axis of the Győr-Moson-Sopron County and crosses the road M86 Rédics-Szombathely-Rajka in the town of Csorna.

The objectives of this project are presented in general terms. It is expected that, once completed, the Csorna bypass could generate benefits in terms of: time savings, safety levels, environmental impact and vehicle operating costs. The project could improve the accessibility of the region enhancing the mobility of both passengers and freight.

As regards its relevance, the project is in line with the EU transport policy, the National Transport Development Strategy of Hungary and with the National Land Use Framework Plan.

The project promoter is the National Infrastructure Developing Private Company Limited (i.e., NIF), the rail and road infrastructure manager of Hungary.

Technical description: The second stage of the Csorna bypass is 5,9 km long. It joins two adjacent sections. The first section is 4,4 km long with two lanes per carriageway. The second section is 1,5 km long with one lane per carriageway. The project includes 4 civil structures, but it is not specified the typology.

The total estimated investment cost is equal to € 47,6 million[57]. The cost breakdown by category is shown in Table 5-7. The expected expenditure schedule is shown in Table 5-8. Information has not been provided concerning estimated operating and maintenance costs.

Table 5-7: Estimated investment cost breakdown by category of the Csorna bypass

Cost category	Estimated cost [€], net of VAT
Engineering and supervision	359.561
Land acquisition	-
Civil works (Building work)	44.647.916
Equipment	-
Miscellaneous	2.625.113
Technical contingencies	-
Price contingencies [% escalation p.a.], if applicable	-
Interest repayment	-
Total	**47.632.590**

Source: Ministry for National Economy of Hungary (2017)

Table 5-8: Expected expenditure schedule of the Csorna bypass

Year	2016	2017	2018	Total
Scheduled expenditure	26.333.302	19.299.358	1.999.930	**47.632.590**

Source: Ministry for National Economy of Hungary (2017)

Project implementation: The construction of the first stage of the project was started in summer 2013 and finished in 2015. The second stage of the Csorna bypass is under construction. The implementation

57 The following exchange rate has been applied to convert the currency, Euro/HUF equal to 310,10.

schedule covers the period from 04/2016 to 04/2018. All necessary permits are available[58] and the necessary procurement process is completed.

Transport demand: There is not a detailed information concerning the transport demand of this section. General statements provide with limited quantitative insights.

The main direction of road freight flows is on the East-West direction along the existing expressway network. The North-South industrial axis in the region generates heavy road freight traffic of which a significant part originates outside of the region, therefore a part of the heavy road traffic is only in transit. Due to the poor competitiveness of the rail mode on short distance, a significant amount of agricultural products is moved by road to the destinations of Burgenland.

In particular, the traffic of the roads M85 and M86 has an international component and is gradually increasing. According to the information provided by the consulted stakeholder, the number of heavy vehicles on the M86 has more than doubled after Hungary's accession to the EU. Figures of the urban section of Csorna[59], indicate that the number of trucks observed on the M85 and M86 has grown from 2.780 to 6.256 vehicles/day (i.e., +125%). The reported share of heavy goods vehicles is remarkably above the Hungarian average (i.e., about 30-33% and on some sections 38%).

Financial analysis: There is no information available concerning neither the profitability, nor the sustainability analysis. According to the consulted stakeholders, a decision has not been taken yet by the Government, but the bypass is expected to be a tolled section.

The financial plan foresees the request of a loan by the EIB covering the entire estimated investment cost (i.e., € 47,6 million). Concerning the funding mechanism, other sources of financing are not foreseen (i.e., national budget or other EU funds).

The operating and maintenance costs will be covered with resources from the national budget (as per Government Decree n. 1978/201 5). The operation and maintenance of Hajdúsámson bypass will be the responsibility of Hungarian Public Road No-profit Private Limited Company (i.e., MK NZrt.) (as per Decree n. 6/1998 (III. 11) of the Ministry of Transport).

Economic analysis: The economic analysis of the Csorna bypass alone is not available. According to the consulted stakeholder the economic analysis was completed for the whole project of the M85. Limited information provided indicates that the economic life span of the project assumed a 30-year period.

Environmental analysis: According to the documents made available to the Consultant, the project will not have significant effects on the environment. Affected areas are agricultural lands. Only one nature conservation point is located nearby, which is not affected by acquisition. No effect on the built and residential areas. Noise emission and air pollution are below the limit. Natura 2000 sites or water resources hydrogeological protection zones are not concerned.

Safety levels: There is no specific information on safety issues and black spots, before and after project implementation.

58 The construction permit has been issued by the Government Office of Győr-Moson-Sopron County.

59 According to information available on the publication "The cross-sectional traffic of national roads in years 2003 to 2010".

5.4.7.2 FR4 Project 4.2 – Construction of Hajdúsámson bypass section, road 471

General information: This project regards the construction of the Hajdúsámson bypass (i.e., 8,6 km long).

The project is localised on the road M471, which crosses the town of Hajdúsámson, in the County of Hajdú-Bihar. The road M471 is part of the TEN-T comprehensive network and is the North-East axis of the County, connecting the city of Debrecen to the state borders with Romania and Ukraine.

The objectives of this project are presented in general terms. Basically, the Hajdúsámson bypass is part of a long development project of road 471, which once completed is expected could generate benefits with respect to: time savings, safety levels, environmental impact and vehicle operating costs. The project could improve the accessibility of the region enhancing the mobility of both passengers and freight.

As regards its relevance, the project is in line with the EU transport policy, the National Transport Development Strategy of Hungary and the National Land Use Framework Plan.

The project promoter is the National Infrastructure Developing Private Company Limited (i.e., NIF), the rail and road infrastructure manager of Hungary.

Technical description: The Hajdúsámson bypass will be single-carriageway road, with one lane per direction. The alignment will pass Hajdúsámson from North-West, crossing the Debrecen-Mátészalka railway line twice. The project foresees also the construction of 3 junctions.

The total estimated investment cost is nearly equal to € 33 million[60]. The cost breakdown by category is shown in Table 5-9. The expected expenditure schedule is summarised in Table 5-10. Information has not been provided concerning estimated operating and maintenance costs.

Table 5-9: Estimated investment cost breakdown of the Hajdúsámson bypass

Cost category	Estimated cost [€], net of VAT
Engineering and supervision	548.210
Land acquisition	n. a.
Civil works (Building work)	26.868.147
Equipment	n. a.
Miscellaneous	5.593.061
Technical contingencies	n. a.
Price contingencies [% escalation p.a.], if applicable	n. a.
Interest repayment	n. a.
Total	**33.009.418**

Source: Ministry for National Economy of Hungary (2017)

Table 5-10: Expected expenditure schedule of the Hajdúsámson bypass

Year	2016	2017	2018	Total
Scheduled expenditure	6.310.867	19.912.286	6.786.265	**33.009.418**

Source: Ministry for National Economy of Hungary (2017)

Project implementation: The project implementation schedule covers the period from 12/2016 to 03/2018. The project is under construction and all necessary permits are available[61]. The ongoing tenders and procurement plan are summarised in Table 5-11.

[60] The following exchange rate has been applied to convert the currency, Euro/HUF equal to 310,10.

[61] The construction permit has been issued by the Government Office of Hajdú-Bihar County.

Table 5-11: Procurement plan of the Hajdúsámson bypass

Contract	Expected date of the signature
Performing the construction tasks of Hajdúsámson bypass and related structures	12/2016
Performing the engineering tasks for the construction tasks of Hajdúsámson bypass and related structures	03/2017

Source: Ministry for National Economy of Hungary (2017)

According to the information provided to the Consultant, the contract "Performing the engineering taks for Hajdúsámson bypass and related structures" has not been signed yet.

Transport demand: There is not specific information provided to the Consultant concerning the transport demand. A very general statement reports that traffic load is increasing.

Financial analysis: There is no information available concerning neither the profitability, nor the sustainability analysis. According to the consulted stakeholders, a decision has not been taken yet by the Government, but the bypass is expected to be a tolled section.

The financial plan foresees the request of loan by the EIB covering the entire estimated investment cost (i.e., € 33 million). Concerning the funding mechanism, other sources of financing are not foreseen (i.e., national budget or other EU funds).

The operating and maintenance costs will be covered with resources from the national budget (as per Government Decree n. 1978/2015). The operation and maintenance of Hajdúsámson bypass will be the responsibility of Hungarian Public Road No-profit Private Limited Company (i.e., MK NZrt.) (as per Decree n. 6/1998 (III. 11) of the Ministry of Transport).

Economic analysis: The economic analysis has not been carried out. The only information provided by the consulted stakeholder indicates that the economic life span of the project assumed a 30-year period.

Environmental analysis: According to the documents made available, the project will not have significant effects on the environment. The Natura 2000 sites are not involved.

The acquisition of agricultural land for the construction activities is envisaged. There are not details on the impact of this activity on time for implementation and costs estimation. The project is expected to (i) reduce transport-derived emissions (i.e., air pollutants and noise[62]). A closed rainwater drainage system should be used in some areas[63].

Safety: There is no specific information on safety issues and black spots, before and after project implementation.

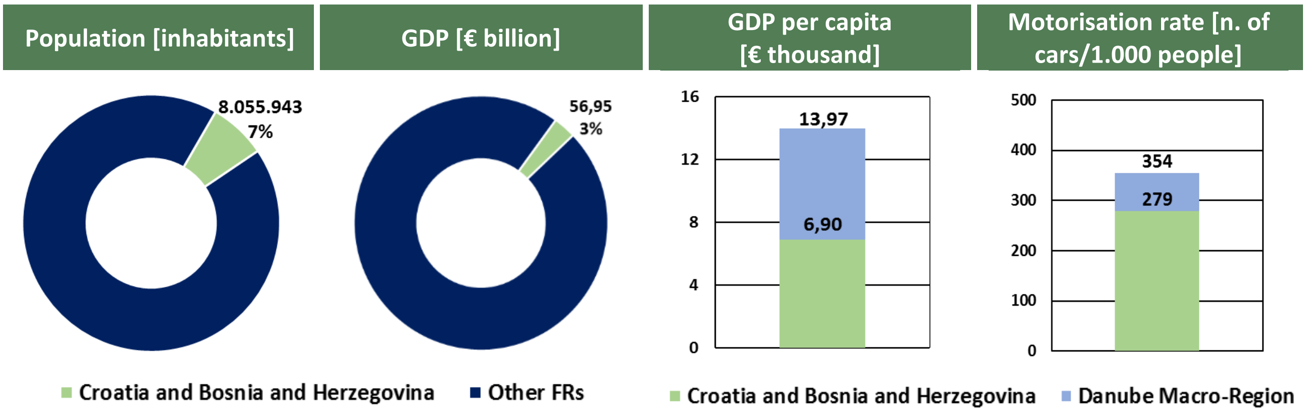
[62] The noise level expected is compliant with the limits set by the national legislation.

[63] To protect hydrogeological resources of "B" type water.

5.5 FR 5 – Croatia and Bosnia and Herzegovina

The FR5 merges two countries, namely the EU Member State of Croatia and the accession country of Bosnia and Herzegovina.

5.5.1 Socio-economic characteristics

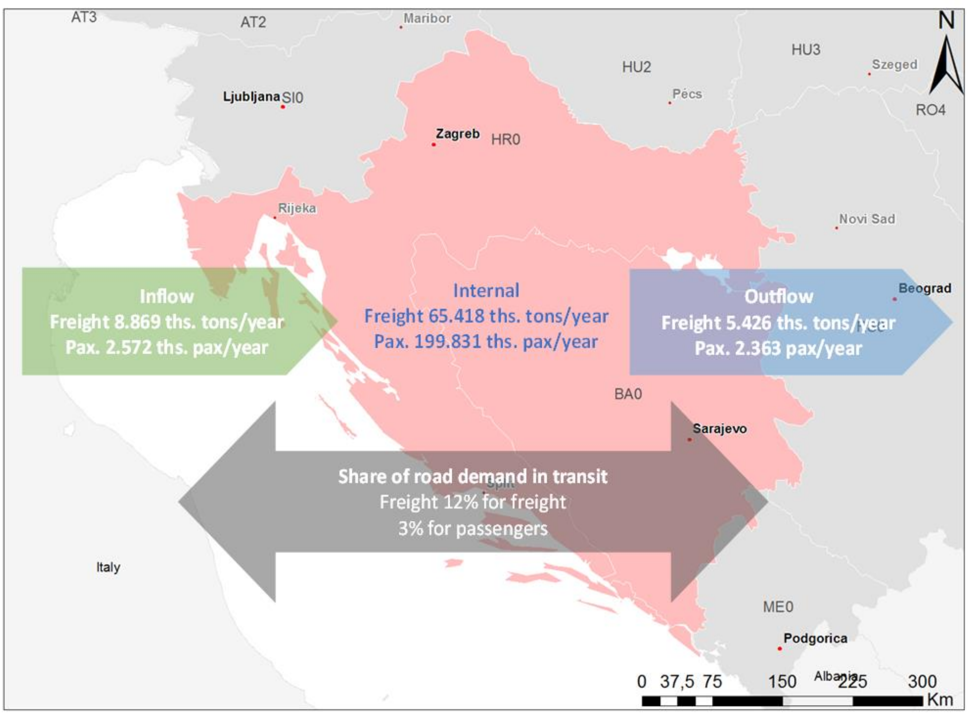


Source: Eurostat (2016), World Bank (2016) and National Statistics (2016)

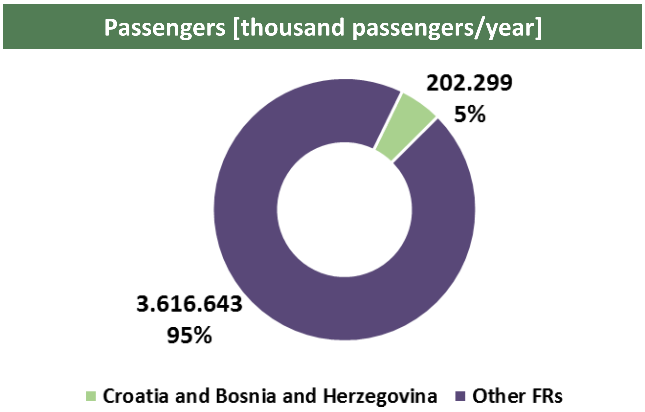
5.5.2 Transport demand and infrastructures

The estimated rail and road transport demand exchanged within FR5 is 6% of the total estimated for the Danube Macro-Region for freight and 5% for passengers. The estimated internal freight flows represent almost the entire demand of this FR (i.e., 97,6 %), while the internal passengers demand stands at a 82,1% of the total. As regards the estimated road demand in transit, it accounts for 12% for freight and 3% for passengers of the total road demand generated by the FR (see Figure 5-20). The main road and rail traffic flows are localised on corridors Vc and X and on the link from Zagreb to Dubrovnik.

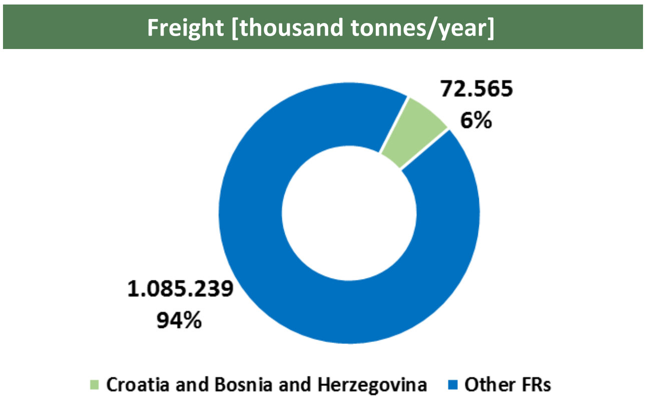
Figure 5-20: Road and rail transport flows of FR5



Source: TRT elaborations on TRUST (2016) and Eastern Partnership models (2016)



O/D	FR5	Other FRs	Total
FR5	199.831	2.363	**202.194**
Other FRs	2.572	3.614.175	**3.616.746**
Total	**202.403**	**3.616.538**	**3.818.941**



O/D	FR5	Other FRs	Total
FR5	65.418	5.426	**70.844**
Other FRs	8.869	1.078.092	**1.086.961**
Total	**74.287**	**1.083.518**	**1.157.804**

Source: TRT elaborations on TRUST (2016) and Eastern Partnership models (2016)

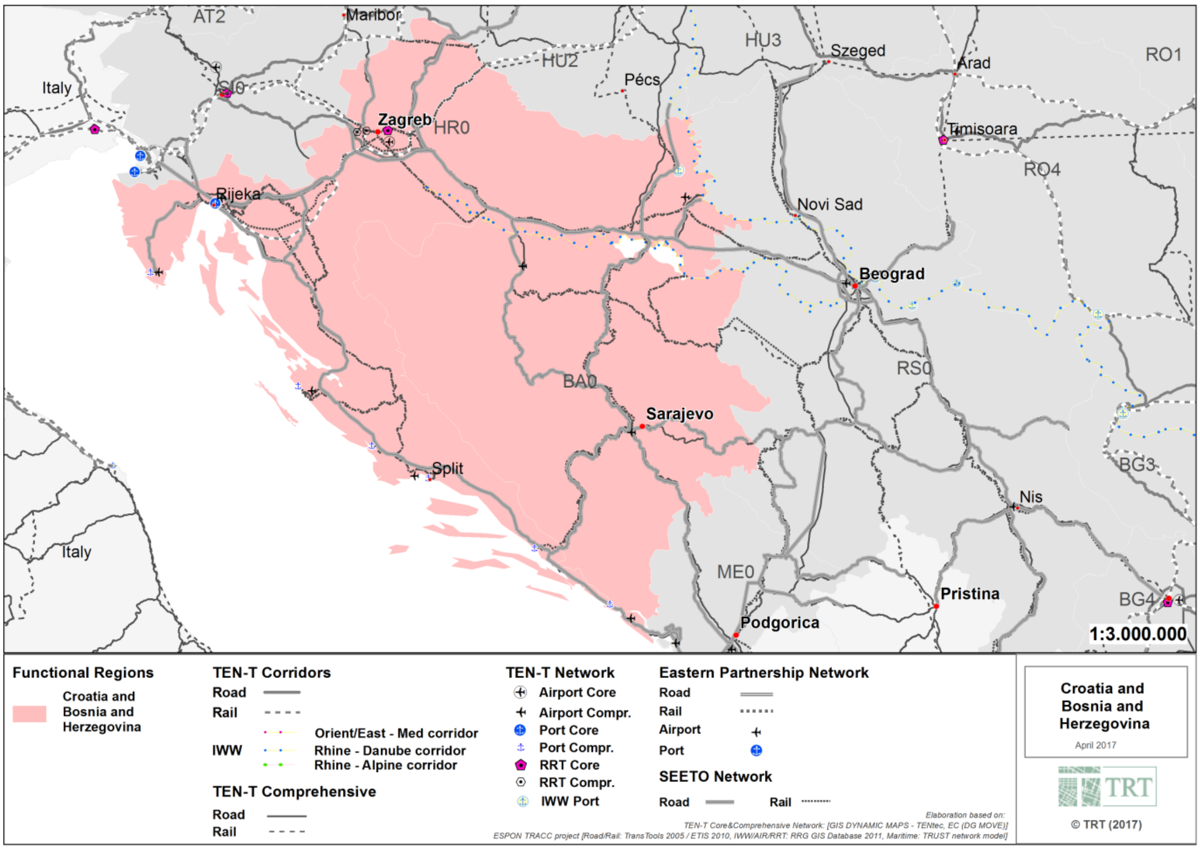
The air traffic of 10 observed airports is relatively small in absolute values. According to latest data of 2015, 8,1 million passengers and 17,8 thousand tonnes have been recorded (i.e., 6% of the total passengers carried and 2% of freight of the Danube Macro-Region). Air traffic mostly concentrates in the regional hub of Zagreb, which holds a share of 32% of passengers and 40% of freight that transited in FR5. It is worth observing that air passengers demand for tourism purposes concentrates in the airport of Split, showing significant peaks during summer (i.e., 80% of the annual volume in transit).

As regards maritime freight traffic, the 7 Croatian ports along the coast of the Adriatic Sea handled a throughput of 15,3 million tonnes in 2015 (i.e., 10,3% of the total of the Danube Macro-Region). The main port is Omisalji in Croatia, with a share of 3% of the total maritime freight transport of the Macro-Region (i.e., 4,7 million tonnes in 2015). As regards passengers transport, the port with the largest number of embarked and disembarked passengers is the Croatian port of Split, with a share of 15% of the total of the Danube Macro-Region (i.e., 3,9 million passengers in 2015).

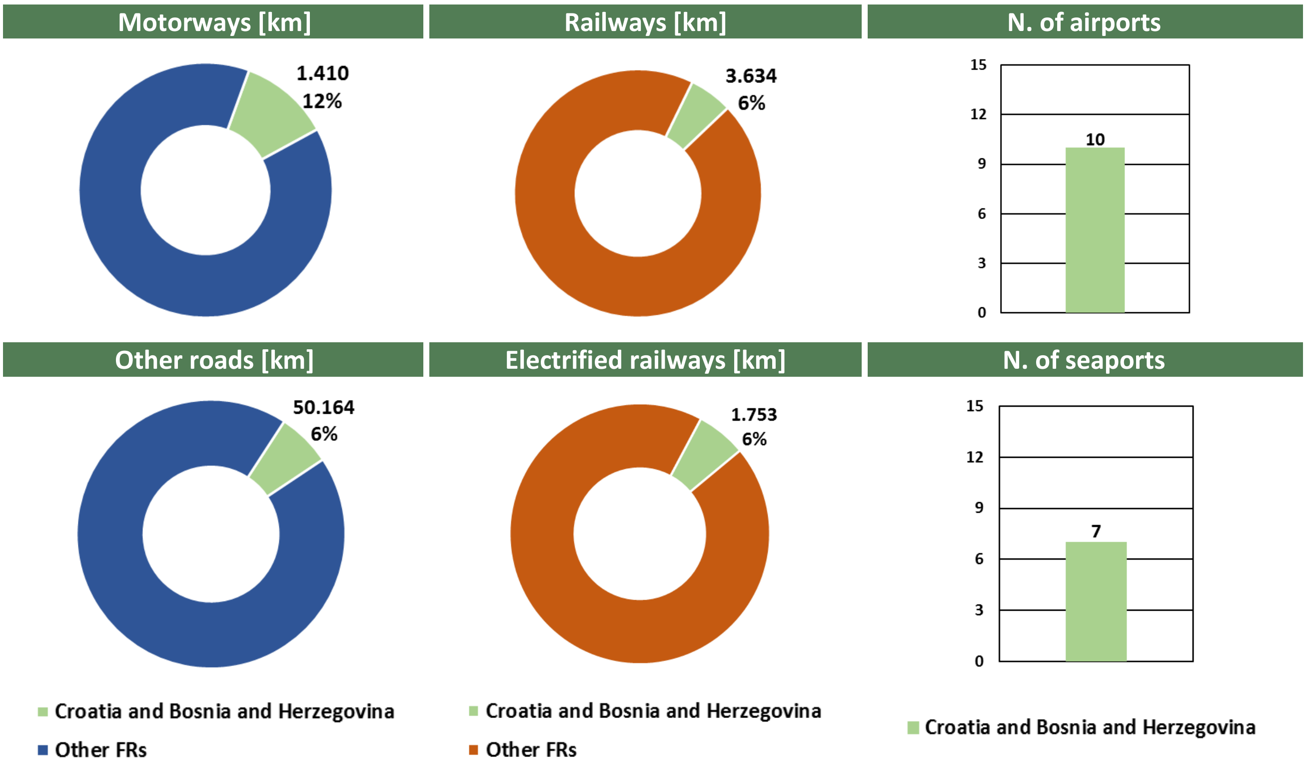
With respect to the transport networks, the Mediterranean TEN-T CNC crosses Croatia. The transport network of Bosnia and Herzegovina is part of the SEETO network[64]. According to the indicative enlargement of the TEN-T to the Western Balkans, the extensions of the Mediterranean CNC overlaps the SEETO network in Bosnia and Herzegovina on corridors Vc and X (see Figure 5-21).

[64] Corridor Vc, Route 2a and Route 3 – for road – and Corridor Vc and Route 9a – for rail.

Figure 5-21: Transport network localisation of FR5



Source: TRT elaborations (2017)



Source: Eurostat (2016), National Statistics (2017), Bosnia and Herzegovina (2016), Ministry of Infrastructure of Ukraine (2017), TRT (2017)

5.5.2.1 Bottlenecks

The main road bottlenecks are located on the western part of the Zagreb bypass, on the section Rijeka-Senj, Split-Makarska, Dubrovnik-state border with Montenegro (Ministry of Transport, Maritime Affairs and Infrastructure, 2014). On sections Semizovac-Sarajevo, Mostar-Zitomislic, Zenica-Visoko and Travnik-Lasva of Corridor Vc[65] (SEETO MAP, 2016), another issue is the isolation of the Dubrovačko-Neretvanska county.

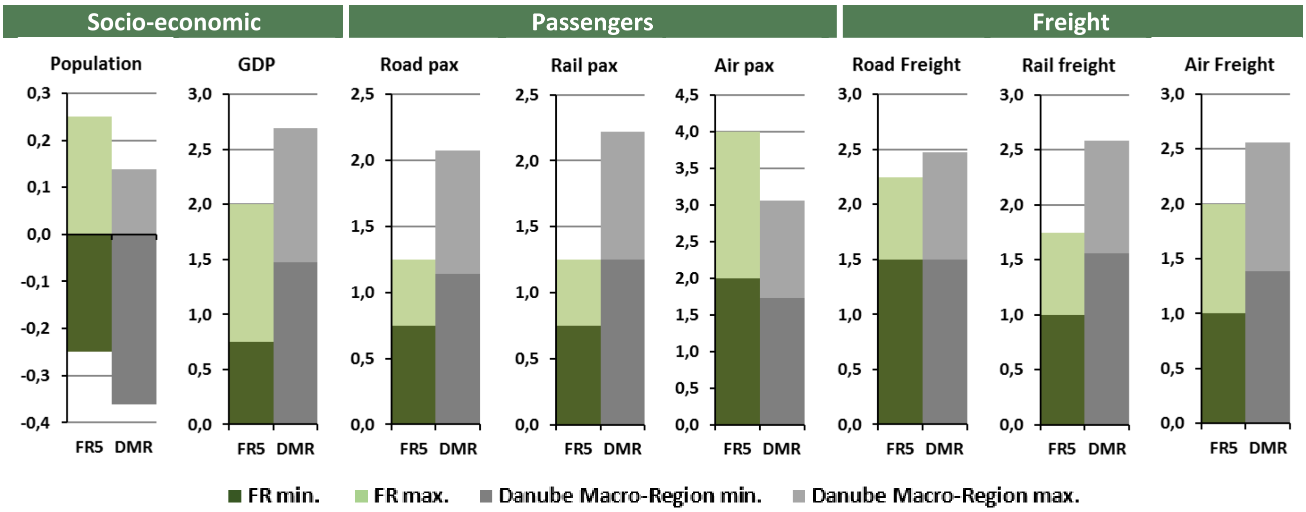
As regards the railway network, there are no sections equipped with ERTMS. The main limitations concern the maximum train length, the maximum allowed speed and the need to change the locomotives to access to non-electrified sections. The node of Zagreb is a bottleneck in terms of lack of capacity, alongside with the sections Zagreb-Dobova (i.e., border with Slovenia), Dugo Selo-Botovo (i.e., Croatia-Hungary border)[66], Zagreb-Dugo Selo and Zagreb-Rijeka (EC, 2014b).

Non-physical bottlenecks exist at cross-border operations, given the heterogeneity of technical standards and existing differences of rail market regulation between EU and non-EU countries. The lack of interoperability of rolling stock and different homologation process result in the compulsory change of locomotives at the border stations (ACROSSEE, 2014).

The physical bottlenecks of the air transport network of FR5 regard the terminal modernisation at Split and Sarajevo airports (IBRD, 2015). The non-physical limitations exist considering the relative vicinity of the nodes in this FR and the limited cooperation amongst regional airports (SEETO, 2016).

5.5.2.2 Indicative projections of key socio-economic parameters and demand volumes

The projected population trend foresees either positive or negative patterns, to some extend depending on the future migration flows of the inhabitants of coastal islands of Croatia. The crisis of the economy negatively impacted on Croatia, but marginally on Bosnia and Herzegovina. This envisage a relatively wide range to project GDP growth depending on the future mix of development paces. Given the size of the two economies, the growth would be at lower rates compared to the average of the Danube Macro-Region. The transport activities would growth accordingly, except for air passengers demand, driven by tourists flows.



Source: TRT elaborations on Capros et al. (2016), EC (2014), IBRD (2015), National Transport Plans and Strategies

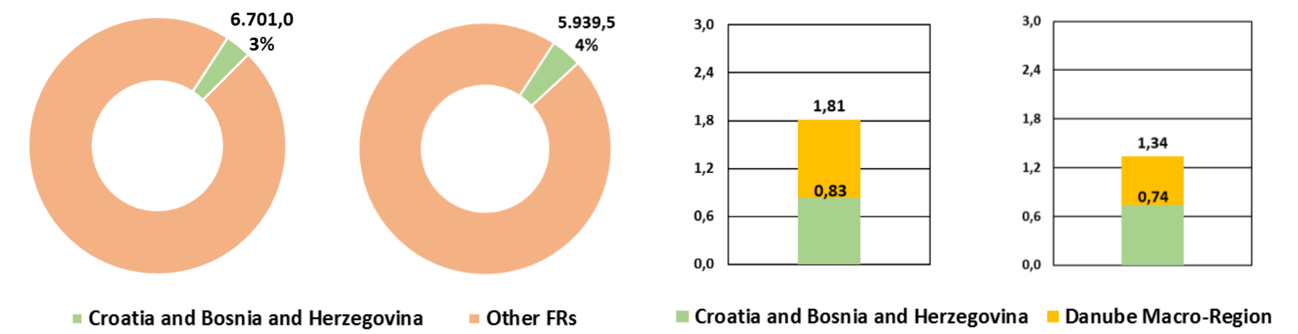
---

65 The project "Construction of the Motorway section Tarčin-Konjic of Corridor Vc" has been identified as a future transport project and the fiche has been developed.

66 The project "Modernisation of the railway line Dugo Selo-Hungarian border (sections Dugo Selo-Križevci and Križevci-state border)" has been identified as a future transport project and the fiche has been developed.

5.5.3 Environmental aspects

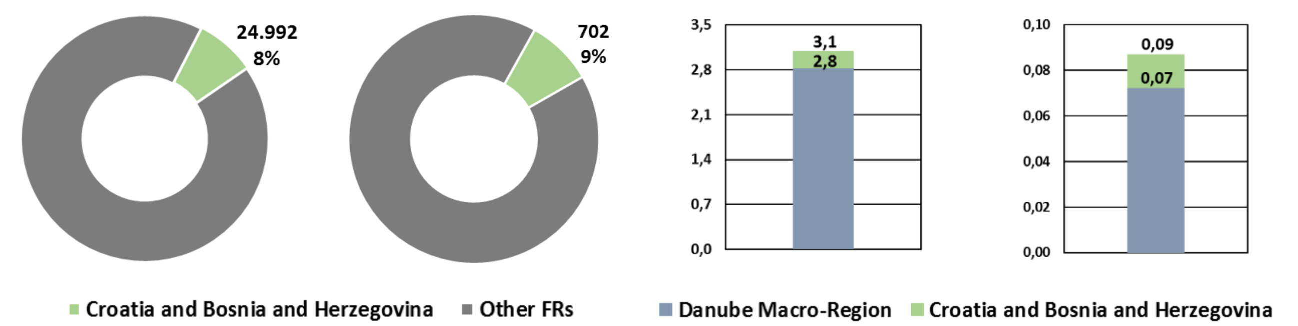
CO_2 emissions		Cars CO_2 emissions per capita	
Total [ths. tons/year]	Cars [ths. tons/year]	Total [tons/year]	Cars [tons/year]



Source: TRT elaborations on the ASTRA and PRIMES models (2016) and the KNOEMA database (2016)

5.5.4 Safety aspects

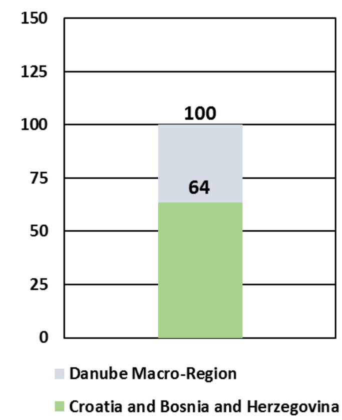
N. of injured people	N. of killed people	N. of injured /1.000 people	N. of killed/1.000 people



Source: TRT elaborations on the OECD (2016), Eurostat (2016) and National Statistics (2016)

5.5.5 Accessibility

With a value of 65, FR5 shows less locational advantages than the average.



Source: TRT elaborations from ESPON TRACC (2012)

5.5.6 Key elements

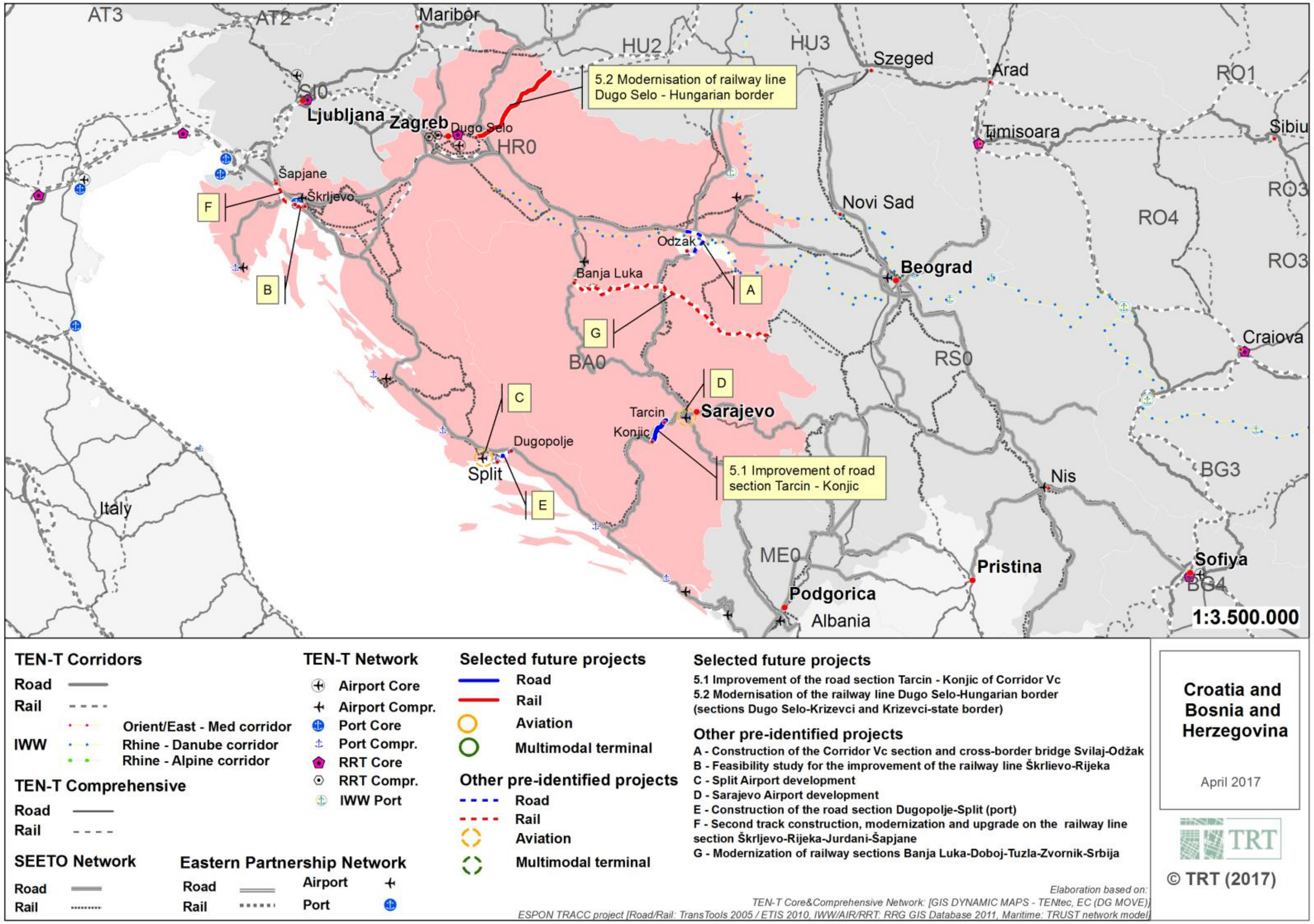
- The socio-economic characteristics of the FR5 reflects the mix of wealth and development paces of the two countries.
- The estimated internal freight flows represent almost the entire demand of this FR, while for passengers internal demand stands at a 82,1% of the total. The main road and rail traffic flows are localised on SEETO corridors Vc and X.

- Air traffic mostly concentrates in the regional hub of Zagreb. Air passengers demand for tourism concentrates in the airport of Split, showing demand peaks during summer season.
- The transport infrastructure networks join the Mediterranean CNC in Croatia with its extensions overlapping the SEETO network in Bosnia and Herzegovina on corridors Vc and X.
- The main road bottlenecks in Croatia are located on the Zagreb bypass. In Bosnia and Herzegovina, on the Corridor Vc.
- There are no rail sections equipped with ERTMS. The limitations of the rail network also concern the maximum train length, the maximum allowed speed and the need to change the locomotives to access to non-electrified sections.
- The emissions of CO_2 are a small share of the Macro-Region.
- The index of accessibility potential to GDP is below the average of the Danube Macro-Region.

5.5.7 Identified future transport projects

- Improvement of the road section Tarčin-Konjic of Corridor Vc
- Modernisation of the railway line Dugo Selo-Hungarian border (sections Dugo Selo-Križevci and Križevci-state border)

Figure 5-22: Map of identified projects in FR5

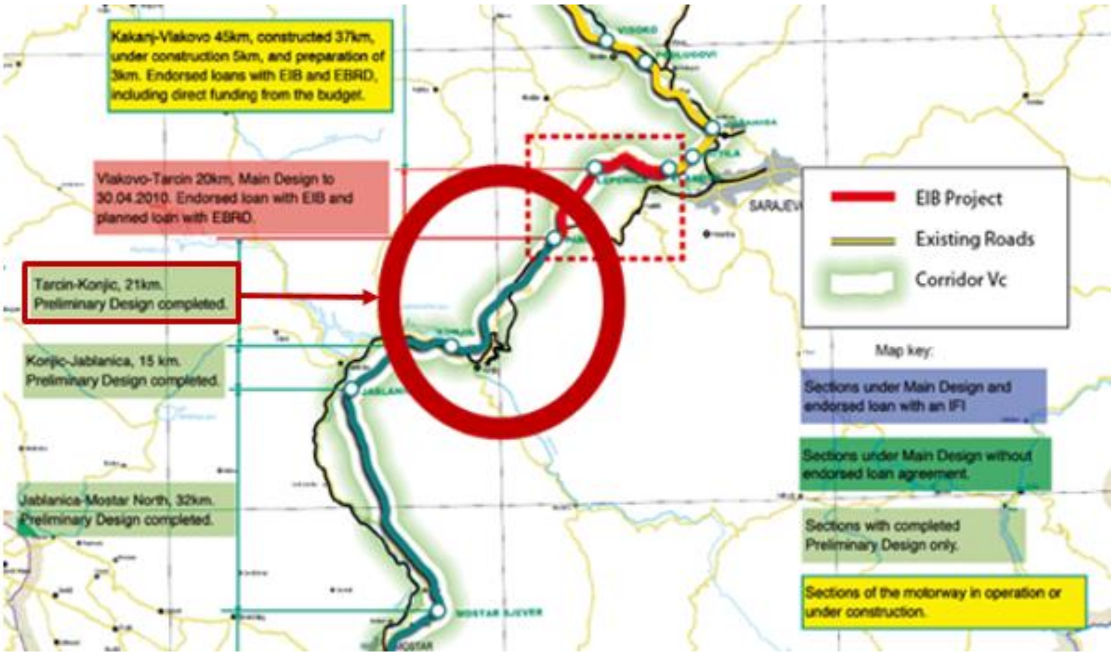


Source: TRT elaborations

5.5.7.1 FR5 Project 5.1 – Improvement of the road section Tarčin-Konjic of Corridor Vc

General information: this project regards the improvement of the road section Tarčin-Konjic, of Corridor Vc (see Figure 5-23).

Figure 5-23: Geographical location of the road section Tarčin-Konjic



Source: TRT elaboration on EIB map

As regards the relevance of the project, the need to improve the motorway Corridor Vc has been included in the Memorandum of Understanding for the development of the core transport network of the South-East Europe and in the Framework of Transport Strategy of Bosnia and Herzegovina (2016). The road Corridor Vc connects the central coast of the Adriatic Sea with Budapest, representing a major route for trans-European transport.

Technical description: the section length is 21,15 km. It will be constructed according to TEM Standards and Recommended Practice (UNECE, 2002), with a design speed of 120 km/h. The maximal longitudinal gradient is 4,99% and the minimal curve radii 650 m. Table 5-12 summarises the estimated costs.

Table 5-12: Estimated construction costs of the road section Tarčin-Konjic

Item	Cost [€ million]
Construction costs	375,14
Other costs (designing, supervision and unforeseen works)	22,51
Land acquisition/reimbursements	3,22
Total realisation costs net of VAT	**400,87**
VAT (17%)	68,15
Total realisation costs	**469,02**

Source: IPSA-Sarajevo and IGH-Zagreb (2006)

Project implementation: the project implementation schedule has not been finalised yet. According to the Government of Bosnia, the project is mature and ready to be implemented, though management and supervision organization are not yet defined, as well as procurement plan and the source of financing.

Transport demand: traffic forecast and modelling for the network with and without the motorway were carried out in accordance with the foreseen schedule of realisation per sections for the timeframe of 30 years upon putting individual sections into operation. The forecasts were elaborated assuming the average annual traffic growth rates for Bosnia and Herzegovina of 5,8% in 2006 and 3,2% from 2036 onwards. The estimated traffic along the section Tarčin-Konjic amounted to 7.331 AADT in 2005.

Financial analysis: the government of Bosnia and Herzegovina considered a PPP scheme for project implementation (i.e., Build, Operate and Transfer). The designated concessionaire company would provide the financing sources for construction works, while the resources for the design, supervision, unplanned works and expropriation would be covered by the government. On the revenues side, two scenarios have been considered for toll collection.

The FNPV of the road section Tarčin-Konjic is negative, (at 4%-6%). The FIRR is 1,14%. The sensitivity analysis has been carried out assuming variations of investment costs and revenues.

Economic analysis: the evaluation assumed a time period of 30 years. The section Tarčin-Konjic shows an EIRR equal to 10,48% in the base case. The ENPV switches from € 86,53 million to € -34,45 million when the social discount rate increases from 8% to 12%. Finally, the project is not sensitive to increases in investments, reductions in benefits and construction delays for 1-2 years within a variation of 10%.

Environmental analysis: upon the realisation of the preliminary EIA and the first round of public consultations, competent ministries agreed to carry out the EIA study for the motorway project of Corridor Vc[67]. Specific conclusions on the impacts of the project are not available.

Safety levels: the Table 5-13 shows the indicators obtained with regard to road accidents along the road network of Bosnia and Herzegovina, and specially on trunk roads network within the zone of Corridor Vc.

Table 5-13: Summary indicators of road accidents and consequences of Corridor Vc

Type of accident	Number of traffic accident per 100 million vehicle·km (entire road network)		Number of traffic accident per 100 million vehicle·km (road network within the zone of Corridor Vc)	
	Bosnia and Herzegovina	Republika Srpska	Bosnia and Herzegovina	Republika Srpska
Fatalities	3,94	6,39	4,60	7,45
Injuries	41,90	46,04	21,76	23,91
Material damage only	121,50	130,68	39,08	42,94

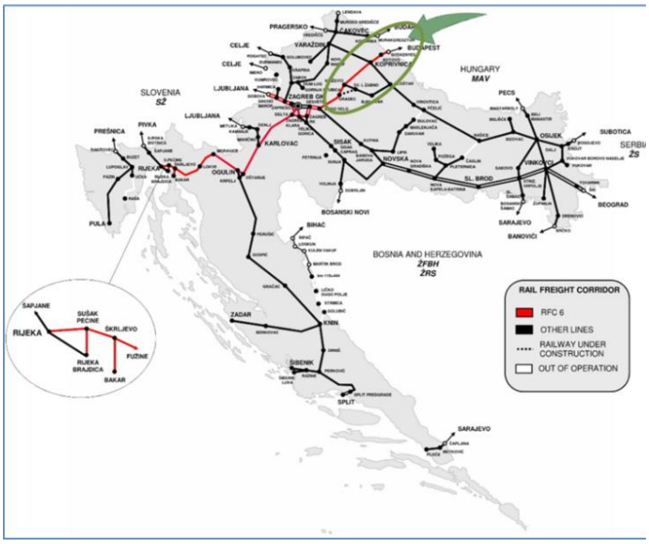
Source: Annual Statistics of Bosnia and Herzegovina (2004), MUP of Republika Srpska and IPSA Institute Sarajevo (2005)

67 This decision included the obligation of the appointed consultant to consider the results of the first round of public consultations with institutional stakeholders (i.e., municipal administrations, power supply company, telecommunication company and other utilities) and wider public represented by inhabitants in the affected areas of the future corridor.

5.5.7.2 FR5 Project 5.2 – Modernisation of the railway line Dugo Selo-Hungarian border (sections Dugo Selo-Križevci and Križevci-state border)

General information: this projects reagrds the modernisation of the railway line connecting Dugo Selo with the Hungarian border, which is part of the Mediterranean CNC. The existing line is single track and electrified with a total length of 79,1 km from Dugo Selo to the border with Hungary (see Figure 5-24).

Figure 5-24: Localisation of the railway line Dugo Selo-Hungarian border within the Croatian railway network



Source: Network Statement for year 2018 (issued on December 2016), HŽ Infrastruktura

The rail line modernisation is part of a larger project for setting up a high-efficiency, double-track railway line for mixed transport along the entire Mediterranean CNC. The rail line modernisation will increase in traffic volumes connecting Rijeka and Zagreb to the Hungarian network. The project will be compliant with the TEN-T requirements and will accommodate interoperable freight trains. The promoter of the project is HŽ Infrastruktura, the rail infrastructure manager of Croatia.

From the functional point of view, the project can be considered as a unique investment, even if due to its complexity the activities are divided into two separate steps concerning (i) the upgrade and construction of the second track between section Dugo Selo and Križevci and (ii) the upgrade and construction of the second track between Križevci, Koprivnica and the border with Hungary.

Technical description

- **Section Dugo Selo-Križevci**: the project comprises the design, construction and putting into service of the Dugo Selo-Križevci rail section including upgrades of existing 35,75 km single track, electrified, railway from Dugo Selo to Križevci with some minor track realignments plus the addition of a second track and station improvements. The total length of the section is 38,23 km.

  The total cost (including expropriation, supervision and contingencies) is € 195 million. Maintenance costs without the project are € 2,53 million/year, while in project scenario are € 4,29 million/year.

- **Section Križevci-Koprivnica-state border:** upgrade and reconstruction of the existing track as well as construction of a second parallel track. At the subsection Carevdar-Lepavina, due to the difficult technical characteristics of the land in this area, the existing route is to be abandoned and a completely new double track railway line is planned.

  The total cost is € 297,11 million (of which € 283,94 million are eligible costs). The maintenance cost is € 2,89 million/year. Due to the doubling of the track, it is estimated that maintenance cost will increase by 25%, while the operating costs will increase by 50% after the year 2031.

Project implementation

- **Section Dugo Selo-Križevci:** construction works started during July 2016 and the opening of the second track is forecasted at beginning of 2020. Even if construction works started yet and are in progress, the representatives of HŽ Infrastruktura during the meeting with the Consultant pointed out how the availability of further financing sources could guarantee of the national budget share of 15%.
- **Section Križevci-Koprivnica-state border:** the contract for the preparation of design and other project documents for upgrade and construction of second track was signed in December 2012 by HŽ

Infrastruktura d.o.o. as Contracting Authority and URS Polska Sp. z.o.o., in consortium with URS Infrastructure and Environment UK Limited and IDOM Ingenieria y Consultoria S.A., as the Consultant.

The total value of the design contract is € 5,3 million, of which 85% is provided by the European Union (IPA) and 15% by the Croatian Government. The deadline for the completion of the design is 42 months from the contract signature date. No details about further procurement plans (for construction) were given to the Consultant at the moment.

Transport demand: only limited information is available about the transport demand and refers to the Dugo Selo-Križevci section. Forecasts were based on a model based on the GDP growth and convergence of Croatia towards EU trends. No generated traffic is foreseen. The increase in traffic is assumed to be solely the effect of economic growth.

Financial analysis: the financial profitability analysis is illustrated in Table 5-14**.**

Table 5-14: Performance indicators of the financial profitability analysis of the Dugo Selo-Križevci project

Section	Return on investment		Return on national capital	
	FNPV(C) [€]	FIRR(C) [%]	FNPV(C) [€]	FIRR(C) [%]
Dugo Selo-Križevci[68]	- 167.970.559	-6,08	- 23.263.718	-0,18
Križevci-Koprivnica-state border[69]	-251.958.925	-5,75	-35.553.214	-0,06

Source: HŽ Infrastruktura

The results of sustainability analyses of Section Dugo Selo-Križevci show that the project will not at any moment run out of cash. The financial sustainability of the Section Križevci-Koprivnica-state border shows that the cumulated cash flow shows is below zero during the first years. This is because all annual net operating expenses will not be covered at the beginning by HŽ Infrastruktura revenues. It is assumed that these amounts will be paid by subsidies.

Economic analysis: the economic performances of the two sections is summarised in Table 5-15.

Table 5-15: Performance indicators of the financial profitability analysis of the Dugo Selo-Križevci project

Section	Social discount rate [%]	ENPV [€ million]	EIRR [%]	Benefit/cost ratio
Dugo Selo-Križevci	5,5	189,00	10,91	2,47
Križevci-Koprivnica-state border	5,0	14,53	5,37	Not available

Source: HŽ Infrastruktura

Environmental analysis

- **Section Dugo Selo-Križevci:** the EIA has been prepared and positive opinion has been obtained from the relevant authority (i.e., Ministry of Environment and Nature Protection) in November 2005. An additional study performed during 2012 concluded that the project will not have any significant adverse effects on the area of National Ecological Network and possible future Natura 2000 sites.
- **Section Križevci-Koprivnica-state border:** the EIA has been prepared and positive opinion has been obtained from the relevant authority (i.e., Ministry of Environment and Nature Protection).

Safety levels: a general improvement of the safety level for both section will be obtained by (i) the development of a more advanced signalling system, (ii) the improvement and reshape of the existing stations designed with higher safety standards and (iii) the de-levelling of the most critical road level crossings, together with the disposition of audio and visual signals and barriers in the ones that are kept.

---

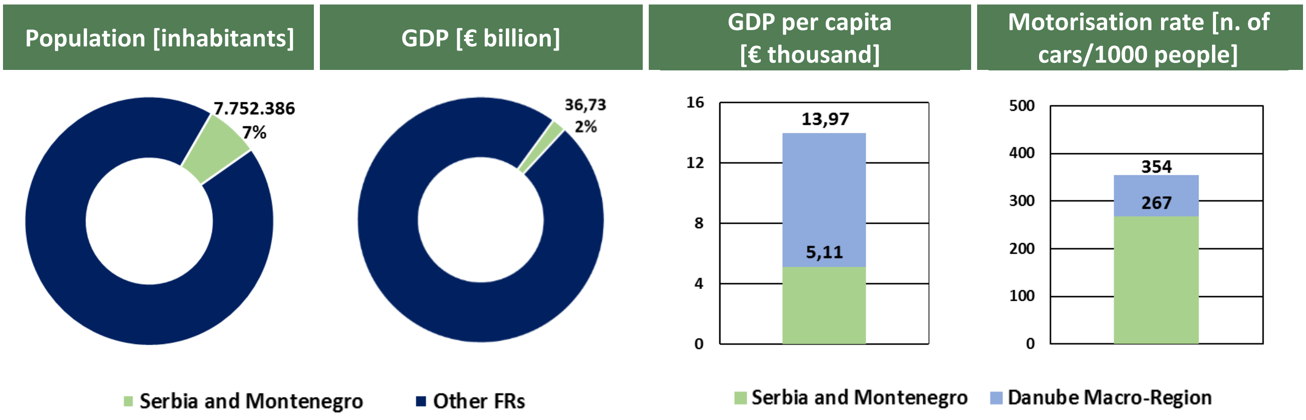
68 Assuming a discount rate equal to 5%.

69 The adopted discount rate was not communicated.

5.6 FR 6 – Montenegro and Serbia

The FR6 merges two countries of the Western Balkans, namely Serbia and Montenegro. Both are candidate countries for accession to the EU.

5.6.1 Socio-economic characteristics

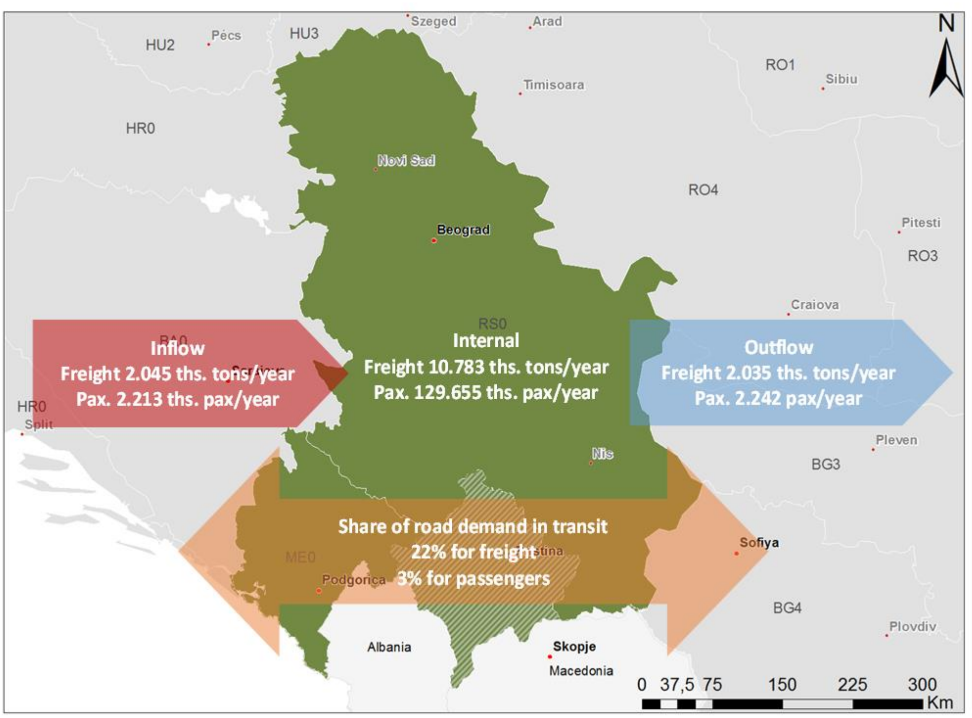


Source: Eurostat (2016), World Bank (2016) and National Statistics (2016)

5.6.2 Transport demand and infrastructures

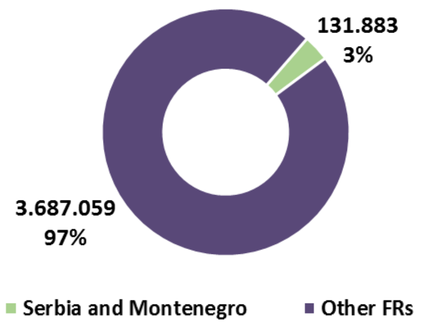
The estimated rail and road transport demand for FR6 is low compared to the rest of the Danube Macro-Region. As regards both passengers and freight transport, they account for 3% and 1% of the total, respectively. The internal demand takes up almost the entire demand of this FR, namely 96,7% for passengers and 72,5% for freight. As regards the estimated road transits, they account for 22% of the total road demand generated by the FR for freight and 3% for passengers (see Figure 5-25).

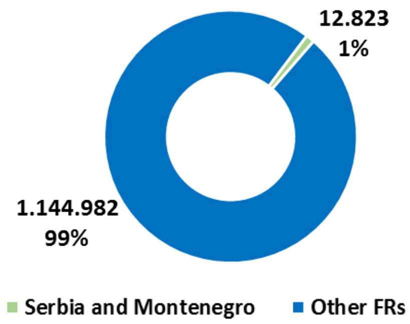
Figure 5-25: Road and rail transport flows of FR6



Source: TRT elaborations on TRUST (2016) and Eastern Partnership models (2016)

Passengers [thousand passengers/year]	Freight [thousand tonnes/year]





O/D	FR6	Other FRs	Total
FR6	129.655	2.242	**131.897**
Other FRs	2.213	3.684.831	**3.687.044**
Total	**131.868**	**3.687.073**	**3.818.941**

O/D	FR6	Other FRs	Total
FR6	10.783	2.035	**12.817**
Other FRs	2.045	1.142.942	**1.144.987**
Total	**12.828**	**1.144.976**	**1.157.804**

Source: TRT elaborations on TRUST (2016) and Eastern Partnership models (2016)

According to figures of 2015 of the four airports of the FR6, the air transport demand accounted for 6,5 million passengers and 15 thousand tonnes of freight (i.e., 4% of the total passenger and 2% of the total freight demand of the Danube Macro-Region). Traffic mainly concentrates in the regional hub of Belgrade, holding 74% and 96% of the total passengers and freight demand of the FR6. The airports of Podgorica and Tivat in Montenegro handle the remaining air transport demand. An important component of air transport demand is from the tourism industry, especially on coastal Montenegro.

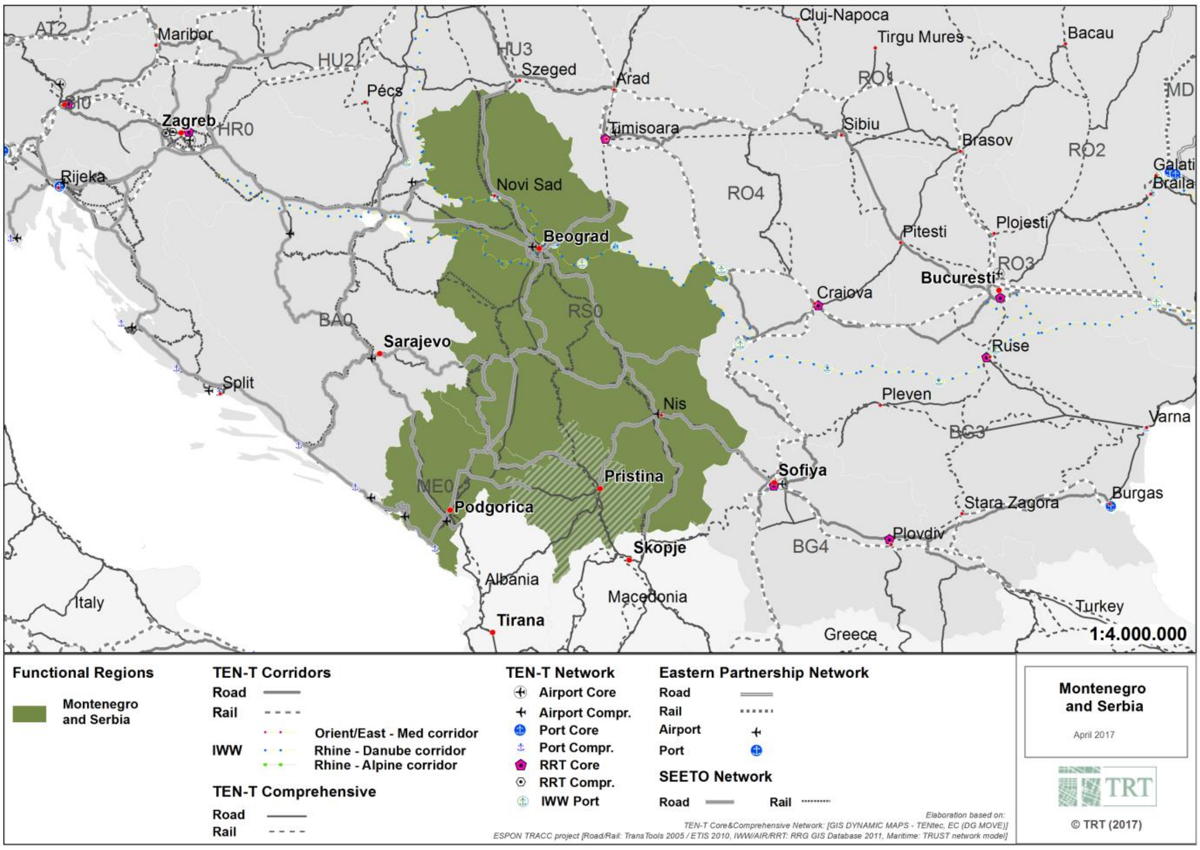
As regards maritime transport, FR6 holds the smallest share of the total transport demand of the Danube Macro-Region. According to the data available, in 2015 the port of Bar in Montenegro – the only gateway to the sea of FR6 – handled 52 thousand tonnes (i.e., 0,04% of the total of the Danube Macro-Region) and embarked/disembarked 39 thousand passengers (i.e., 0,1% of the total).

Concerning inland navigation on the Danube river, the four ports of the FR6[70] handled 14% of the total freight demand of the Macro-Region, with a throughput in of 5,2 million tonnes (2014). The major river port is in Smederevo, with 1,6 million tonnes handled in 2014 (i.e., 4% of the Danube Macro-Region).

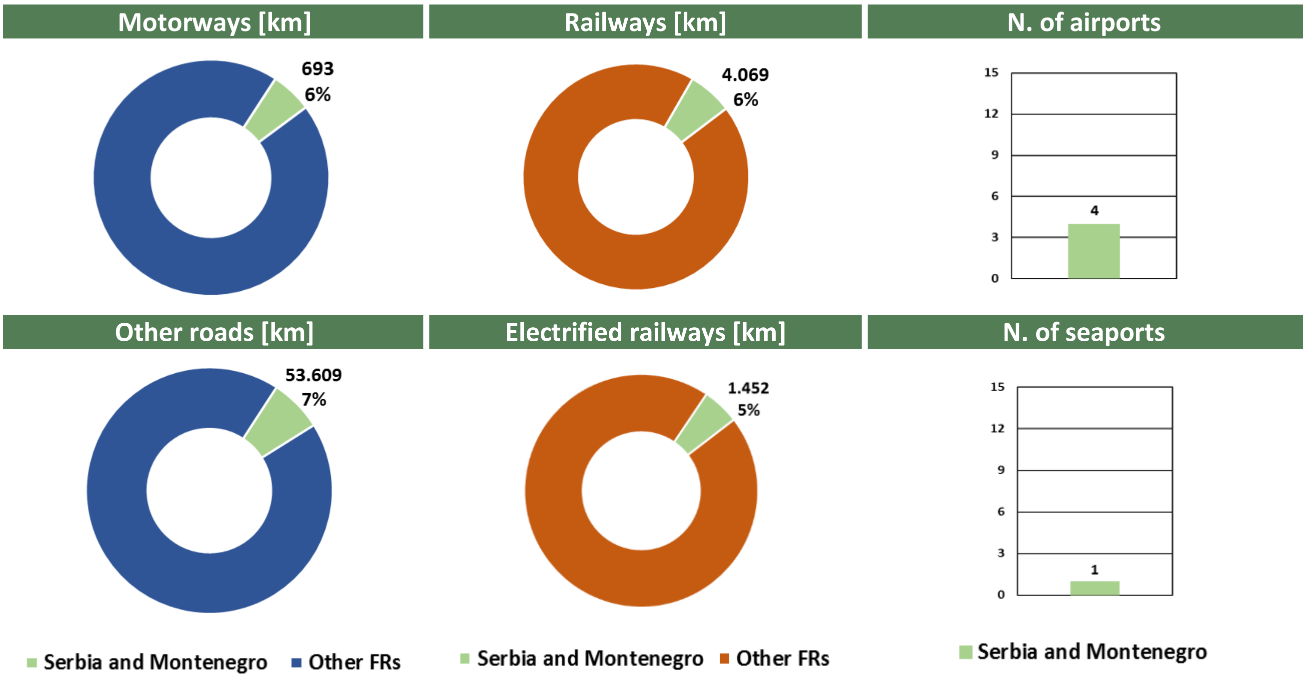
With respect to the transport infrastructure networks, the FR6 is part of the SEETO network. Notably, it is crossed by the rail and road Corridors X, Xb and Xc and by the rail and road Route 4 (i.e., from Belgrade to Bar, via Podgorica). According to the indicative enlargement of the TEN-T to the Western Balkans, the extension of the Mediterranean CNC overlaps the Corridor X from the border with Croatia to Belgrade and the extension of the Orient/East-Med CNC overlaps the Route 4 from Belgrade to Bar. The Figure 5-26 shows the localisation of the transport network of FR6.

[70] They are all located in Serbia: Smederevo, Belgrade, Novi Sad and Pančevo.

Figure 5-26: Transport network localisation of FR6



Source: TRT elaborations (2017)



Source: Eurostat (2016), National Statistics (2017), Bosnia and Herzegovina (2016), Ministry of Infrastructure of Ukraine (2017), TRT (2017)

5.6.2.1 Bottlenecks

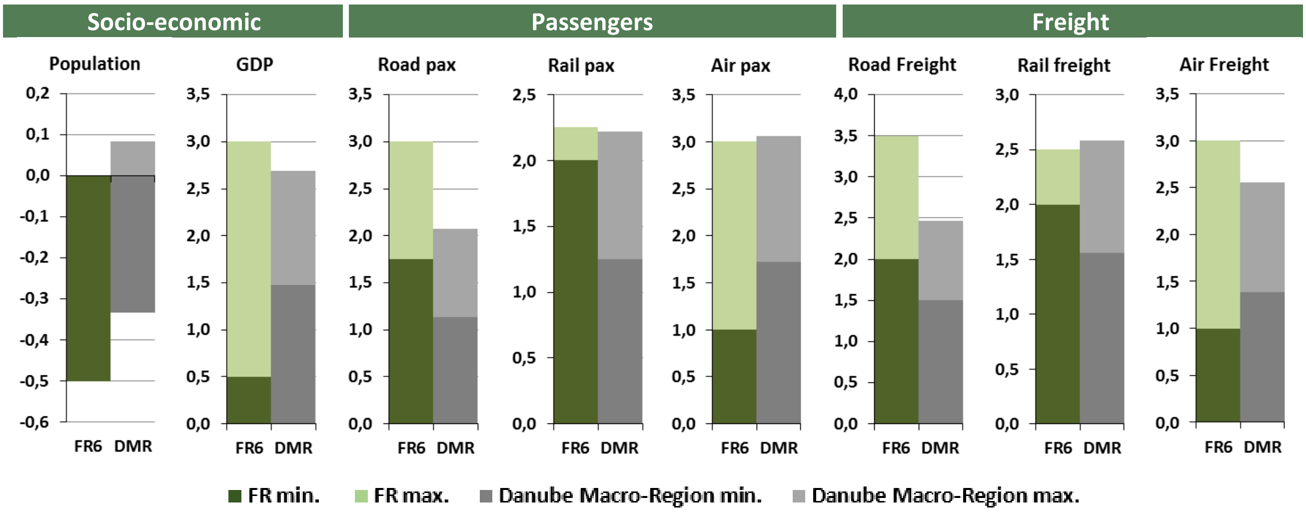
The main physical bottlenecks of the road network are localised on section Raskrnica E65-Budva (i.e., 19,5 km), Kolašin-border with Kosovo, on the road sections of Corridor X Novi Beograd-Bubanj Potok (i.e., 17 km), Dobanovci-Novi Beograd (i.e., 15 km), on the Route 4 sections Belgrade-Belgrade Cukarica[71], Orlovaca-Lazarevac, Gornij Mila-novac-Cacak, Pozega-Uzice, for a total length of 74 km and, eventually, on the Route 5 section Kraljevo-Beranovac (i.e., 5 km) (SEETO MAP, 2016).

With respect to the railway network, bottlenecks exist along the sections between Belgrade, Velika Plan and Niš (including the nodes of Belgrade and Niš), on the single-track section Stalać and Đunis (i.e., on the Belgrade-Niš section of the Corridor X) (SEETO MAP, 2016; EC, 2016a). Bottlenecks exits also along the Northern and Southern branches of Corridor X[72] and on the cross-border section Golubinci-Šid/border with Croatia with a significant speed limitation on one of its two tracks. In this respect, the allowed speed exceeds 100 km/h only on a 3,2% of the lines and about 50% of the network allows a maximum speed up to 60 km/h. All other railway lines have obsolete technical and technological parameters and the speed limit is often set at 20 km/h or less. Non-physical bottlenecks include customs and administrative issues still present among borders and the different and costly homologation procedures of the locomotives.

Physical bottlenecks for the air transport mode in FR6 have been identified with regard to the passengers terminal, manoeuvring areas and apron of Tivat airport[73] (IBRD, 2015). The non-physical limitations exist considering the relative vicinity of the air nodes in this FR and the limited cooperation amongst regional airports (SEETO, 2016).

5.6.2.2 Indicative projections of key socio-economic parameters and demand volumes

The projected population trend foresees a negative pattern, possibly driven by the demographic tendency of Serbia (i.e., depopulation, considerable decrease in natural population growth and aging). The crisis of the economy had a limited impact on this FR and the fast recovery to pre-crisis levels could suggest a general positive outlook, even above the average of the Danube Macro-Region. Relatively to the tiny volumes at stake, the transport activities could be projected accordingly, notably concerning road and air.



[71] The project "Belgrade bypass - section C" has been identified as a future transport projects and the fiches has been developed. See also Spatial Plan of the Republic of Serbia (2010).

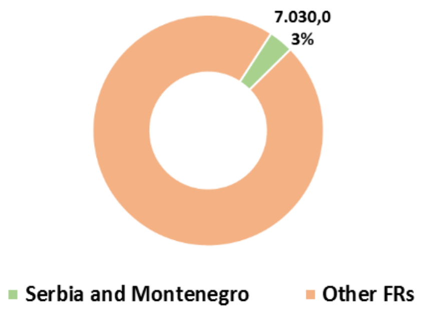
[72] The project "Reconstruction and modernization of the railway line Niš-Dimitrograd" has been identified as a future transport project and the fiche has been developed.

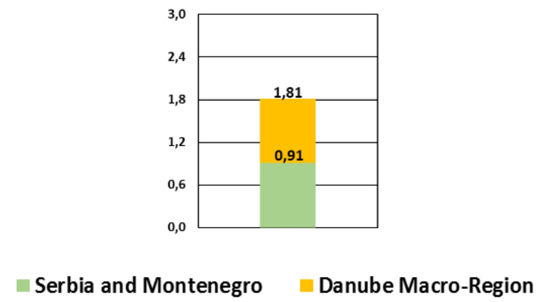
[73] The project "Tivat airport development" has been identified as a future transport project and the fiche has been developed.

Source: TRT elaborations on IBRD (2015), National Transport Plans and Strategies

5.6.3 Environmental aspects

Total CO_2 emissions [ths. tons/year]	Per capita CO_2 emissions [tons/year]

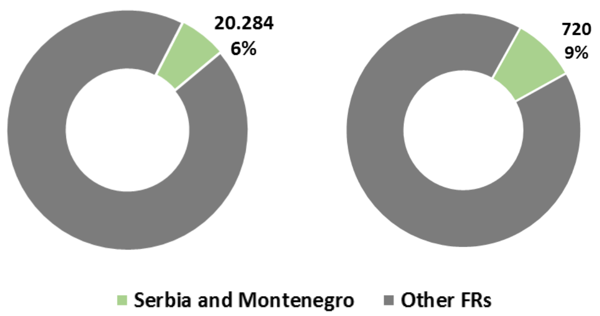


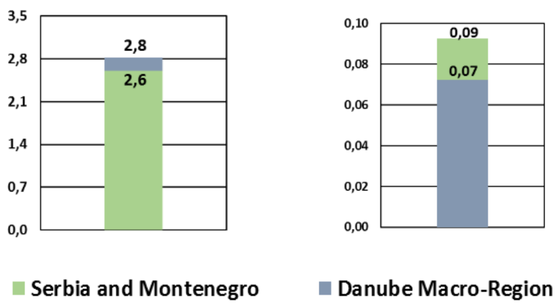


Source: TRT elaborations on the ASTRA and PRIMES models (2016) and the KNOEMA database (2016)

5.6.4 Safety aspects

N. of injured people	N. of killed people	N. of injured /1.000 people	N. of killed/1.000 people





Source: TRT elaborations on the OECD (2016), Eurostat (2016) and National Statistics (2016)

5.6.5 Accessibility

With an index of 53, the multimodal freight accessibility of FR6 is approximately half of the average of the Danube Macro-Region.

Source: TRT elaborations from ESPON TRACC (2012)

5.6.6 Key elements

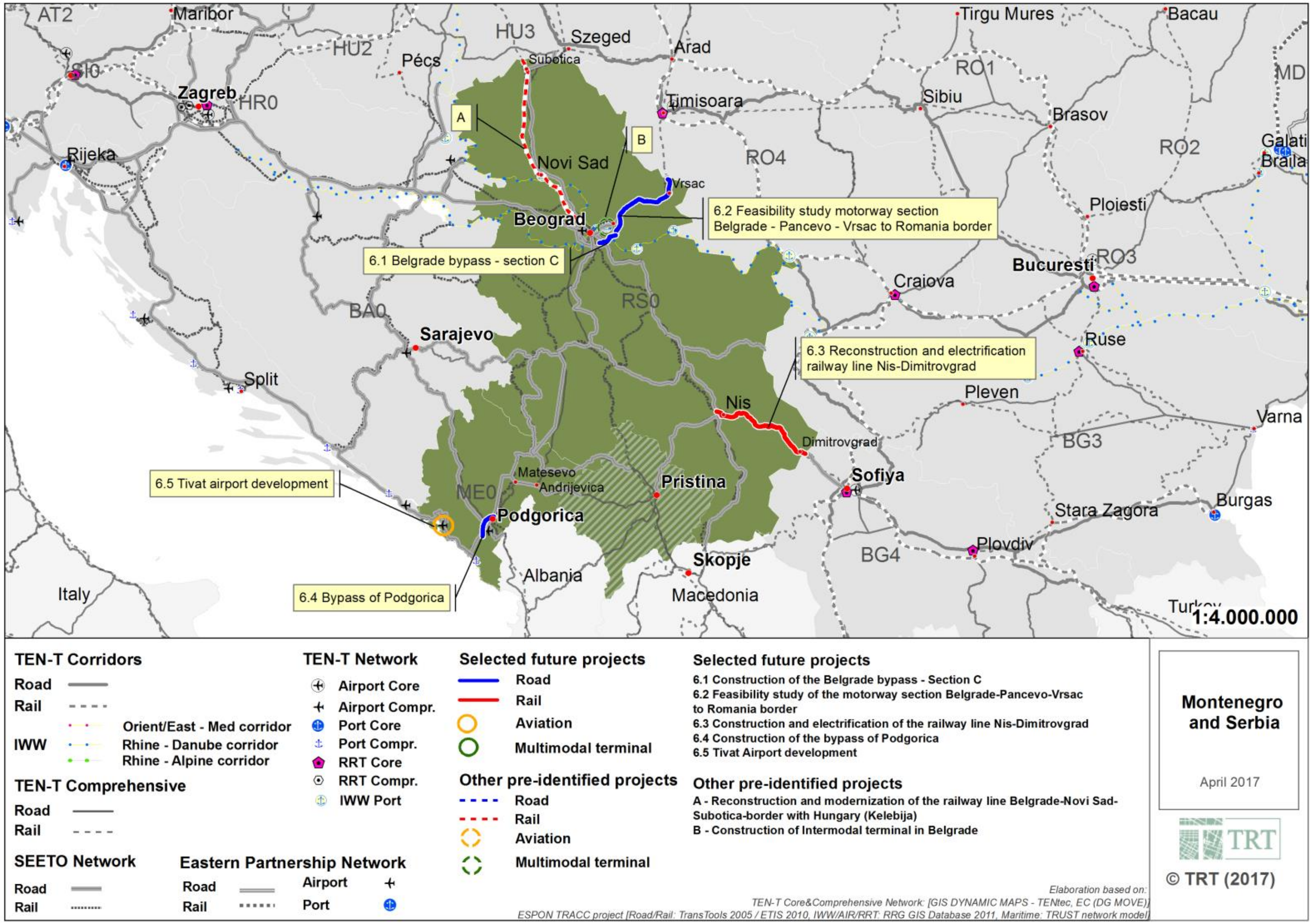
- The size of the economy of the FR6 is the smallest of the Danube Macro-Region. The population showed a significant reduction, especially in Serbia.
- The estimated rail and road transport demand for FR6 is low compared to the rest of the Danube Macro-Region. The internal demand takes up almost the entire demand of this FR.

- Traffic mainly concentrates in the regional hub of Belgrade. The airports of Podgorica and Tivat in Montenegro handle the remaining air transport demand, with a growing component from the tourism industry.
- The FR6 is part of the SEETO network, notably Corridors X, Xb and Xc and Route 4. According to the indicative enlargement of the TEN-T to the Western Balkans, the extension of the Mediterranean CNC overlaps the Corridor X and the extension of the Orient/East-Med CNC overlaps the Route 4.
- The main physical bottlenecks of the road and rail networks are localised on Corridor X. Significant speed limitations are applied to sections of the rail network.
- The emissions of CO_2 are a tiny share of the Macro-Region.
- The index of accessibility potential to GDP is approximately half of the average of the Danube Macro-Region.

5.6.7 Identified future transport projects

- Construction of Belgrade bypass – section C
- Feasibility study of the motorway section Belgrade-Pančevo-Vršac to Romania border
- Reconstruction and electrification of the railway line Niš-Dimitrovgrad
- Construction of the bypass of Podgorica
- Tivat airport development

Figure 5-27: Map of identified projects in FR6



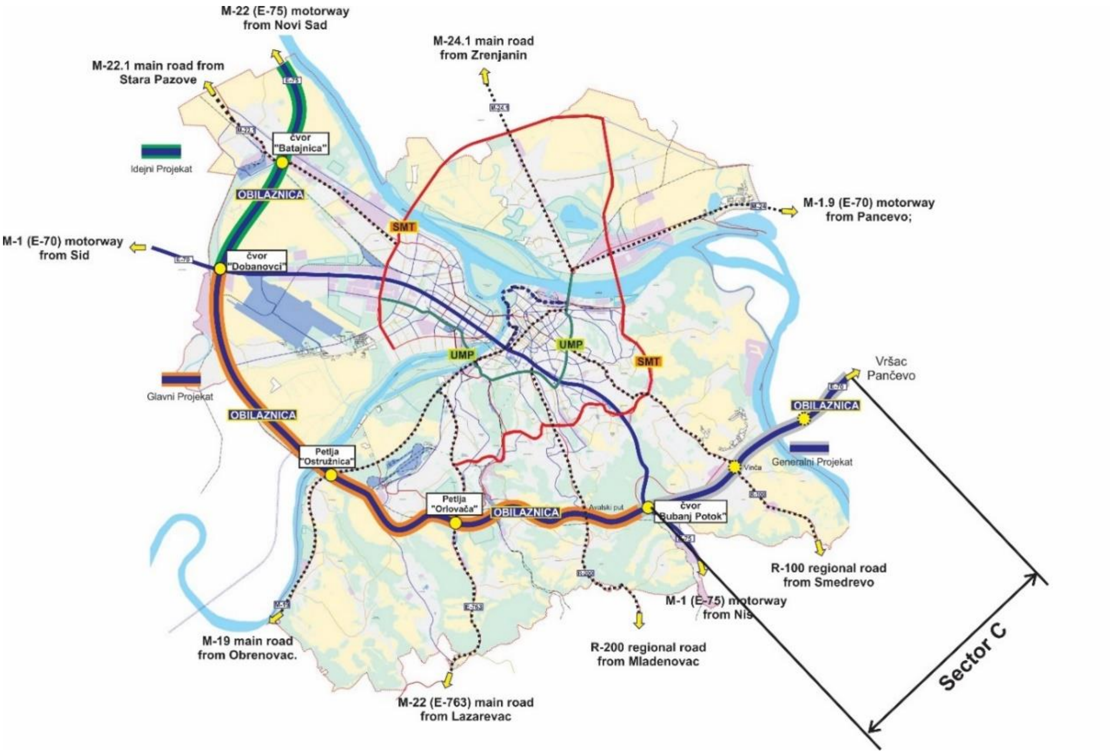
Source: TRT elaborations

5.6.7.1 FR6 Project 6.1 – Construction of Belgrade bypass – section C

General information: the project regards the construction of a new stretch of the Belgrade motorway bypass (i.e., section C)[74], linking Corridors X (i.e., E-75) and IV (i.e., E-70) of the SEETO network. The purpose of the project is to divert most of the traffic in transit out of the urban area of Belgrade (see Figure 5-28). Furthermore, section C will serve as a bypass of the city of Pančevo.

The construction of section C of the Belgrade bypass has been identified as a priority project in the Spatial Plan of the Republic of Serbia 2010-2014-2020 (2010). This project is also linked with the feasibility study of the motorway section Belgrade-Pančevo-Vršac to Romania border (see section 5.6.7.2).

Figure 5-28: Belgrade Bypass with links to road network of Serbia – Overview of section C



Source: TRT elaboration on Belgrade core road network

Technical description: Section C of the bypass will be constructed according to a 4-lane motorway standard, with a design speed of 120 km/h. The alignment consists of 3 sub-sections, for a total length of 31 km and a total estimated cost of approximately € 281,9 million[75]. The project envisages the construction of a 600 meter combined rail/road bridge over the Danube river connecting Boleč to Starčevo, 2 tunnels with a combined length of 6 km, 5 grade-separated interchanges and several bridges and culvert structures.

Project implementation: the implementation period of the project is not yet scheduled and the project management and the supervision are not yet defined. The Government is still looking for financing options. Loan or PPP schemes are envisaged.

Transport demand: the demand analysis was carried out in the period 2007-2008. Two scenarios were developed covering the period 2011-2025, depending on the development process of the Accession Agreement with the EU (i.e., optimistic and pessimistic).

[74] Regarding the other sections, section A is in operation and section B is under finalisation.
[75] The estimated costs breakdown is reported in CIP (2008).

The relevant data on passenger and freight transport has been collected as to elaborate an origin-destination matrix used to produce future traffic flows for network modelling.

The traffic growth factors have been elaborated relying on the forecasted trends of the economy, the process of political accession to the EU and the demographic patterns in the area (see Table 5-16). According to the updated REBIS study (IBRD, 2015), the annual GDP growth rates are assumed in the interval 1,11-1,83% depending on the development of the economy (i.e., low/moderate and moderate/high), for the period 2020-2030. The estimated growth of transport demand of the pre-feasibility study is fairly in line with the assumed trend of the economy of the updated REBIS study.

Table 5-16: Traffic growth factors for the period 2005-2030 [%] of Belgrade bypass - section C

Year	2005-2010	2010-2015	2015-2020	2020-2025	2025-2030
Total rate	23,32	21,58	15,04	9,71	7,84
Annual rate	4,66	4,32	3,01	1,94	1,57

Source: CIP (2008)

Financial analysis: the transit on the bypass of Belgrade is free of charge. The financial analysis was not carried out.

Economic analysis: the information regarding the economic analysis is not complete. The planned construction period is not presented in the pre-feasibility study. The appraisal period extends until 2030, but the starting year is not available.

Assuming a social discount rate equal to 10%, the analysis resulted in an ENPV of € 88,0 million. The EIRR is equal to 14,4% and the B/C ratio amounts to 2,3.

Environmental analysis: during the construction phase, a certain number of civil and engineering activities were envisaged having an impact to the environment components. Temporary air pollution is expected to rise on specific sections up to the end of construction works. The soil can be contaminated by spillages and can be controlled by proper handling. Borrow pits and deposit areas will be defined and proposed in the design documentation. The re-cultivation of the excavated areas will be carried out.

The corridors defined in the design will bear certain negative environmental impacts in the form of increased noise level, air pollution and contamination of soil, surface and ground waters. A detailed analysis of the necessary mitigation measures for minimisation of the negative impacts is yet to be carried out.

Safety levels: information on the analysis of safety levels is not available in the documentation consulted.

5.6.7.2 FR6 Project 6.2 – Feasibility study of the motorway section Belgrade-Pančevo-Vršac to Romania border

General information: this project regards the preparation of the feasibility study for the construction of a new motorway from the end of Belgrade bypass in Pančevo (see section 5.6.7.1) to Vršac and the Romanian border. This section belongs to the E-network of major European roads directing from West to East (i.e., route E-70).

The implementation of this road section would complete the missing motorway link between Serbia and Romania, linking transport Corridors X in Belgrade with Corridor IV in Timisoara. Moreover, this section has been included in the Spatial Plan of Serbia[76]. The localisation of the motorway section Belgrade-Pančevo-Vršac to Romania border is shown in Figure 5-29 (see the blue line).

Figure 5-29: Localisation of the motorway section Belgrade-Pančevo-Vršac to Romania border

Source: TRT Elaboration

Technical description: according to preliminary estimations, it extends for approximately 90 km. Design characteristics would assume a 4-lane transversal section and design speed of 120 km/h.

As shown in Figure 5-30, significant spatial limitations would influence the alignment, due to physical constraints concerning:

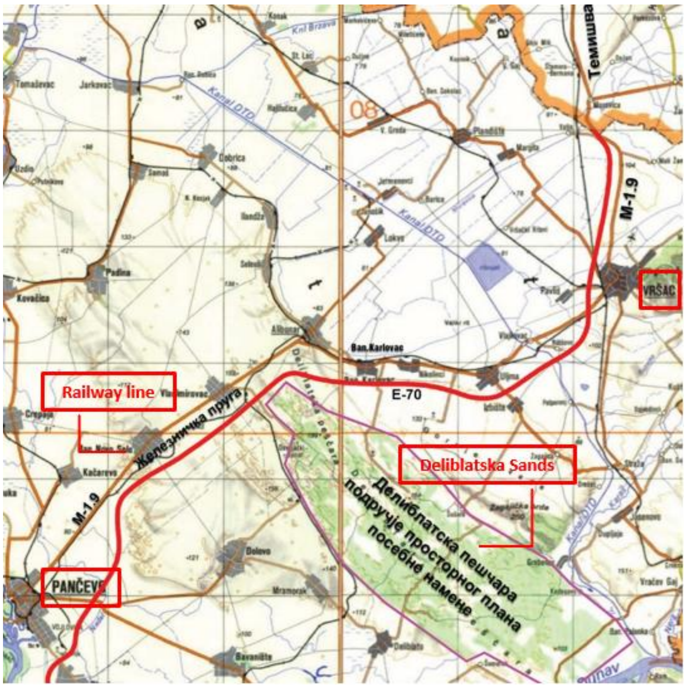
- Deliblatska Sands area, which is a special nature reserve;
- existing railway line;
- topographic characteristics of the terrain;
- the area of Vršac municipality.

---

[76] Ministry of Environment and Spatial planning of the Republic of Serbia (2010). According to consulted stakeholder, this is a strategic project within the Interreg IPA CBC Romania-Serbia (2014-2020).

Notably, the Vršac hill imposes to bypass the Vršac urban area on the west side. The intersection of the existing road infrastructures (i.e., highways M-1.9 and M-7.1) and the existing railway line pose relevant challenges to the alignment design.

Figure 5-30: Possible alignment of the motorway section Belgrade-Pančevo-Vršac to Romania border



Source: Highway Institute - Belgrade analysis

This project is expected to include the construction of the following civil structures:

- a bridge over the Tisa-Danube channel;
- small size bridges and culvert structures;
- a number of interchanges, notably intersecting Vršac and Banatski Karlovac.

The main design characteristics are illustrated in Table X-Y of the annex. The project costs still need to be estimated.

Project implementation: the project needs preparatory studies and design.

Transport demand: a limited information exists on the expected traffic volume. The annual average daily traffic is estimated in the interval of 3.000-7.000 vehicles for 2013. Specific investigations, traffic counting, origin destination matrix and forecasts need to be developed.

Financial analysis: the financial analysis has not been carried out. It is expected that the motorway will have toll regime.

5.6.7.3 FR6 Project 6.3 – Reconstruction and electrification of the railway line Niš-Dimitrovgrad

General information: this project regards (i) the reconstruction of the section Sicevo-Dimitrovgrad with preparatory works for electrification and signalling and telecommunication systems and (ii) the electrification of the entire section from Niš-Dimitrovgrad. On the Bulgarian side (i.e., FR7), the line extends to the Volujak-Dragoman line (see section 5.7.7.2).

The line is part of a corridor connecting Central Europe to Bulgaria and Turkey through Croatia and Serbia. It is an alternative to Rhine-Danube CNC. The rail section Niš-Dimitrovgrad is a real bottleneck, being the only part of the entire corridor that is not electrified and having a weight limits of category D3. The Bulgarian side of the corridor is electrified with the same system adopted in Serbia and in Croatia (i.e., 25 kV AC 50 KHz) and has a weight limit of category D4.

The beneficiary of the project is Serbian Rail Infrastructure Manager Infrastruktura železnice Srbije.

Technical description: The two parts of the project includes the reconstruction and modernization of the track, with upgrading of the track elements for the traffic speeds of up to 120 km/h, permissible axle load of 22,5 tons and permissible load per linear metre of 8 tons/m (i.e., Class D4) and electrification of the whole railway line from Niš to the station Dimitrovgrad over the length of 97 km.

The estimated costs for the reconstruction of the Sicevo-Dimitrovgrad is estimated equal to € 84,4 million and the estimated cost for electrification section from Niš-Dimitrovgrad (estimated to be € 59 million). There is not detailed costs information for maintenance and operation.

Project implementation: the project is under discussion since years. As regards the spatial planning documentation the available documents are:

- Infrastructure corridor plan;
- Regional spatial plan;
- Municipal spatial plan;
- General urban plan;
- Land acquisition (land formally available).

Documents are not available concerning (i) the General regulation plan and (ii) the Urban design (to be verified if needed or not).

As regards the project technical documentation the available documents are:

- Prefeasibility study;
- General project design;
- Preliminary design;
- Environmental Impact Assessment;
- Final design;
- Construction permit.

The documents not available are (i) the cost-benefit analysis and (ii) tender documentation.

Transport demand: on the basis of the Railway Master Plan for years 2012-2021 for the Republic of Serbia, the line may have up to 1.169 passengers/day and 17.317 tonnes/day at year 2027. Assumptions at the basis of this estimation will need further review.

Financial analysis: The Railway Master Plan for years 2012-2021 for the Republic of Serbia prepared by Italferr SpA[77] produced the following results:

- a FIRR of -8,80% (negative and below the discount rate of 5% that was adopted);
- a FNPV of € -255,75 million;
- a B/C ratio of 0,18.

It has to be highlighted that the pre-feasibility study carried out by Italferr SpA was made on different bases and assumptions. For instance, the investment cost taken into account was almost two times the amount now taken into account, namely € 271 million against the current estimated € 143,4 million. This is the reason why these figures are given just as reference.

As regards the sources of financing, talks have recently taken place between the Serbian authorities and the EIB for a possible financing of this project within an overall loan of € 230 million for the railway sector in Serbia.

Economic analysis: The Railway Master Plan for years 2012-2021 for the Republic of Serbia prepared by Italferr SpA comprises a cost benefit analysis based on an investment cost of € 271 million that produced the following economic indicators:

- an EIRR of 6,68% (higher than the discount rate of 5,5%);
- an ENPV of € 33,66 million;
- a B/C ratio of 1,14.

The value presented in the PPF5 Gap Analysis is 14,10% that, in this case, is referred to a total investment of € 122,7 million, slightly lower compared with the most recent € 143,4 million.

The results presented above show a general feasibility of the investment, even with costs that are higher than those considered in the most recent available documentation.

Environmental analysis: on the basis of the information available from the PPF5 Gap Analysis, "Environmental Impact Assessment has been prepared only for the project of reconstruction involving construction works, wherefore the preparation of a new study is necessary in order to scrutinize electrification of the subject-matter railway line".

The Consultant's remark is that electrification should anyway improve the environmental conditions thanks to the elimination of diesel traction.

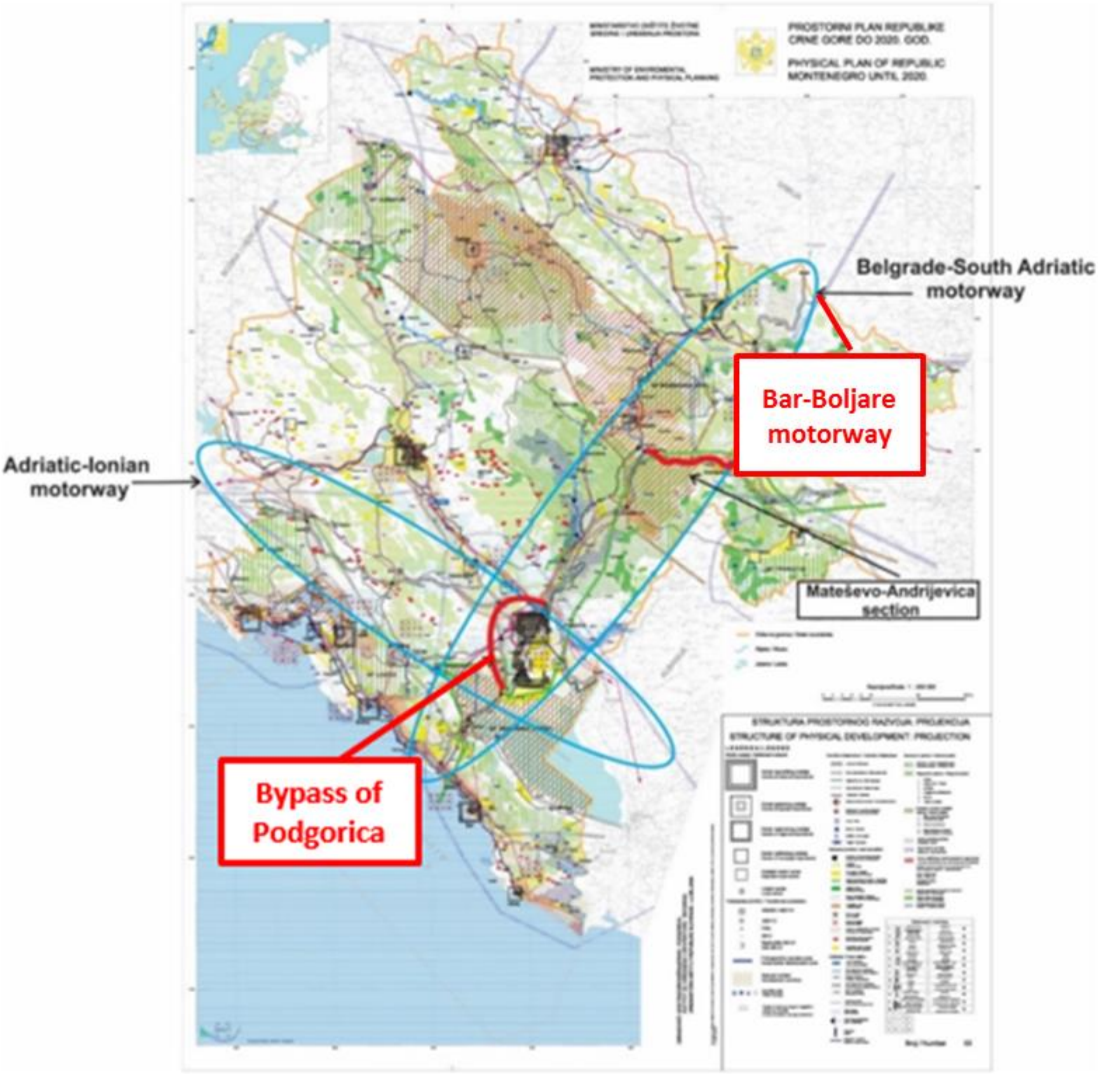
Safety levels: a general improvement of the safety levels for both sections will be obtained with the implementation of a more advanced signalling system that will replace the existing mechanical system and possibly with the improvement of the existing stations and the de-levelling of level crossings.

77 See Italferr SpA (2014), "Rail Rehabilitation in Serbia/Technical Assistance for Railway Infrastructure (Railway Master Plan for years 2012-2021) - CBA for Section G - Sičevo–Stanicenje–Dimitrovgrad, May 2014".

5.6.7.4 FR6 Project 6.4 – Construction of the bypass of Podgorica

General information: this project regards the construction of the bypass of Podgorica, localised on the Farmaci-Smokovac section, where the Adriatic-Ionian and Bar-Boljare motorways intersect (see Figure 5-31). The construction of the bypass of Podgorica has been identified as a priority transport project in the Transport Development Strategy of Montenegro. The promoter is the Ministry of Transport, Maritime and Telecommunications of Montenegro.

Figure 5-31: Localisation of the bypass of Podgorica



Source: TRT elaboration on Ministry of Economic Development (2008)

Technical description: four different options of alignment have been considered. Two on the west side (i.e., options A and C) and two on the east side (i.e., options B and D). The variant C resulted the most suitable. The adopted variant was designed assuming two separate carriageways for a total length of approximately 17 km and with a design speed of 100 km/h. The project includes the construction of a number of bridges and tunnels. According to SEETO MAP (2016), the estimated investment cost is equal to € 280 million.

Project implementation: the project implementation schedule has not been defined yet, as well as the procurement plan.

Transport demand: modelling exercise for traffic estimation was carried out for the years from 2007 to 2027 and considering the entire road network of Montenegro. The Table 5-17 shows the aggregate outputs for three different scenarios, depending on the development of the economy and the road network[78].

Table 5-17: Forecasted transport demand volumes [AADT]

Scenario	Variable	2007	2012	2017	2022	2027
Normal	volume	63.423	93.612	134.774	183.166	222.234
	annual growth rate	-	9,52%	8,79%	7,18%	4,27%
Standard	volume	63.423	90.292	117.952	147.554	176.606
	annual growth rate	-	8,47%	6,13%	5,02%	3,94%
Low	volume	63.423	81.308	102.618	124.816	141.370
	annual growth rate	-	5,64%	5,24%	4,33%	2,65%

Source: Elaboration from Louis Berger (2008)

According to the updated REBIS study (IBRD, 2015), the GDP growth of Montenegro assumed an annual average rate of 2,41% and 3,18%, respectively for low/moderate and moderate/high scenarios, over the period from 2020 to 2030. On average, the annual growth rate of the period 2022-2027 of the forecasted demand volume is equal to 5,72%, 4,48% and 3,49%, respectively for the three scenarios of the modelling exercise. The assumed GDP growth of the updated REBIS better approximates the low scenario of growth considered in the modelling exercise.

The **normal evolution scenario** has been used to elaborate the origin-destination matrix and assign the volumes to the network. Roughly 80% of the estimated volume of vehicles of 2027 is expected to transit on the Bar-Boljare route and 20% on the Adriatic-Ionian motorway. The section with the highest traffic load is the bypass of Podgorica. In 2027, the forecasts estimates approximately 14 thousand vehicles/day.

Financial analysis: the financial analysis has not been carried out. As possible financing sources, loans, concession or PPP schemes are all options considered.

Economic analysis: the economic analysis has not been carried out.

Environmental analysis: the preliminary assessment of potential environmental risks of the construction of the Podgorica bypass indicate that the most negative impact is the contamination of underground water due to the hydro-geological characteristics of the soil in the region of the alignment. In this respect, it will be necessary to conduct appropriate studies during the next designing phase and identify protection measures, like the construction of a closed drainage system for the pavement and building impermeable film at the contact point between embankment and subsoil.

Safety levels: the EU standards design assumed for this project will contribute to a significant improvement of safety levels. However, regarding this project there is not a specific quantification of safety levels and an identification of black spots.

78 Information on transport demand segments (i.e., long and short distance) and the modal share between cars and trucks is not available.

5.6.7.5 FR6 Project 6.5 – Tivat airport development

General information: this project regards the modernisation of the Tivat airport, the second in Montenegro after Podgorica. The Tivat airport is located on the South-Eastern coast of the Tivat Bay on the M2 motorway (i.e., E80/E65, the Adriatic highway), which connects the coastal cities and Montenegro with the neighbouring countries.

The current layout does not meet the recommendations according to international standards set on the space required along the sides of the runway. Moreover, all spatial reserves for future development have been exhausted. With respect to the transport demand, the current capacity is insufficient to handle seasonal peaks, the airport often overcrowded and flights delayed.

According to the Airports of Montenegro, the project promoter, the modernisation of the airport seeks to address these issues by increasing the handling capacity of the passenger terminal and improving service quality as well as achieving compliance with requirements of ICAO by improving conditions of the airside.

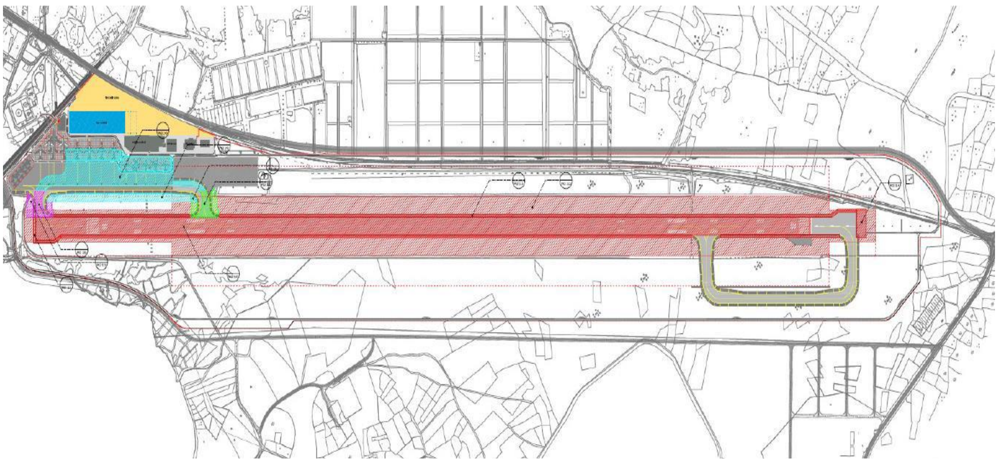
As far as the relevance of the project is concerned, the Spatial Plan of Montenegro defines the role of the Tivat Airport and the strategic commitment for further spatial development. The project has been included in the SEE2020 Air Transport Strategy and a development plan was elaborated (MonteCEP and CEP, 2013).

Technical description: the project foresees four main components: (i) the rehabilitation of the manoeuvring area and apron; (ii) the widening of the commercial aviation apron, three new proposed taxiways and several utilities; (iii) the displacement of the runway threshold (14 and 32); and (iv) the concept design for a new terminal building, the reconstruction of the existing one and new parking and access roads.

The investment cost is equal to € 55 million (excluding VAT), of which € 23 million are foreseen for the construction of the new terminal building, € 4 million for the reconstruction of the existing terminal building, € 23 million for airside works and € 2,5 million for parking and access roads. The estimation of operating and other expenses was based on historical data and reported equal to € 5,8-6,7 million.

The development of the control tower has been completed in early 2016 for a total investment of € 4 million. The SMATSA financed the works.

Figure 5-32: Rehabilitation of the pavement structure of the manoeuvring areas and apron of the Tivat airport



Source: Concept Design document

Project implementation: the Table 5-18 illustrates the advanced phase of the pre-implementation process.

Table 5-18: Development phases of concept design of Tivat airport

Development phase	Time line
Inception Report presentation	October 2015
Stakeholders consultations	November 2015
Presentation of proposed solutions	December 2015
Draft Concept Design presentation	February 2016
Final Concept Design and Draft Concept Design presentations	April 2016
Draft Concept Design	May 2016
Final Concept Design presentations to APM	June 2016
Final Concept Design presentations to stakeholders	June 2016

Source: Concept Design document

Transport demand: the Tivat airport has been one of the fastest growing in the region, doubling the passengers volume from 450 thousand in 2006 to 980 thousand in 2016 (i.e., +12% on annual basis). The forecasts of passenger demand were developed assuming three scenarios of growth (see Table 5-19).

Table 5-19: Forecasted passengers volume of Tivat airport

Airport	2009	2010	2015	2020	2025	2030
Tivat - Low	532	553	767	977	1.091	1.138
Tivat - Base	532	553	919	1.202	1.372	1.431
Tivat - High	532	553	1.172	1.625	1.699	1.738
Podgorica	n. a.	648	1.136	1.898	2.883	3.220
Total Montenegro	**n. a.**	**1.201**	**2.055**	**3.100**	**4.255**	**4.651**
Share of Tivat airport (base) [%]	n. a.	46	45	39	32	31

Source: TRT elaboration from MonteCEP and CEP (2013)

According to the updated REBIS study (IBRD, 2015), the estimated volume of passengers at the Tivat airport in 2030 is in the interval 1,3-1,6 million. The estimated annual growth factor is assumed in the interval 4,1-7,0% between 2012 and 2030. The volumes and rates depend on the macroeconomic scenarios of development of Montenegro and are in line with the abovementioned forecasts.

Financial analysis: the financial profitability analysis was based on demand projections and investment and maintenance costs estimations. The evaluation period extended for 10 years. Revenues consist of operating and commercial items. For operating revenues, the largest share comes from passengers services (i.e., 47%), from handling services (i.e., 20%) and from landing services (i.e., 15%). The commercial revenues generated 15-17% of the total income.

The FIRR is equal to 8,99% and the FNPV is equal to € 4,67 million, with a payback period of 8 years. Information is not available regarding sensitivity and risks analyses and about financial sustainability analysis. The funding mechanism foresees that the Airports of Montenegro could provide 50% of the investment costs. Financial resources in form of loans are estimated for € 26,9 million.

Economic analysis: the ENPV is equal to € 455 million. The economic performance has been calculated over the period 2015-2030 and discounting at 4%. The benefit-cost ratio is 4,61. Information is not available with respect to the methodology and assumptions developed to elaborate the economic analysis.

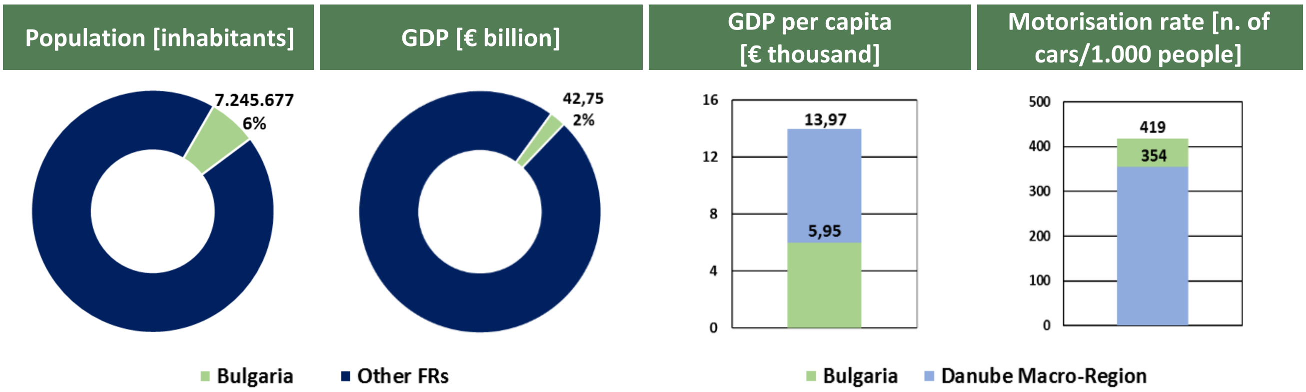
Environmental analysis: the project has no influence on Natura 2000 sites and the analysis of environment impacts (i.e., noise and air pollution study) has been addressed according to ICAO and EASA regulatory requirements. The project is expected to reduce noise impact by building a rapid taxiway.

Safety levels: one of the most relevant safety issue addressed by the project regards the distance between the existing road and Runway 14. The road should not be located where it is at present. Another safety issue regards the topographical features of the Tivat airport location: the relief of the terrain penetrates into a large part of the inner horizontal surface and the conical surface result in a limited possibility for flying above the airport.

5.7 FR 7 – Bulgaria

The FR7 coincides with Bulgaria.

5.7.1 Socio-economic characteristics

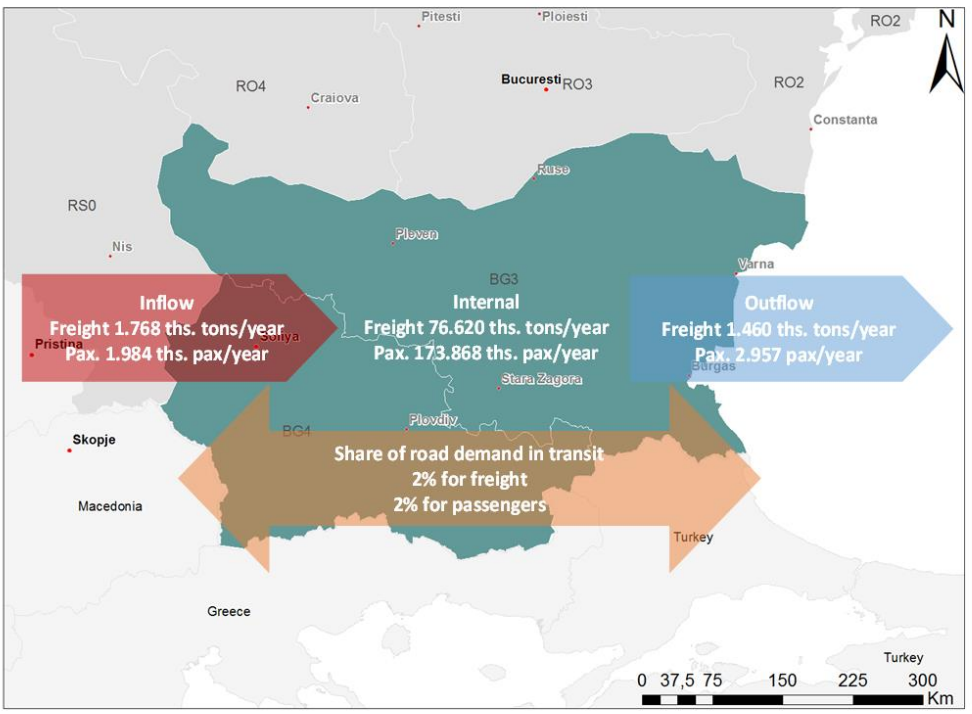


Source: Eurostat (2016), World Bank (2016) and National Statistics (2016)

5.7.2 Transport demand and infrastructures

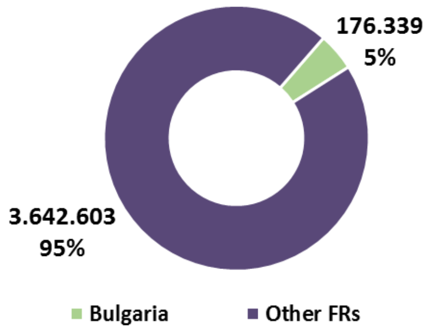
The estimated rail and road transport demand for FR7 accounts for a 5% of the total passengers moved and a 7% for freight transported within the Danube Macro-Region. The internal demand takes up almost the entire demand of this FR, namely 97,2% of passengers and 96,0% of freight. As regards the estimated road transits, these account for 2% of both freight and passengers volumes generated by FR7 (see Figure 5-33).

Figure 5-33: Road and rail transport flows of FR7



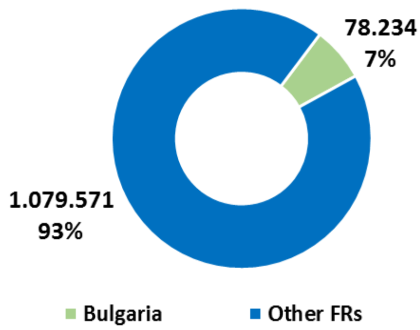
Source: TRT elaborations on TRUST (2016) and Eastern Partnership models (2016)

Passengers [thousand passengers/year]



O/D	FR7	Other FRs	Total
FR7	173.868	2.957	**176.825**
Other FRs	1.984	3.640.132	**3.642.116**
Total	**175.852**	**3.643.089**	**3.818.941**

Freight [thousand tonnes/year]



O/D	FR7	Other FRs	Total
FR7	76.620	1.460	**78.079**
Other FRs	1.768	1.077.956	**1.079.725**
Total	**78.388**	**1.079.416**	**1.157.804**

Source: TRT elaborations on TRUST (2016) and Eastern Partnership models (2016)

Air transport demand of FR7 is rather low compared to the rest of the Danube Macro-Region. In 2015, passengers volume accounted for a 5% of the total and freight demand for a 3% (i.e., 7,8 million passengers and 31,7 thousand tonnes). The airport of Sofia holds the largest share of the FR7 for both passengers (i.e., 52%) and cargo (i.e., 59%).

The maritime demand of freight is serviced by the ports of Varna and Burgas, on the Black Sea. The total volumes of freight accounted for around 27 million tonnes in 2015 (i.e., 18,2% of the total handled in the seaports of the Danube Macro-Region). The main seaport is in Burgas, with throughput of 16 million tonnes in 2015 (i.e., 11% of the total volumes of the Danube Macro-Region). As regards maritime passengers, the FR7 holds a minor share, namely 0,01% (i.e., approximately 2 thousand passengers in 2015 for both Varna and Burgas seaports).

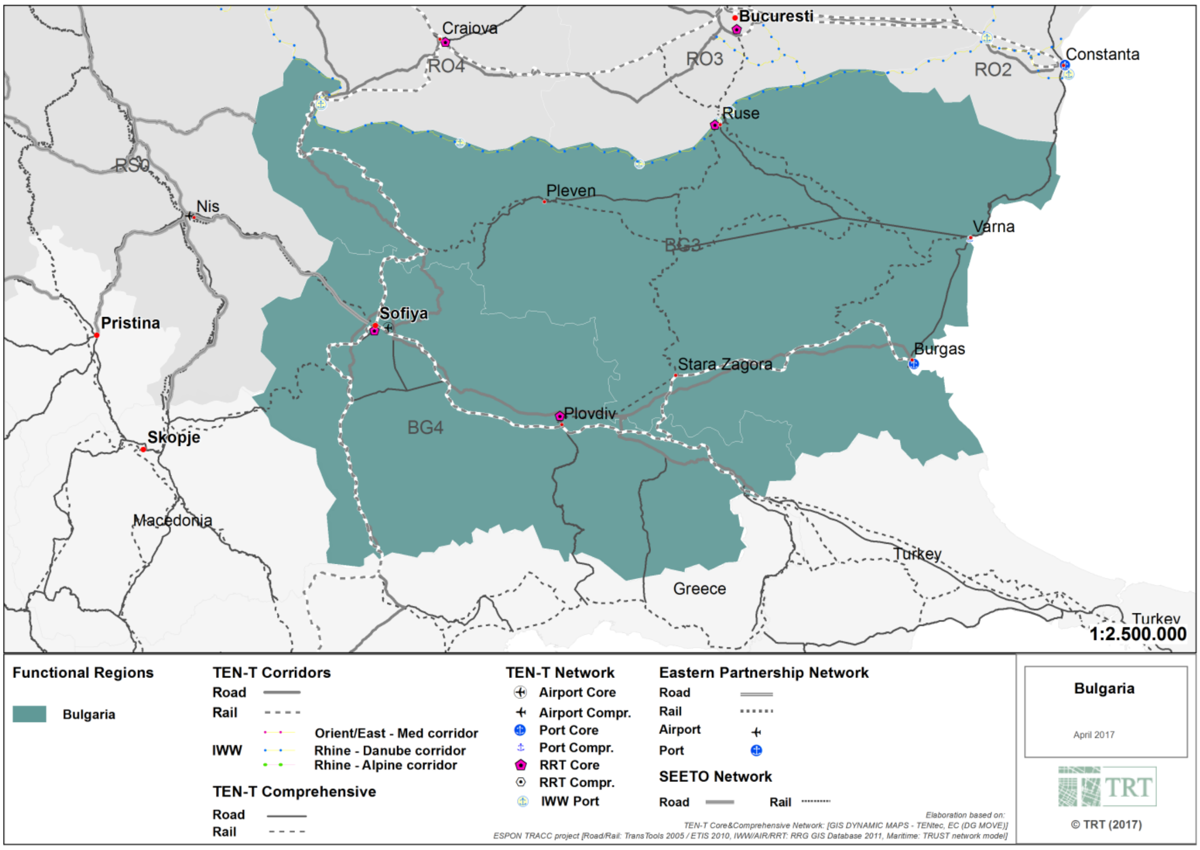
As regards inland navigation on the Danube river, the 4 ports of the FR7[79] handled a 17% of the total freight volume of the Macro-Region, with a throughput in 2014 of 6,2 million tonnes. The main inland port of FR7 is in Oriahovo, with a share of 42% of the total freight transported on inland waterways of the FR.

With respect to the transport networks, the FR7 is crossed by one TEN-T CNC, namely the Orient/East-Med CNC (see Figure 5-34).

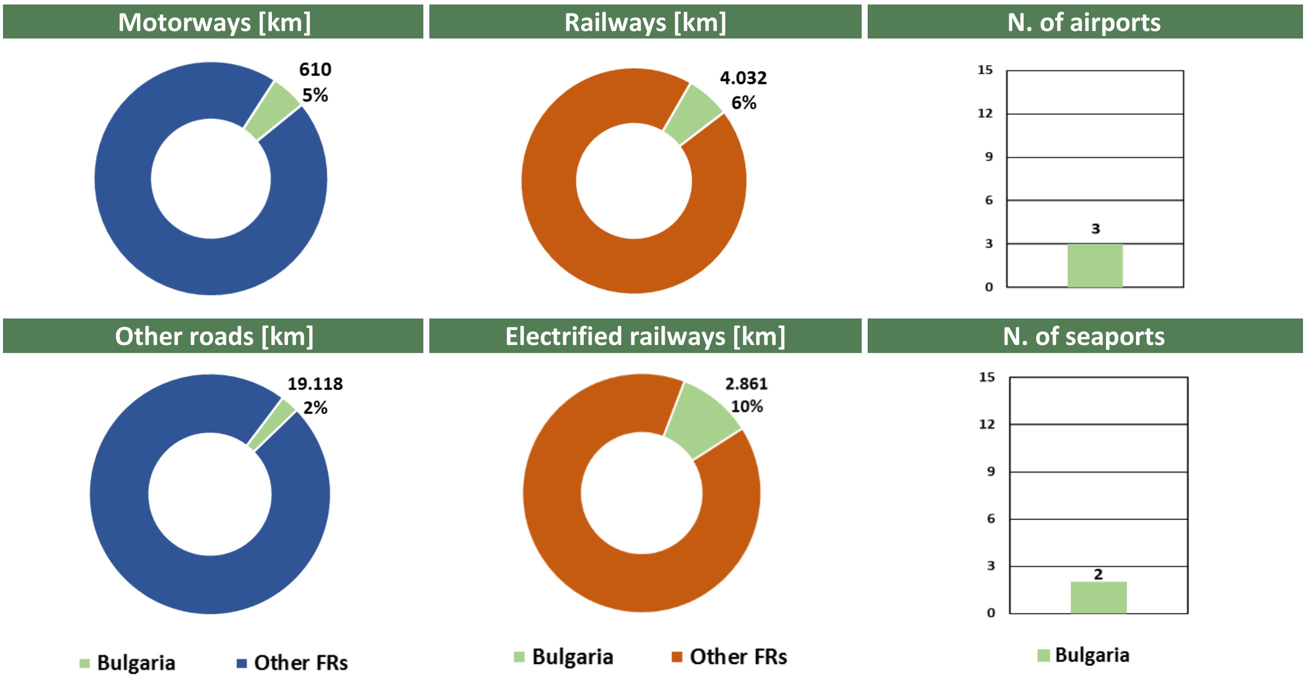
The coverage of the road network of Bulgaria is uneven and the East-West direction appears better developed than the North-South one. This largely depends on the topography of the territory. The same occurs for the rail network, being more developed in the North-East part of the country, compared to the South-West and South Central territories. The connections with neighbouring countries are rather limited.

[79] The ports of Vidin, Svishtov, Ruse and Oriahovo.

Figure 5-34: Transport network localisation of FR7



Source: TRT elaborations (2017)



Source: Eurostat (2016), National Statistics (2017), Bosnia and Herzegovina (2016), Ministry of Infrastructure of Ukraine (2017), TRT (2017)

5.7.2.1 Bottlenecks

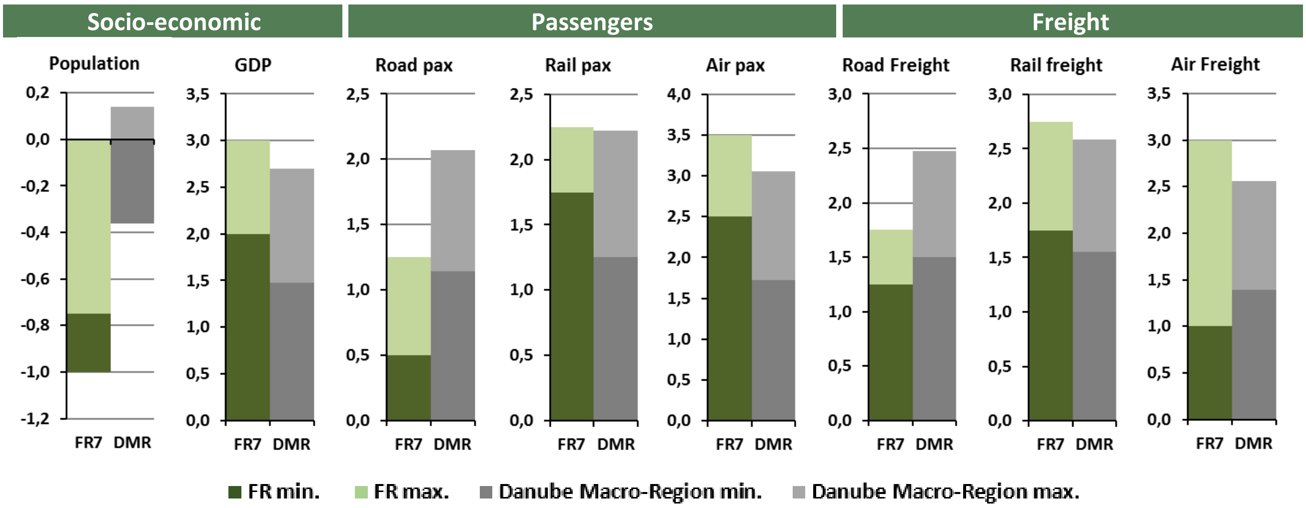
With respect to the road network, physical bottlenecks consist of missing sections along the Orient/East-Mediterranean CNC. Notably, important bottlenecks have been identified on the route Vidin-Sofia-Kulata, the cross-border bridges Vidin-Calafat and Ruse-Giurgiu, the Hemus Motorway (i.e., E79), the road section Blagoevgrad-Sandanski (with the tunnel of Kresna Gorge)[80] and the Shipka tunnel (EC, 2014c).

With respect to the railway network, bottlenecks are mainly due to reduced speed localised on the sections Sofia-Septemvri, Vidin-Medkovets-Sofia and Plovdiv-Mihaylovo. Moreover, a large part of the railway facilities (i.e., bridges and tunnels) are at the end of the life cycle such as the route Ruse-Varna[81] and the railway line Plovdiv-Burgas (EC, 2014c; Ecorys, 2011)[82].

Regarding the above, a significant part of the railway lines was built more than fifty years ago, with geometry parameters, construction and equipment suitable for speeds of 100 km/h maximum. Much of the security, telecommunications and energy supply systems are outdated and do not meet modern requirements for interoperability (Ministry of Transport, Information Technology and Communications of Bulgaria, 2010).

5.7.2.2 Indicative projections of key socio-economic parameters and demand volumes

The depopulation of un-urbanised regions and peripheral territories suggests a negative outlook for future population trend. Despite this, the observed trend after the global crisis of the economy suggests a gradual increase of the national and per capita GDP. This could envisage also a positive outlook in the medium term horizon a support the increase of both demand of passengers and freight, especially for rail and international air transport.



Source: TRT elaborations on Capros et al. (2016), EC (2014), National Transport Plans and Strategies

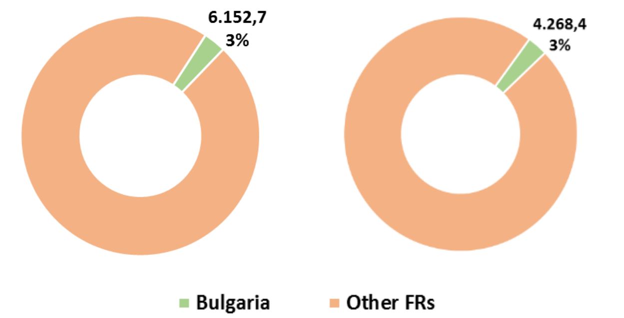
[80] On this section, a future transport project has been identified: "Construction of Lot 3.2 of the A3 Struma Motorway (Blagoevgrad-Sandanski)".

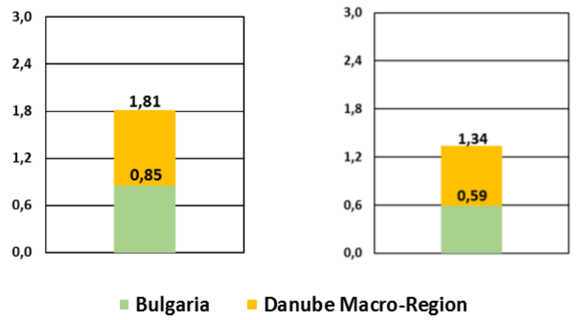
[81] The project "Rehabilitation of Varna-Ruse railway line" was suggested by the country.

[82] See also Ministry of Transport, Information Technology and Communications of Bulgaria (2010).

5.7.3 Environmental aspects

CO_2 emissions		Cars CO_2 emissions per capita	
Total [ths. tons/year]	Cars [ths. tons/year]	Total [tons/year]	Cars [tons/year]

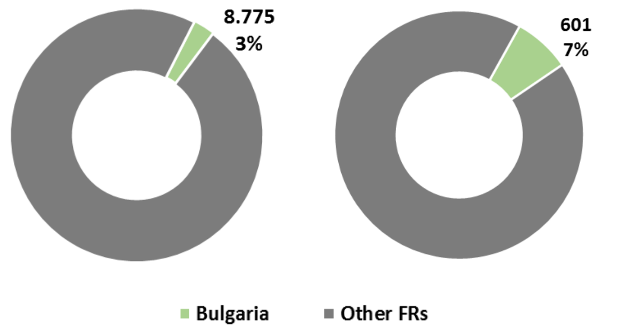


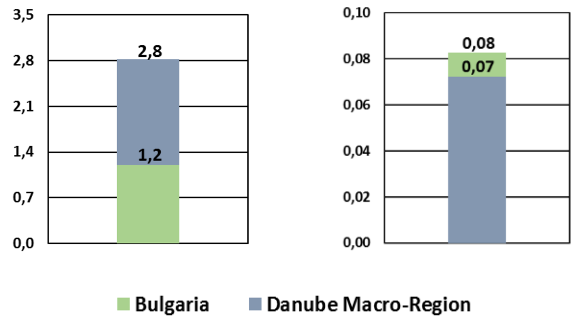


Source: TRT elaborations on the ASTRA and PRIMES models (2016) and the KNOEMA database (2016)

5.7.4 Safety aspects

N. of injured people	N. of killed people	N. of injured /1000 people	N. of killed/1000 people

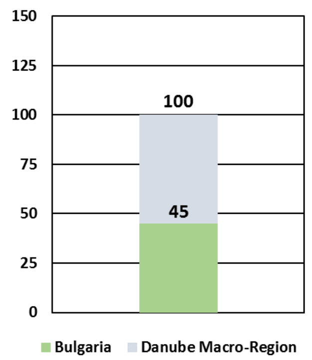




Source: TRT elaborations on the OECD (2016), Eurostat (2016) and National Statistics (2016)

5.7.5 Accessibility

With a value of 45, the multimodal freight accessibility of FR7 is the lowest of the Danube Macro-Region, accounting for 45% of the average.



Source: TRT elaborations from ESPON TRACC (2012)

5.7.6 Key elements

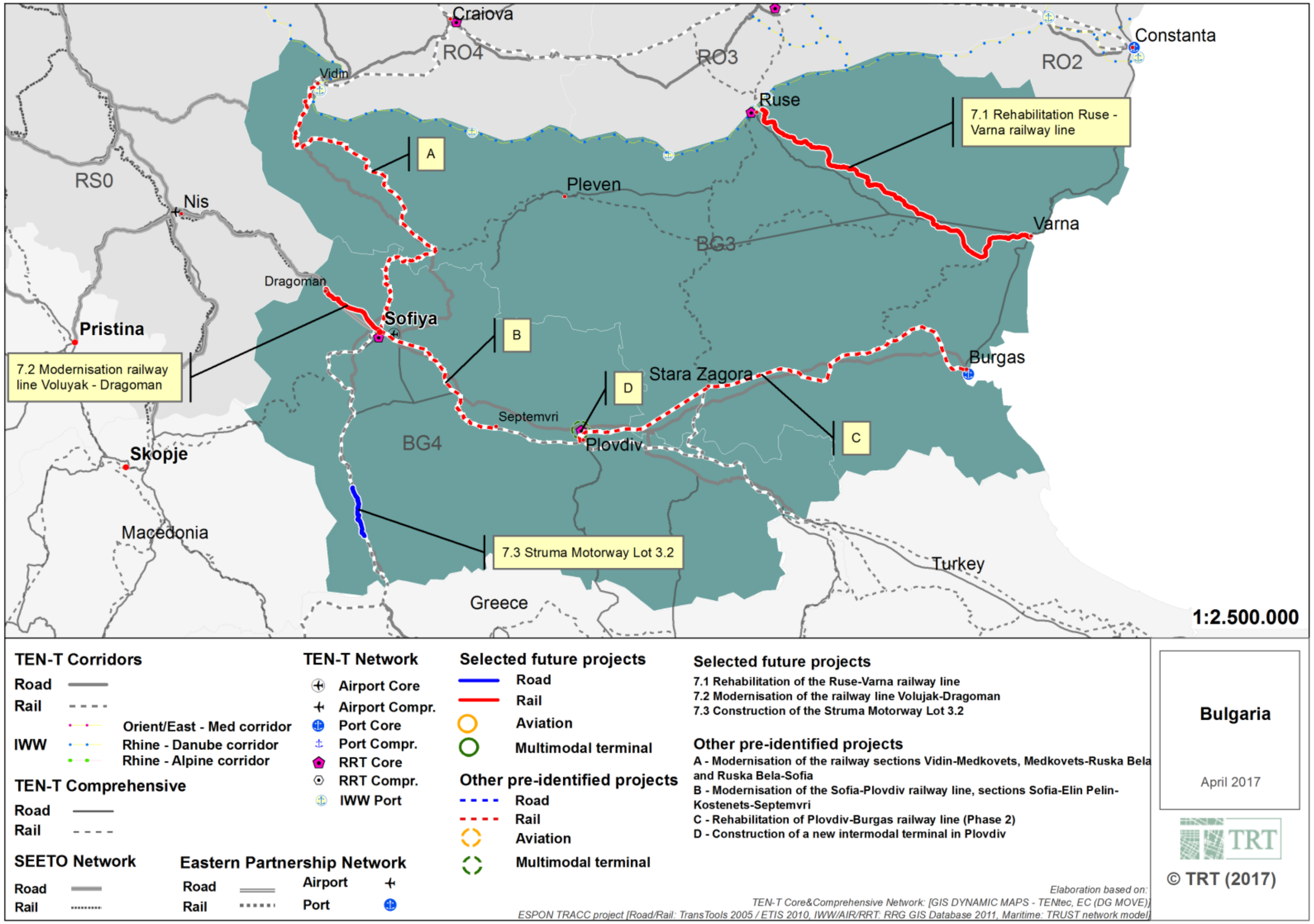
- The size of the economy of the FR7 is relatively small, but the national GDP has been constantly increasing during the recent years. The population shows a significant negative trend.
- The estimated rail and road transport demand accounts for a 5% of the total passengers moved and a 7% for freight transported within the Danube Macro-Region. The internal demand is almost the entire demand. The estimated road transit volumes are negligible.

- Air transport demand is rather low. The airport of Sofia holds the largest share for both passengers and cargo volumes.
- This FR is crossed by the Orient/East-Med CNC.
- The motorway and railway networks represent 5% and 6% of the networks of the Danube Macro-Region, respectively. The coverage of the road and rail networks is uneven and largely depends on the topography of the territory. The connections with neighbouring countries are rather limited.
- With respect to the road network, physical bottlenecks consist of missing sections along the Orient/East-Mediterranean CNC. The bottlenecks of the rail network are mainly due to reduced speed as a significant part of the lines was built more than fifty years ago, with unsuitable geometry parameters and equipment. A large part of the rail bridges and tunnels are at the end of the life cycle.
- The emissions of CO_2 are a tiny share of the Macro-Region.
- The index of accessibility potential to GDP is less than half of the average of the Danube Macro-Region.

5.7.7 Identified future transport projects

- Rehabilitation of the Ruse-Varna railway line
- Modernisation of the railway line Volujak-Dragoman
- Construction of the Struma Motorway Lot 3.2

Figure 5-35: Map of identified projects in FR7

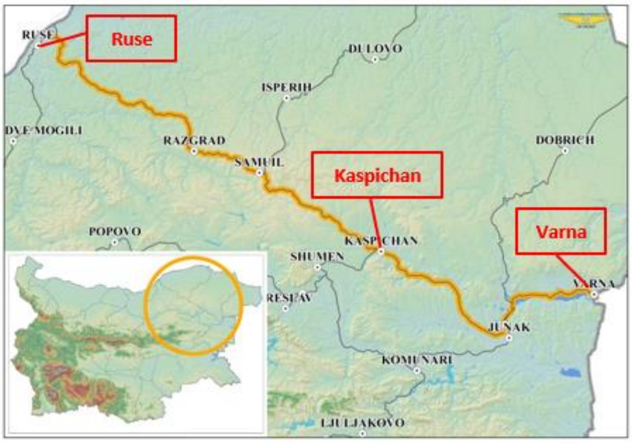


Source: TRT elaborations

5.7.7.1 FR7 Project 7.1 – Rehabilitation of the Ruse-Varna railway line

General information: this project regards the rehabilitation of the Ruse-Varna railway line, on the TEN-T comprehensive network. This route is the unique connection between the cross-border river port of Ruse (i.e., on the Danube river) and the Black Sea port in Varna. On the Romanian side (i.e., FR8), the section continues along the Giurgiu-Bucharest line (see the project in section 5.8.7.2) (see Figure 5-36)

Figure 5-36: Localisation of the Ruse-Varna railway line



Source: NRIC

The project was developed in order to eliminate a bottleneck of the interconnections between the South-Eastern region of the EU and the EU neighbouring countries.

The project is included in the following important strategic documents: (i) EUROPE 2020 strategy, (ii) the New White Paper on EU Transport Policy (2011), (iii) the Revision of Guidelines for Trans-European Network for Transport; (iv) the National Transport Strategy of the Republic of Bulgaria up to 2020, and (v) the Long-term programme for the development of the railway infrastructure 2011-2020.

The **project promoter** is the State Enterprise National Railway Infrastructure Company (NRIC).

Technical description: the railway line Ruse-Varna is approximately 230 km long, with a design speed of 70-130 km/h. In 1983, the line was electrified. The longitudinal gradients are up to 25‰. The section Ruse-Kaspichan (i.e., 141 km) is single-track and the section Kaspichan-Varna (i.e., 85 km) is double-track.

The main activities to be completed for the rehabilitation of the line consist of the design and construction of the railway structures and the renewal of superstructures; the rehabilitation of the catenary, of five power substations and of the station buildings; and the implementation of ERTMS and GSM-R.

Four project alternatives were identified (i.e., B1, B2, C1 and C2). The identified project alternative is B1, with an estimated investment cost equal to € 383 million.

Project implementation: the project will be implemented under service contracts and separate tenders are envisaged for selection of the contractors. The expected construction period lasts 4 years.

Transport demand: the transport demand forecasts were based on a modelling exercise covering the period 2010-2040. Forecasts were elaborated with respect to key socio-economic and trade transport drivers assuming (i) GDP of 2007 equal to 100 and estimated equal to 282 in 2040 (i.e., annual growth of 3,2%) (ii) population of 2040 projected to 6,3 million inhabitants. The rail demand at national level was expected to grow by 120% in 2040. The generated and diverted traffic was calculated. The estimated passengers and freight volumes are summarized in Table 5-20.

Table 5-20: Estimated passengers and freight volumes of the Ruse-Varna railway line

Section	Base year	2015	2020	2030	2040
Passengers	667.932	813.052	896.667	1.116.718	1.386.165
Passengers·km	151.210.416	184.085.556	203.016.972	252.839.504	313.845.778
Tonnes	982.404	1.217.636	1.311.585	1.450.311	1.549.408
Tonnes·km	222.428.999	275.688.619	296.959.842	328.369.265	350.806.118

Source: NRIC

Financial analysis: the time-horizon assumed for the financial analysis is 30 years, from 2010 to 2040. A financial discount rate of 5% has been used. The **financial profitability performance** is shown in Table 5-21. There is no information available with respect to the sensitivity and risk analyses.

Table 5-21: Financial performance indicators of the Ruse-Varna railway line

Indicator	Alternative B1	Alternative B2	Alternative C1	Alternative C2
FNPV C [€]	-366.625.411	-359.394.849	-586.448.210	-648.969.823
FIRR C [%]	-1,88	-1,78	n. a.	n. a.
FNPV K [€]	-74.658.059	-67.150.950	-120.881.701	-133.552.899
FIRR K [%]	2,44	2,51	1,74	1,39

Source: NRIC

Economic analysis: the time-horizon and the construction period are the same assumed for the financial analysis. The discount rate is equal to 5,5%. The value of time for passengers and freights is equal 11,59 €/passengers·hour for business trips, 4,08 for other trips and 0,40 €/tonnes·hour for freight transport. The results of the economic analysis are summarised in Table 5-22.

Table 5-22: Economic performance indicators of the Ruse-Varna railway line

Indices	Alternative B1	Alternative B2	Alternative C1	Alternative C2
ENPV [€]	59.066.536	-70.565.962	-38.812.871	-168.047.932
EIRR [%]	7,14	3,64	4,66	1,71
B/C	1,21	0,79	0,91	0,63

Source: NRIC

On the basis of the results obtained, the alternative B1 is the economically viable alternative.

The sensitivity analysis was carried out identifying the investment costs and the value of time as critical variables. In this respect, the sensitivity analysis shows that the project is economically viable, even increasing the investment costs by 20%.

Environmental analysis: as a result of the conducted procedures for assessment of the necessity of the EIA implementation, the Ministry of Environmental and Waters (i.e., MOEW), issued Decision n. 9-PR.2010 stating that it is not necessary to carry out EIA for this project.

Safety levels: currently, the telecommunications links are made through trunk copper cables and signalling equipment in the stations is currently worn out. For this reason, the project includes the construction of computer interlocking in the stations; the construction of Dispatching Centre for Centralised Traffic Control and Electric Traction Power Supply Control in Gorna Oryahovitsa and the installation of ERTMS ETCS level 1; GSM-R and SCADA.

NRIC will establish a system for controlling parameters of the rolling stock for the stations of Ruse, Razdelna and Samuil. Depending on the necessity of the separate control hot points, different parameters shall be monitored such as the identification of the vehicle, wheel loading and wheel flats, hot axle box, hot points and overheated brakes. There is no specific information on safety issues and black spots, before and after project implementation.

5.7.7.2 FR7 Project 7.2 – Modernisation of the railway line Volujak-Dragoman

General information: this project regards the modernisation of the railway line Volujak-Dragoman. Together with the adjacent section Sofia-Volujak[83], is on the Orient/East-Med CNC (see Figure 5-37). The project incorporates the necessary measures for the achievement of an interoperable rail network by the (i) optimisation of the capacity, (ii) elimination bottlenecks and (iii) improvement of the safety and reliability. The modernisation of the railway section Volujak-Dragoman is part of the Strategy for the Development of the Transport System of the Republic of Bulgaria until 2020. On the Serbian side (i.e., FR7), the line extends to the Niš-Dimitrovgrad line (see section 5.6.7.3).

The project promoter is State Enterprise National Railway Infrastructure Company (NRIC)

Figure 5-37: Localisation of the railway line Volujak-Dragoman

Source: NRIC

Technical description: the section Volujak-Dragoman is single-track, with a length of approximately 35 km. The modernisation of this section includes the upgrade of the line speed to 160 km/h, the construction and repair works of structures, earth works and dewatering[84] activities, cable ducts construction, track works for double track railway line, the construction of new station buildings in Slivnica and adaptation of power substations in Aldomitrovtsi and Volujak. The estimated investment cost is € 167,8 million (net of VAT). Details regarding maintenance and operating costs are available in the consulted documents.

Project implementation: the project implementation consists of the sequence of the following activities: land acquisition, construction works, supervision of works, interoperability assessment, archaeological monitoring, information and publicity and technical assistance. As regards the tentative procurement plan, all the tenders these activities should be carried out by the end of 2017.

Transport demand: the traffic forecasts cover the period 2017-2044. Four investment scenarios have been considered. The do-nothing scenario (i.e., base scenario) includes only the modernisation of the railway line. The scenario A assumes increased train speed to maximum possible levels. The scenario B assumes increased speed of freight trains to 100 km/h and of passenger trains to 120 km/h and the construction of a double-track railway line where it is not. The scenario C (in two sub-options, C1 and C2) assumes increased

[83] The section Sofia-Volujak is part of the action "Development of Sofia Railway Junction: Volujak-Sofia railway section" financed by CEF.

[84] Recovering of contaminated water.

speeds to 120 km/h for freight trains and to 160 km/h for passenger trains and the construction of a double-track where the railway line is not doubled.

Projections of key socio-economic parameters were used to elaborate the transport model. The traffic forecasts have been provided for scenario C1 (see Table 5-23 and Table 5-24).

Table 5-23: Forecasts of passengers transport volume for the railway line Volujak-Dragoman

Year	Base Scenario passengers·km	Scenario C1 passengers·km	Base Scenario passengers·h	Scenario C1 passengers·h	Base Scenario trains·km	Scenario C1 trains·km
2015	17.109.373	17.109.373	285.442	285.442	499.211	499.211
2025	16.638.414	38.375.474	277.584	305.294	537.185	1.111.644
2035	16.046.499	41.650.427	267.709	331.348	507.280	1.157.963
2044	15.215.798	43.318.324	253.850	344.617	488.724	1.146.128

Source: NRIC

Table 5-24: Forecasts of freight transport volume for the railway line Volujak-Dragoman

Year	Base scenario		Scenario C1	
	tonnes·km	trains·km	tonnes·km	trains·km
2015	205.683.751	534.456	205.683.751	534.456
2025	203.390.579	512.701	390.473.809	929.489
2035	207.129.094	527.166	489.007.387	1.115.387
2044	205.702.464	530.283	539.881.040	1.181.494

Source: NRIC

Financial analysis: the financial profitability analysis has been carried out assuming 2014 as base year. The project time horizon period extends from 2015 to 2044, including the 5-year period of construction (from 2016 to 2020). A discount rate of 4% is applied. The financial performance of the scenario C1 has been calculated with and without EU grant (see Table 5-25).

Table 5-25: Financial performance of scenario C1 of the railway line Volujak-Dragoman

Indicator	Without EU grant	With EU grant
FIRR [%]	-0,4	10,4
FNPV [€ million]	-77,9	35,3

Source: NRIC

As regards the financial sustainability, the cumulative cash flow is nil as the amount of subsidy disbursed is equal to the amount of operation and maintenance costs.

Economic analysis: the economic analysis has been elaborated assuming a social discount rate of 5%. The benefits considered savings of travel time, vehicle operating costs, safety and pollutants emissions. Financial costs have been converted into economic values applying conversion factors. The ENPV is equal to € 60.492, the EIRR is equal to 5,0024% and a B/C ratio is equal to 1,00. The incidence of each benefit is: value of time 48,9%, vehicle operating costs 25,7%, safety 0,9%, air pollution 17,1%, climate change 6,8% and noise 0,72%. The sensitivity analysis of the economic analysis has been carried out.

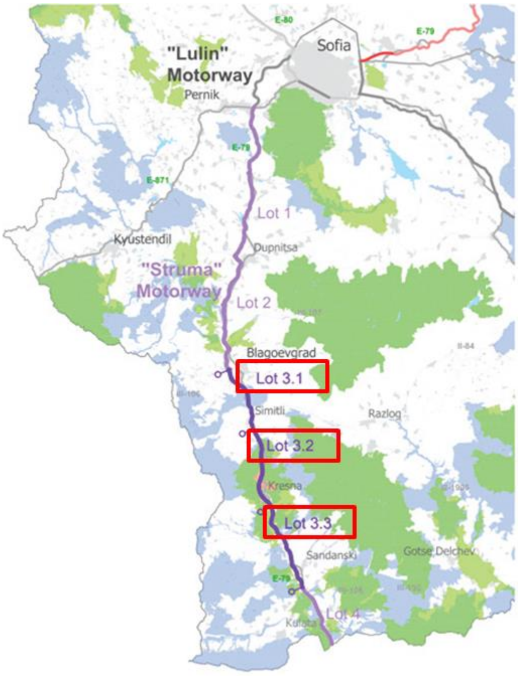
Environmental analysis: the EIA (issued on 05/05/2016) has defined a number of measures for mitigating the environmental impact, especially during the period of operation. Public consultations were held in the municipalities affected by the project. The conclusions of the EIA identified as less impacting the alternative C1 for section Sofia-Peturch and the alternative A for section Peturcha-Dragoman. The special area of conservation "Dragoman Rajanovtzi" as well as the river basins will not be adversely affected.

Safety levels: to improve the safety levels, signalling equipment of the stations in Slivnica and Kostinbrod will be refurbished and NRIC will establish a system for controlling parameters of the rolling stock. However, there is no specific information on safety issues and black spots, before and after project implementation.

5.7.7.3 FR7 Project 7.3 – Construction of the Struma Motorway Lot 3.2

General information: this project regards the construction of Lot 3.2 of the Struma Motorway. The Struma Motorway carries the heaviest volume of traffic of any other route crossing Bulgaria along the north-south direction. The Struma Motorway is on the Orient/Est-Med CNC (see Figure 5-38).

Figure 5-38: Localisation of the lots of the Struma Motorway



Source: Road Infrastructure Agency

The motorway completion is considered important from a strategic point of view for the regional development of Bulgaria and the bordering countries. It provides a direct route through Bulgaria to the Aegean Sea. The completion of the Struma Motorway is mentioned in the Strategy for the Development of the Transport System of the Republic of Bulgaria until 2020 (2010), as a priority project.

The existing road cannot accommodate peak traffic levels, which results in traffic congestions in weekend and holiday periods. The combination of low technical characteristics of the existing road and high demand together with a high share of HGVs leads to a much higher accident rate compared with the country average. The lack of feasible alternative routes blocks domestic and international traffic in case of road accidents. The intense traffic also produces considerable harmful emissions.

The project promoter is the Road Infrastructure Agency (i.e., RIA).

Technical description: the Lot 3.2, from Krupnik to Kresna, is approximately 21 km long. The section runs through a challenging mountainous terrain and is dominated by a tunnelled route in the Kresna gorge, for a total length of approximately 15,5 km. Several studies have been conducted and alternatives for the Kresna gorge area have been developed (see Table 5-26).

Table 5-26: Project alternatives and estimated costs of the Lot 3.2 of the Struma Motorway

Alternative	Estimated costs [€ million net of VAT]	
	Investment	Operation and Maintenance
Do-minimum	39	0,18
Long Dual Tunnel	812	4,64
Long Single Tunnel (with unidirectional traffic)	728	2,63
Long Single Tunnel (with bidirectional traffic)	701	2,63
Dual Carriageway	283	0,97
Staged Dual Carriageway	264	1,37
Western Alternative	619	3,43

Source: NCSIP (2016)

In 2017, according to advancements of the project design for Lot 3.2 the project costs will be further updated.

Project implementation: with regards to the progress on the preparation of Lot 3.2, in 2000 the company Patproject prepared the feasibility study of Lot 3.2 (i.e., Struma-Eastern options). A design was presented for a road with two carriageways, a transversal section 10,5 m wide and design speed of 80 km/h.

Thereafter, the RIA initiated public procedure for road section design through Kresna Gorge in November 2016. The purpose of the competition procedure is to obtain improved and updated conceptual design, detailed geodetic mapping and geological survey. The received proposals are expected to be evaluated in early April 2017. In the best case, the construction of this section of the highway may start in 2019.

Transport demand: in 2014 NCSIP commissioned the update of the existing traffic forecasts and cost-benefit analysis of the project and prepared an application for obtaining funding under OPTTI. The updated analysis and application form were developed in accordance with the requirements and guidelines for the new programming period. The study produced a traffic model and forecast. The results from the updated traffic forecast model show a reduction of the traffic that was envisaged in the previous traffic study in 2011. Detailed information has not been made available to the Consultant.

Financial analysis: the Struma Motorway is a toll-free road, therefore the financial profitability analysis has not been developed. The preparation of Lot 3 was financed under the OPTTI 2007-2013. As the regards the construction works, these are financed as a priority project under the OPTTI 2014-2020. In September 2015, a grant was allocated to NCSIP for the implementation of the project.

Economic analysis: the updated economic analysis applied the methodology based on the EC guidelines of 2014. The updated analysis was developed for all lots and including the Kresna tunnel. It ended showing a negative performance (i.e., ENPV equal to € -239 million, EIRR equal to 3,46% and B/C equal to 0,79). The results showed that a project including a long tunnel, as part of Lot 3.2, is economically unfeasible.

Given such outcomes, a simplified economic analysis was carried out for all the alternatives. In 2015, JASPERS accepted this model, but the report finalised in 2015 is not available to the Consultant. The economic performance indicators for each alternative is reported in Table 5-27.

Table 5-27: Economic performance indicators of the Lot 3.2 of the Struma Motorway

Economic Indicators	Do Minimum	Long dual tunnel	Long single tunnel - unidirectional	Long single tunnel - bidirectional	Dual carriageway	Staged dual carriageway	Western alternative
ENPV (in million €)	224,14	-238,97	-190,2	-163,93	88,78	95,72	-116,99
EIRR (%)	7,19	3,46	3,74	3,89	5,75	5,82	4,17
B/C ratio	1,37	0,79	0,82	0,84	1,12	1,13	0,88

Source: NCSIP (2016)

The results indicate that, apart from the do-minimum alternative, the Dual Carriageway and Staged Dual Carriageway alternatives are the only ones economically feasible. Finally, the Multi Criteria Analysis finalised in 2016, suggested that the Dual Carriageway alternative would be the best option, closely followed by the Staged Dual Carriageway alternative.

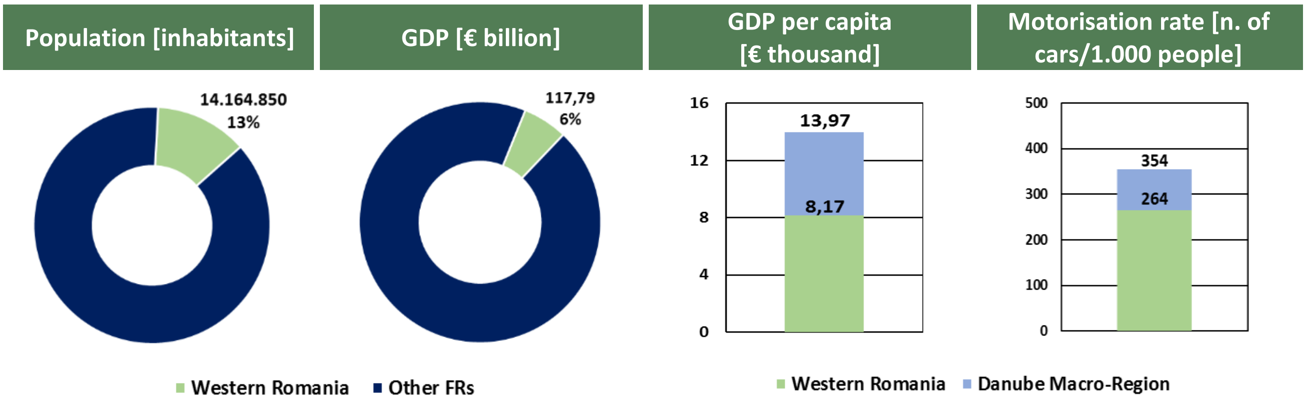
Environmental analysis: the alignment of Lot 3 crosses several Natura 2000 sites as well as the bio-corridors connecting them. The key sites are the habitats site “Kresna-Ilindentsi” and the bird site “Kresna Gorge”. The Terms of Reference for the determination of the scope and contents of the EIA have been developed. The updated EIA is expected to be issued after the completion of Lot 3.2 conceptual design, currently foreseen for late 2017.

Safety levels: the construction of the motorway section is expected to improve safety levels. The analysis of the existing situation shows that in Kresna, the existing road passes through the town resulting in numerous safety problems. The frequency and severity of traffic accidents in the Kresna gorge are amongst the highest in the country. There is no specific information on safety issues and black spots, before and after project implementation.

5.8 FR 8 – Western Romania

The FR8 coincides with the Western territories of Romania[85].

5.8.1 Socio-economic characteristics

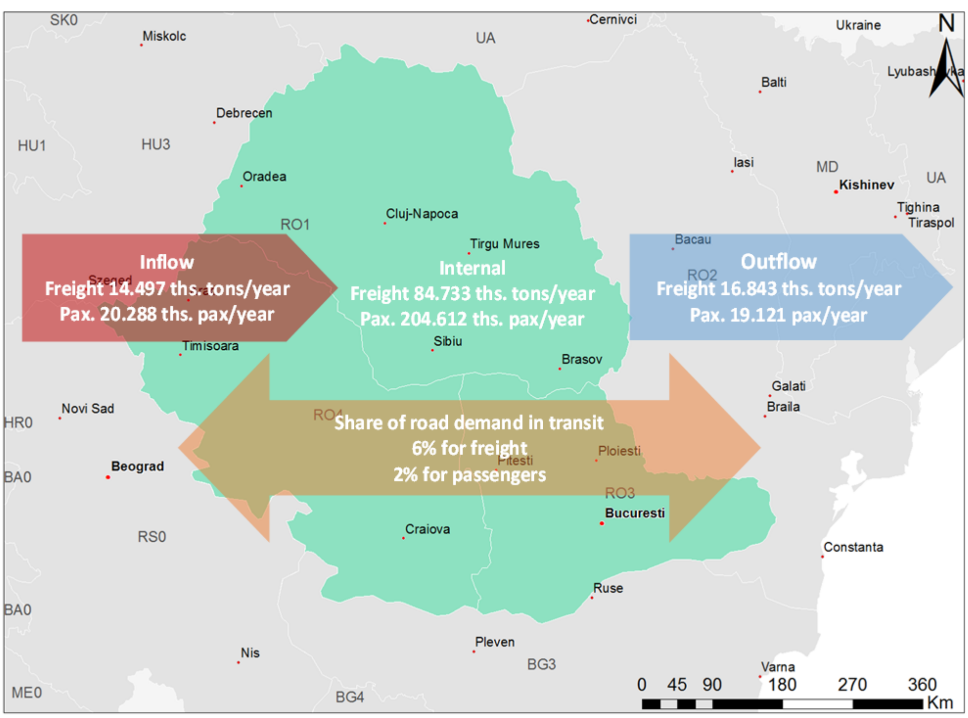


Source: Eurostat (2016), World Bank (2016) and National Statistics (2016)

5.8.2 Transport demand and infrastructures

The estimated rail and road transport demand of FR8 accounts for a 6% of the total passengers of the Danube Macro-Region and a 9% concerning freight. The internal demand takes up the greatest part of the total demand of the FR, namely 83,9% of passengers and 72,7% of freight volumes. As regards the estimated road transits, this component accounts for 6% for freight and 2% for passengers of the total road demand generated by the FR (see Figure 5-39).

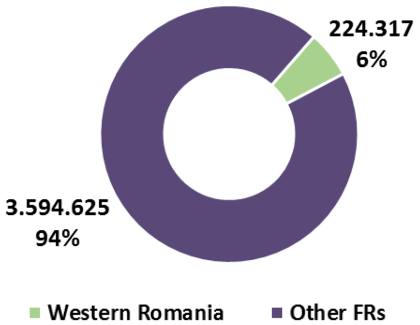
Figure 5-39: Road and rail transport flows of FR8

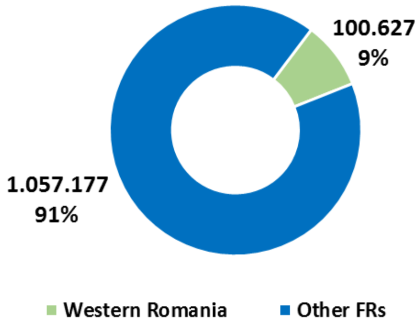


Source: TRT elaborations on TRUST (2016) and Eastern Partnership models (2016)

85 Merging the Macroregions 1,3 and 4 defined according to NUTS nomenclature.

Passengers [thousand passengers/year]	Freight [thousand tonnes/year]





O/D	FR8	Other FRs	Total
FR8	204.612	19.121	**223.733**
Other FRs	20.288	3.574.920	**3.595.208**
Total	**224.900**	**3.594.041**	**3.818.941**

O/D	FR8	Other FRs	Total
FR8	84.733	16.843	**101.575**
Other FRs	14.947	1.041.282	**1.056.229**
Total	**99.680**	**1.058.125**	**1.157.804**

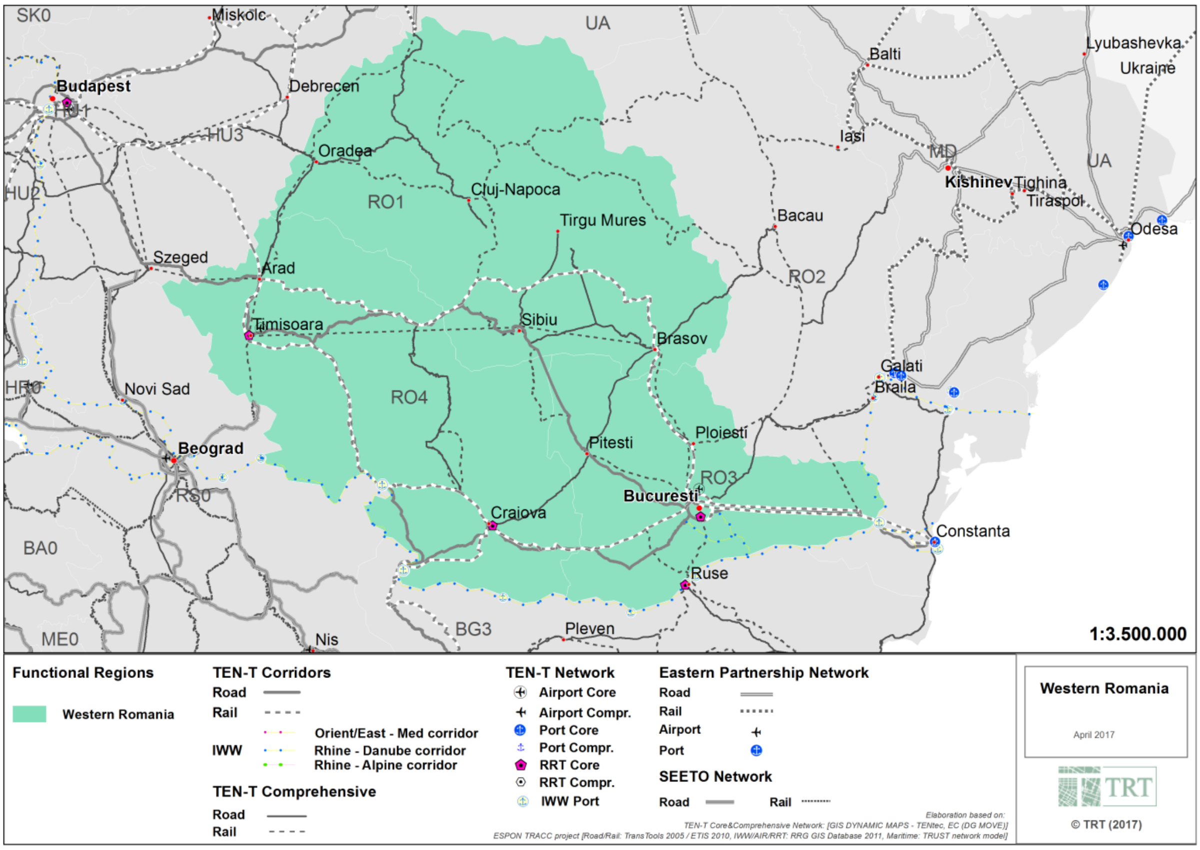
Source: TRT elaborations on TRUST (2016) and Eastern Partnership models (2016)

Air transport demand of 12 observed airports of FR8 accounted for 12,3 million passengers and 33,4 thousand tonnes in 2015 (i.e., 8% and 4% of the total of the Danube Macro-Region, respectively). The largest majority of demand concentrates in the airport of Bucharest, with a traffic of 75% of the total passengers and 87% of the total freight transited in the FR. The other major international airports are in Timisoara and in Cluj-Napoca.

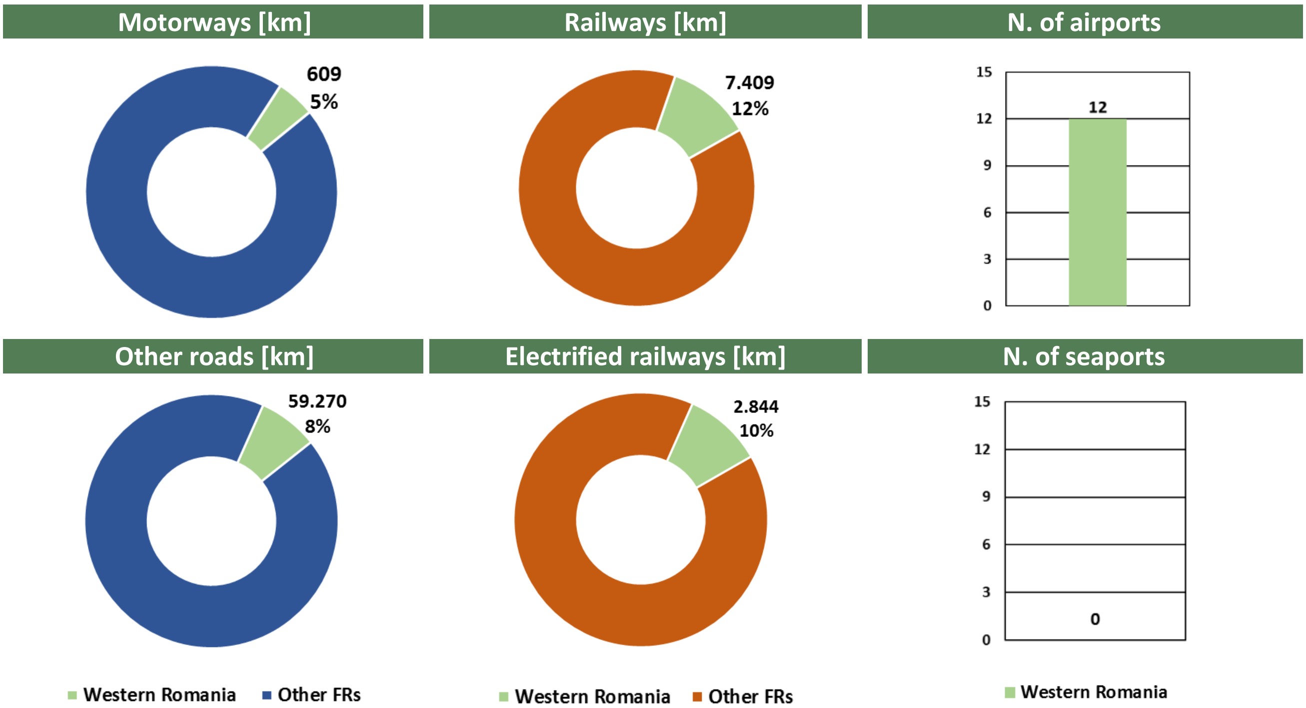
With respect to the transport supply side, FR8 is crossed by two TEN-T CNCs, namely the Rhine-Danube and the Orient/East-Med CNCs (see Figure 5-40).

There are 609 km of motorways in FR8, mostly developed in the basic spatial entity of Bucharest. The non-motorway roads extend for more than 59 thousand km and shows an even density across the concerned territories. The length of the rail network is 7,4 thousand km, of which a 38% electrified. The electrification is more advanced around Bucharest.

Figure 5-40: Transport network localisation of FR8



Source: TRT elaborations (2017)



Source: Eurostat (2016), National Statistics (2017), Bosnia and Herzegovina (2016), Ministry of Infrastructure of Ukraine (2017), TRT (2017)

5.8.2.1 Bottlenecks

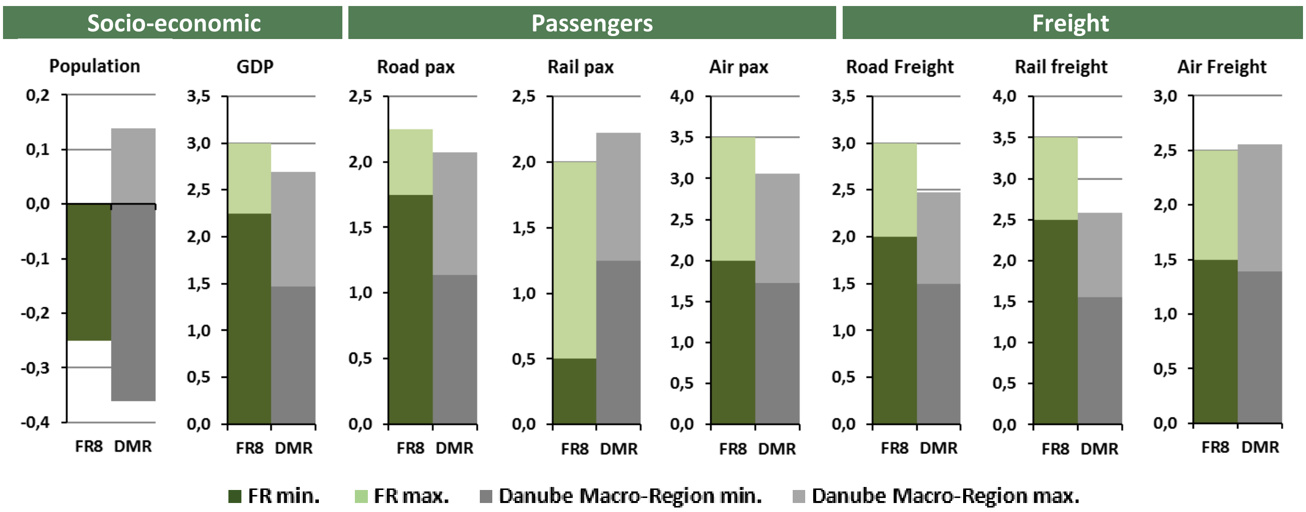
As regards the road network of FR8, the main bottlenecks are due to missing links and roads with unfavourable conditions, speed limits lower than 70% of the reasonable target and due to the poor quality of 20% of the network. Notably, the road sections in most urgent need of interventions are Sibiu-Brasov, Turda-Halmeu, Sighisoara bypass, Brasov-Bacau, Bucharest Southern ring, Comarnic-Brasov-Pitesti and Bucharest-Alexandria-Craiova (EC, 2014d).

Concerning the railway network, bottlenecks are caused mainly by non-interoperable lines, a chronic lack of maintenance and a limited speed to 50 km/h on almost one third of the network. Some of the most relevant bottlenecks are the sections Teius-Cluj, Bucharest-Giurgiu[86], Bucharest-Constanta, Craiova-Calafat, Lököshaza-Curtici and Timisoara-Stamora Moravita (AECOM, 2014; Club Feroviar, 2013).

With respect to the air mode, Cluj-Napoca, Satu Mare, Craiova and Timisoara[87] airports are expected to run out of apron stand capacity by 2020 (AECOM, 2014).

5.8.2.2 Indicative projections of key socio-economic parameters and demand volumes

From the socio-economic perspective, the population could be projected either unchanged or in reduction according to the patter observed during the recent years. The GDP growth rate could be higher than the average of the Danube Macro-Region, relying on the expected development of the economic activities and increase of the population employed. As concerns the transport demand, all the modes are expected to grow faster or in line with the average of the Danube Region, except for rail passenger transport. This given a significant increase of the motorisation rate of private vehicles.



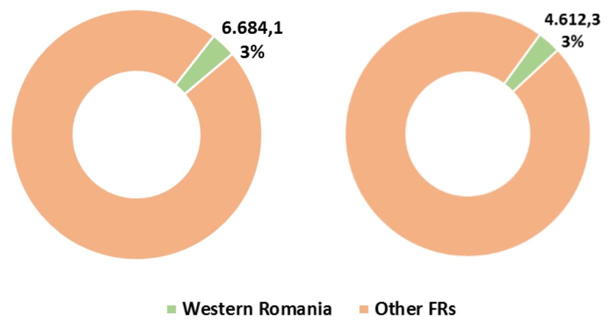
Source: TRT elaborations on Capros et al. (2016), EC (2014), National Transport Plans and Strategies

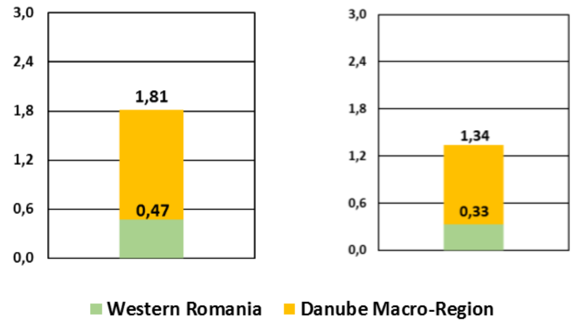
[86] The project "Modernisation of the Bucharest – Giurgiu (border with BG) section" has been identified as a future transport project and the fiche has been developed.

[87] The project "Timisoara airport development" has been identified as a future transport project and the fiche has been developed.

5.8.3 Environmental aspects

CO_2 emissions		Cars CO_2 emissions per capita	
Total [ths. tons/year]	Cars [ths. tons/year]	Total [tons/year]	Cars [tons/year]

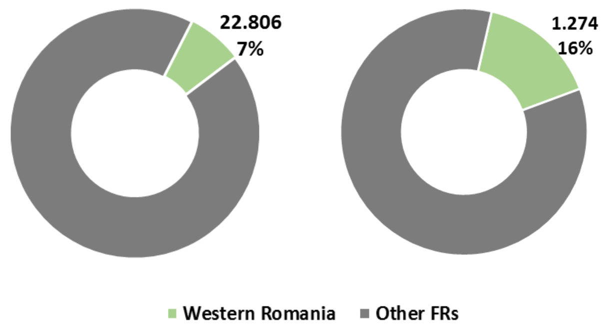


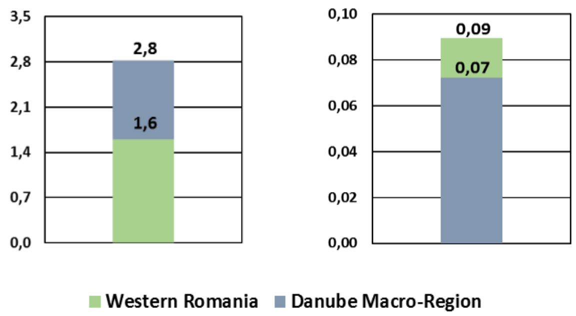


Source: TRT elaborations on the ASTRA and PRIMES models (2016) and the KNOEMA database (2016)

5.8.4 Safety aspects

N. of injured people	N. of killed people	N. of injured /1.000 people	N. of killed/1.000 people

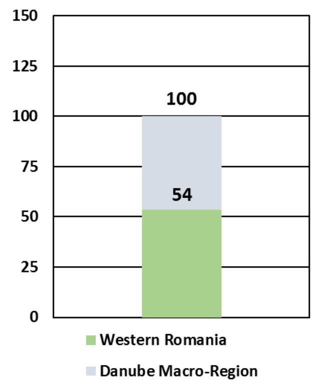




Source: TRT elaborations on the OECD (2016), Eurostat (2016) and National Statistics (2016)

5.8.5 Accessibility

The accessibility potential to GDP of FR8 is approximately the half of the average of the Danube Macro-Region



Source: TRT elaborations from ESPON TRACC (2012)

5.8.6 Key elements

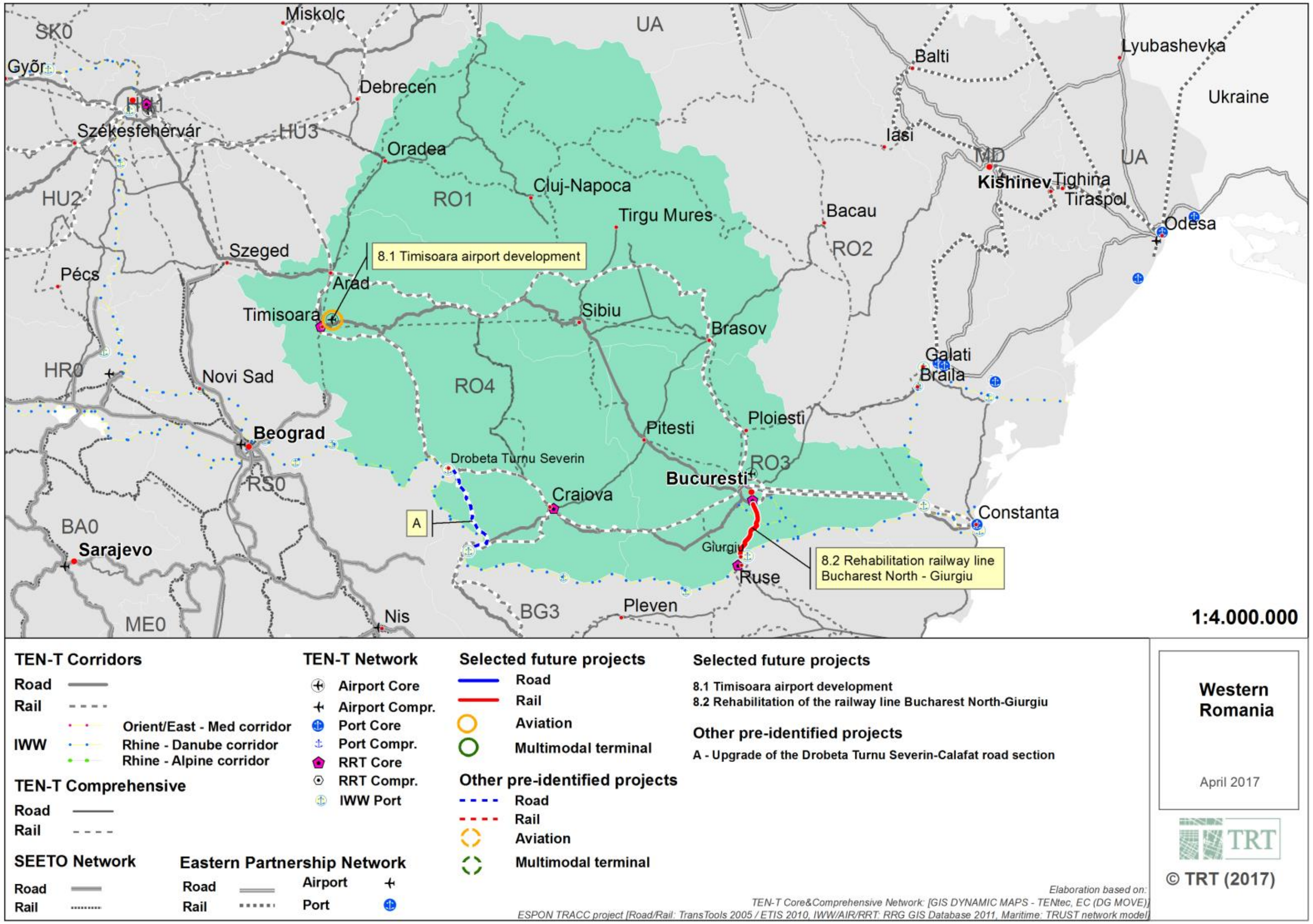
- The size of the economy of the FR8 is relatively small, but the size of the GDP has been increasing through time and recovered to pre-crisis level. The population shows a significant negative trend.
- The estimated rail and road transport demand of FR8 accounts for a 6% of the total passengers of the Danube Macro-Region and a 9% concerning freight. The internal demand takes up the greatest part of the total demand of the FR. The road transits accounts for 6% for freight is negligible for passengers.

- The airport of Sofia holds the largest share for both passengers and cargo volumes. The other major international airports are in Timisoara and in Cluj-Napoca.
- This FR is crossed by two TEN-T CNCs, namely the Rhine-Danube and the Orient/East-Med CNCs.
- The motorway network is mostly developed in the basic spatial entity of Bucharest. The non-motorway roads extend for more than 59 thousand km and shows an even density across the concerned territories. The length of the rail network is 7,4 thousand km, of which a 38% electrified. The electrification is more advanced around Bucharest.
- The main road bottlenecks are due to missing links and roads in unfavourable conditions. Concerning the railways, bottlenecks are caused mainly by non-interoperable lines, lack of maintenance and speed limitations. Cluj-Napoca, Satu Mare, Craiova and Timisoara are the airports with expected apron stand capacity bottlenecks.
- The emissions of CO_2 are a tiny share of the Macro-Region.
- The index of accessibility potential to GDP is approximately the half of the average of the Danube Macro-Region.

5.8.7 Identified future transport projects

- Timisoara airport development
- Rehabilitation of the railway line Bucharest North-Giurgiu

Figure 5-41: Map of identified projects in FR8

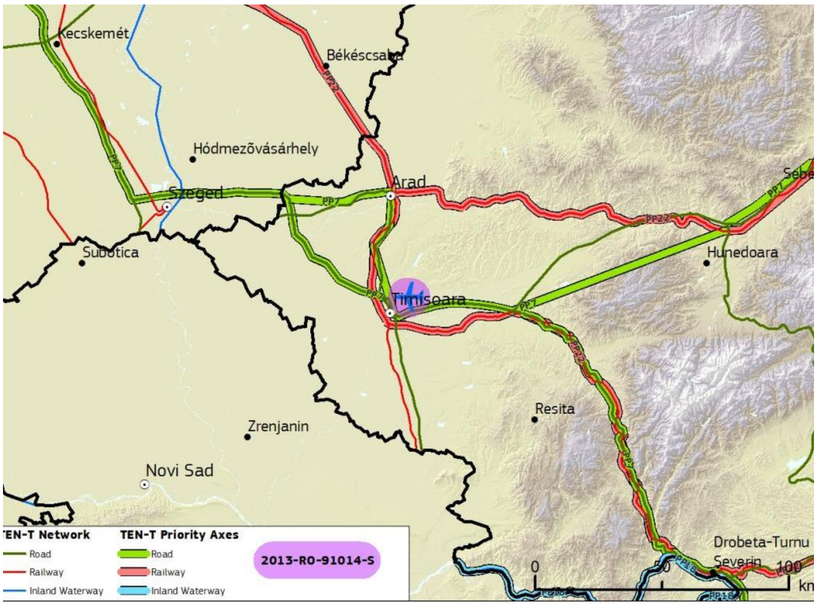


Source: TRT elaborations

5.8.7.1 FR8 Project 8.1 – Timisoara airport development

General information: this project regards the upgrade of the Timisoara Airport which is a core node of the Orient/East-Med CNC. The Figure 5-42 shows the localisation of the airport.

Figure 5-42: Localisation of Timisoara airport



Source: TRT elaboration from INEA website (2016)

In the 1980s, the Timisoara airport was designated as an international airport. The runway was extended from 2.500 to 3.500 m and terminal buildings for international flights, the control tower, the official hall and the administrative building were constructed. In 2006, the aircraft parking facilities were enlarged to cater for the increasing air traffic and the construction of a new parking lot and an access road in the airport. The extension works for the international terminal were completed in 2007. In 2010, the works to expand the domestic terminal was completed.

The project has been approved and supported by the government. The Timisoara Airport and the Ministry of Transport will implement the project.

Technical description: regarding the passenger terminal, it will be built in two phases and will include a large air station, equipped with commercial and operational facilities. In addition, a bus terminal will be connected through a shopping gallery to the main terminal, facilitating regional and international bus transport.

According to the consulted stakeholders, the updated project includes the following three building phases (i) international arrivals terminal, (ii) passenger transport multimodal hub and (iii) multimodal terminal cargo. The estimated investment costs and additional operating costs reported in the Romania General Transport Master Plan (AECOM, 2014) account for respectively € 78,3 and 4,0 million, while, according to the consulted stakeholders, the total estimated investment is equal to € 100,8 million (without VAT). There is no available information on costs breakdown by category.

Project implementation: the current project development plan is summarised in Table 5-28.

Table 5-28: Project implementation timeline of Timisoara airport

Project component	Expected time line
Extension of the passengers terminal (1)	2020
Extension of the passengers terminal (2)	2025
Analysis of the opportunity for development of a cargo terminal	2020

Source: TRT elaboration from AECOM (2014)

The construction of the passenger terminal has already received the approval for the joint financing by Timisoara International Airport (30%) and the Ministry of Transport (70%). Information on the project management and supervision organisation is not available, as well as on the procurement plan for the project.

Transport demand: the demand volume of passengers has been fluctuating over the last ten years (see Figure 5-43). The airport experienced a significant decrease after it lost the carrier Carpatair in 2011. According to traffic forecasts (AECOM, 2014), the airport is expected to accommodate 1,79 million passengers by 2020 and 2,22 by 2025. Approximately 75% of the demand is international.

Regarding the annual growth rates, an increase of 3,6% is expected from 2011 to 2020 and by 4,7% from 2020 to 2025. Growth rates are relatively in line with the GDP projections of the EU Reference Scenario (Capros et al., 2016). For years 2015 and 2016, the annual passenger growth rate was of about 26% per year, exceeding the forecasts of AECOM (2014). In 2016, the Timisoara Airport registered 1,16 million passengers and it is expected that the traffic number should achieve 1,70 million passengers in 2017, following the arrival of the low cost airline Ryanair in September 2016.

Figure 5-43: Demand trend and forecasts of 2020 and 2025 of Timisoara airport

Source: TRT elaboration from AECOM (2014)

On the airside, the Timisoara airport does not show critical issues with respect to the number of apron stands available (i.e., 26) in comparison with the forecasts for 2020 and 2025. The rate of utilisation is expected to increase from 65% to 81%.

Financial analysis: information on the financial analysis is not available.

Economic analysis: the performance parameters of the economic analysis carried out in AECOM (2014) indicate a ENPV equal to € 65,2 million, an EIRR equal to 5,7 and a B/C ratio equal to 1,65.

The information available does not provide with details regarding the methodology used to carry out the economic analysis and the appraisal period assumed. There are no indications neither regarding conversion factors from financial to economic inputs, nor for assumptions on the residual value of the investment.

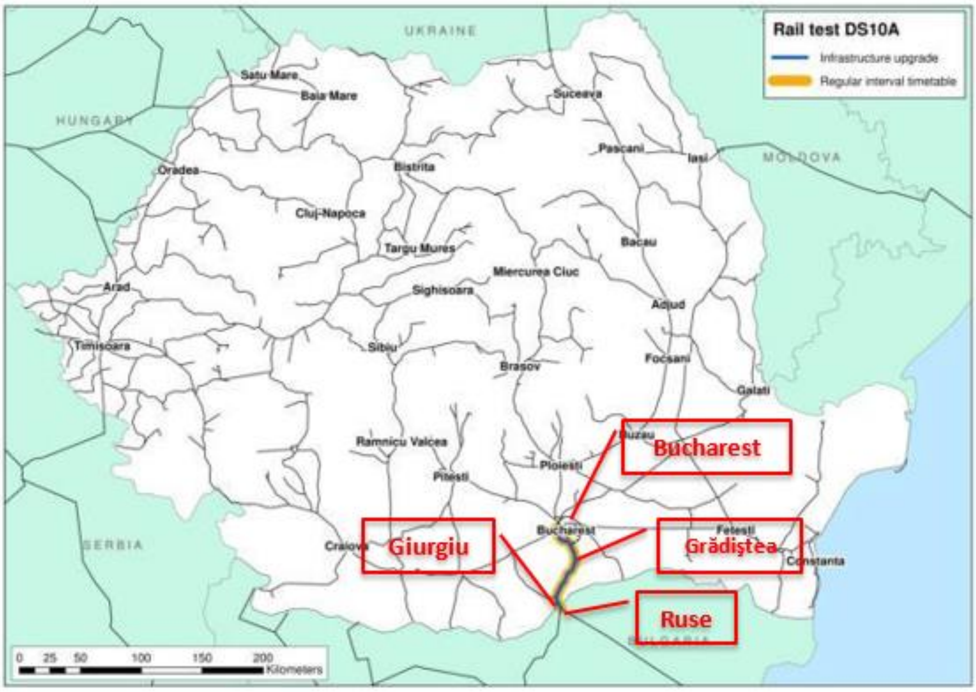
Environmental analysis: the EIA is not available.

Safety levels: the second building phase of the passenger transport terminal hub will improve the Timisoara Airport's safety and security equipment as to comply with EU standards. There is no specific information on safety issues and black spots, before and after project implementation.

5.8.7.2 FR8 Project 8.2 – Rehabilitation of the railway line Bucharest North-Giurgiu

General information: the project regards the rehabilitation of the cross-border railway section Bucharest-Giurgiu, which connects the capital city of Romania with Bulgaria via Grădiştea. The Bucharest-Giurgiu rail line is part of the Pan-European Corridor IX, on the TEN-T comprehensive network. It is a very important link, being the unique connection with the Bulgarian cross-border river port of Ruse, on the Danube River. This project is in continuation with the railway line Ruse-Varna, identified in the FR8 (see Figure 5-44).

Figure 5-44: Localisation of the railway line Bucharest North-Giurgiu



Source: AECOM (2014)

In 2005, the Grădiştea bridge collapsed due to the severe damages caused by a flood. Since then, the Bucharest-Giurgiu line closed to traffic. At the moment, trains transit through the much longer route Videle-Giurgiu to pass the border between Romania and Bulgaria. The urgency of the rehabilitation of the section is necessary because traffic diversion is overstressing the Videle-Giurgiu line, designed for lighter traffic. The project to modernise the line Bucharest North-Jilava-North Giurgiu-state border with Bulgaria aims to:

- reopen the section to train traffic;
- improve safety of rail traffic;
- reduce travel time by increasing speed across the section;
- improve the ride comfort;
- increase transit cargo traffic;
- reduce GHGs and negative environmental impacts.

According to the Romania General Transport Master Plan (AECOM, 2014), the rail rehabilitation projects includes different operations:

- rehabilitation to design speed of corridor 902 between Bucharest and Giurgiu;
- steady state maintenance of the network;
- improvement of signalling and communication systems to enhance running speed and increase the corridor's capacity;

- reconstruction of the Arges river bridge (between the railway station Vidra-Grădiştea).

Technical description: the estimated investment costs and additional operating costs are illustrated in Table 5-29. There is no information regarding the costs breakdown by category.

Table 5-29: Estimated investment and operating costs of the railway line Bucharest North-Giurgiu

Item	Description	Estimated value [€ million, 2014]
Investment	Rehabilitation of track to provide current design speeds Rehabilitation of power supply, including regenerative braking Rehabilitation of signalling equipment	113
Operating	Additional operating costs for trains	122

Source: TRT elaboration from AECOM (2014)

It is worth noting that the costs will be updated in the feasibility study for Bucharest North-Jilava-Giurgiu North-Giurgiu Nord Frontieră that will be completed in 2018.

Project implementation: the project is part of the programme "Large Infrastructure Operational Programme 2014-2020", which aims to remove the main bottlenecks and develop sustainable, efficient and green transport modes in the member countries.

On September 2016, the state-owned rail infrastructure manager CFR SA launched a € 4,3 million open tender for the preparation of the feasibility study for the modernisation of the rail section. The feasibility study will identify the best option and propose a schedule of activities by developing a structure of works with two lots. The Lot 1 will include works on the bridge over the river Arges between stations Vidra and Grădiştea. The Lot 2 will comprise works on the railway infrastructure and on the Giurgiu and Bucharest North railway stations.

Transport demand: according to AECOM (2014), once the project will be completed, it is forecasted an increase of passengers and freight traffic by +3% and +1%, respectively. On the consulted documents, there is no information available with respect to the assumed values of key drivers of traffic growth and indications are not provided on the evolution of level of service or capacity.

Financial analysis: information of the financial analysis is not available.

Economic analysis: the performance of the economic analysis is reported in Table 5-30.

Table 5-30: Economic performance indicators of the railway line Bucharest North-Giurgiu

Performance indicator	Value
ENPV [€ million, 2014]	263
Benefit/Cost	4,20
EIRR [%]	14,67

Source: TRT elaboration from AECOM (2014)

The information available does not provide with details regarding the methodology used and the appraisal period assumed. It is worth noting that in 2011 an economic analysis was carried out focusing only on the new rail bridge construction. Though the results were positive, the study is not available.

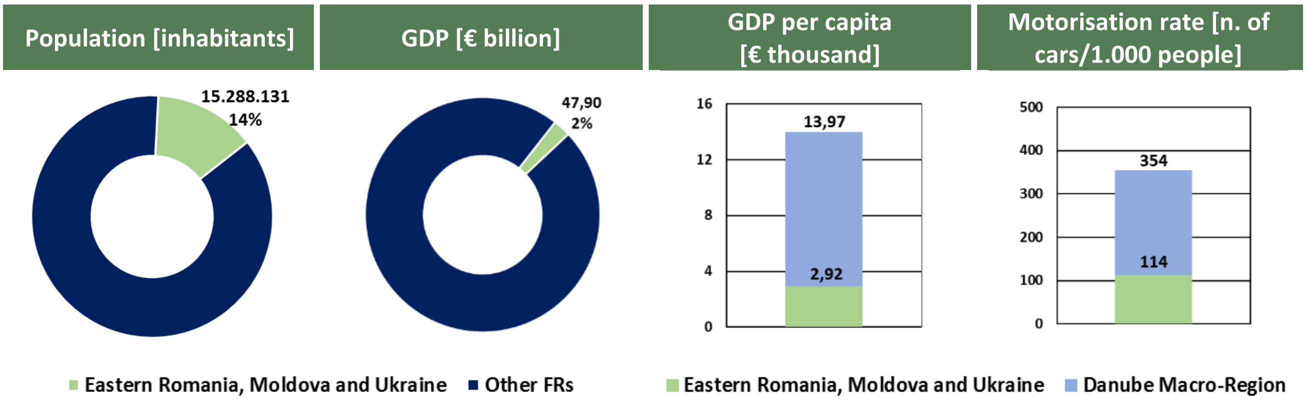
Environmental analysis: the reduction of greenhouse gas emissions and, generally, of the negative environmental impacts are part of the project's scope. Nonetheless, the EIA is not yet available; it will be ready once the Feasibility Study will be completed.

Safety levels: there is no specific information on safety issues and black spots before and after the project implementation but the increase in safety is included in the launched tender for the Feasibility Study as a major objective of the project.

5.9 FR 9 – Eastern Romania, Moldova and Ukraine

The FR9 assembles the territories of three different countries, namely Eastern Romania, Moldova and four provinces of Ukraine.

5.9.1 Socio-economic characteristics

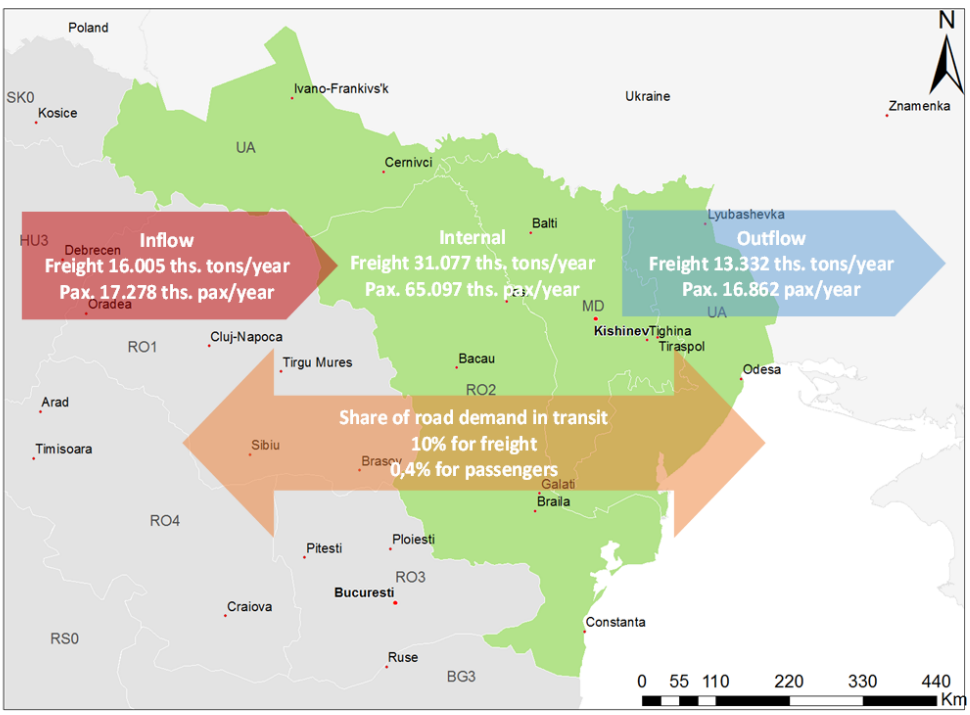


Source: Eurostat (2016), World Bank (2016) and National Statistics (2016)

5.9.2 Transport demand and infrastructures

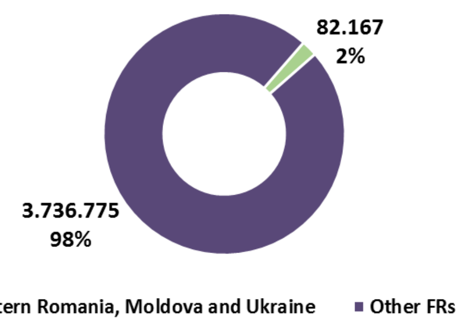
The estimated rail and road transport demand of FR9 is the lowest observed for the Danube Macro-Region, accounting for 2% of the total for passengers and 4% for freight. The share of the internal demand is the lowest of the Danube Macro-Region, namely 66% for passengers flows and 51% for freight and possibly suggesting a more intense interaction with neighbouring territories or national economies of Romania and Ukraine. As regards the estimated road transits, they account for 10% for freight and 0,4% for passengers of the total road demand generated by the FR (see Figure 5-45).

Figure 5-45: Road and rail transport flows of FR9



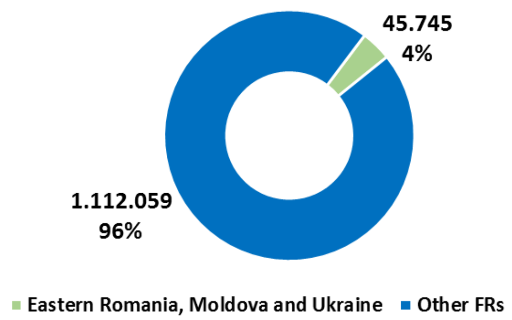
Source: TRT elaborations on TRUST (2016) and Eastern Partnership models (2016)

Passengers [thousand passengers/year]



O/D	FR9	Other FRs	Total
FR9	65.097	16.862	**81.959**
Other FRs	17.278	3.719.705	**3.736.983**
Total	**82.375**	**3.736.566**	**3.818.941**

Freight [thousand tonnes/year]



O/D	FR9	Other FRs	Total
FR9	31.077	13.332	**44.409**
Other FRs	16.005	1.097.391	**1.113.396**
Total	**47.082**	**1.110.723**	**1.157.804**

Source: TRT elaborations on TRUST (2016) and Eastern Partnership models (2016)

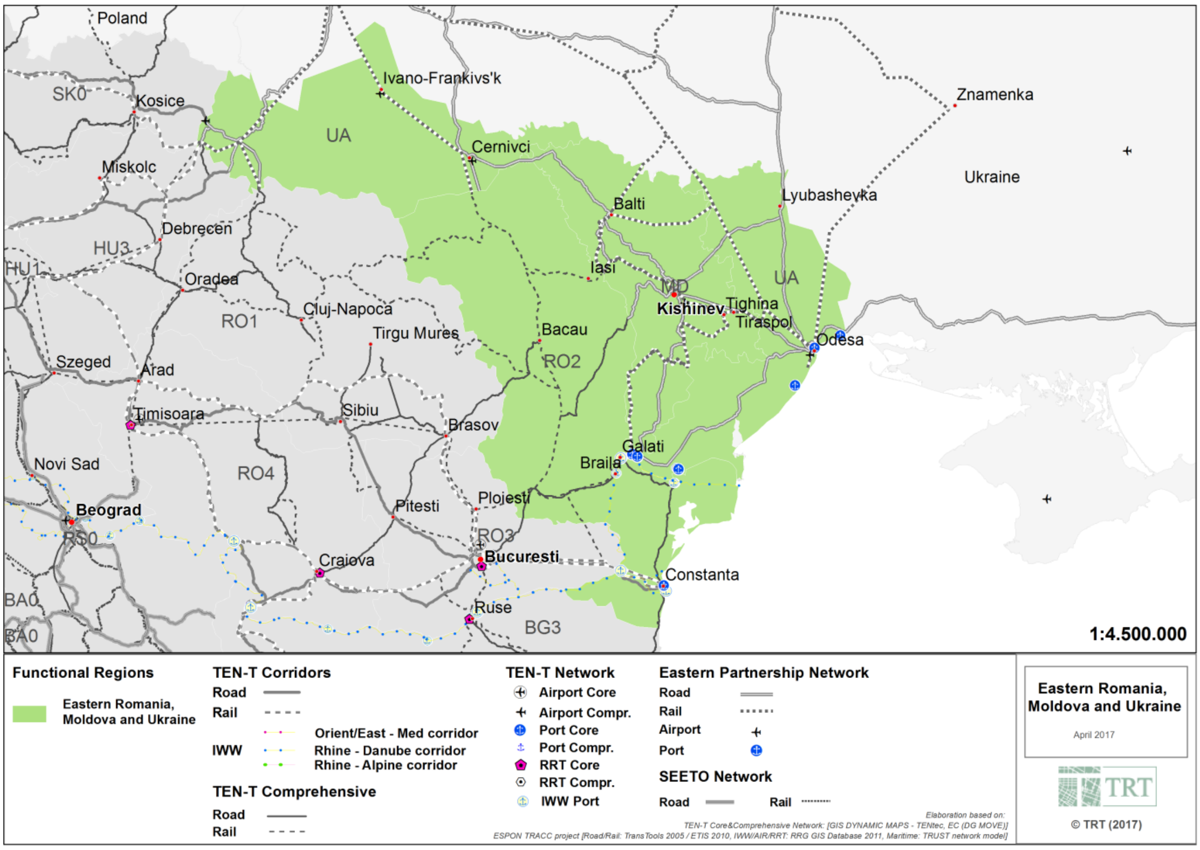
The FR9 holds the smallest share of air transport demand of the Danube Macro-Region, namely 1% of the total passengers (i.e., 745 thousand passengers in 2015) and 0,3% of the total freight (i.e., 2,9 thousand tonnes in 2014). The majority of air traffic is generated by the airport of Chisinau in Moldova, which accounts for the entire cargo demand of the FR and – in 2014 – for a 76% of the embarked and disembarked passengers (i.e., 1,7 out of 2,3 million).

The maritime freight volume of FR9 represents more than half of the Danube Macro-Region, accounting for a 58,1% (i.e., 86,5 million tonnes in 2015). The main port is in Constanta, on the Black Sea coast of Romania, with a volume of freight handled equal to 36,2 million tonnes in 2015, or a 24% of the total of the Macro-Region. As regards maritime passenger traffic, the share of the FR9 is negligible, accounting for less than 0,01% of the total.

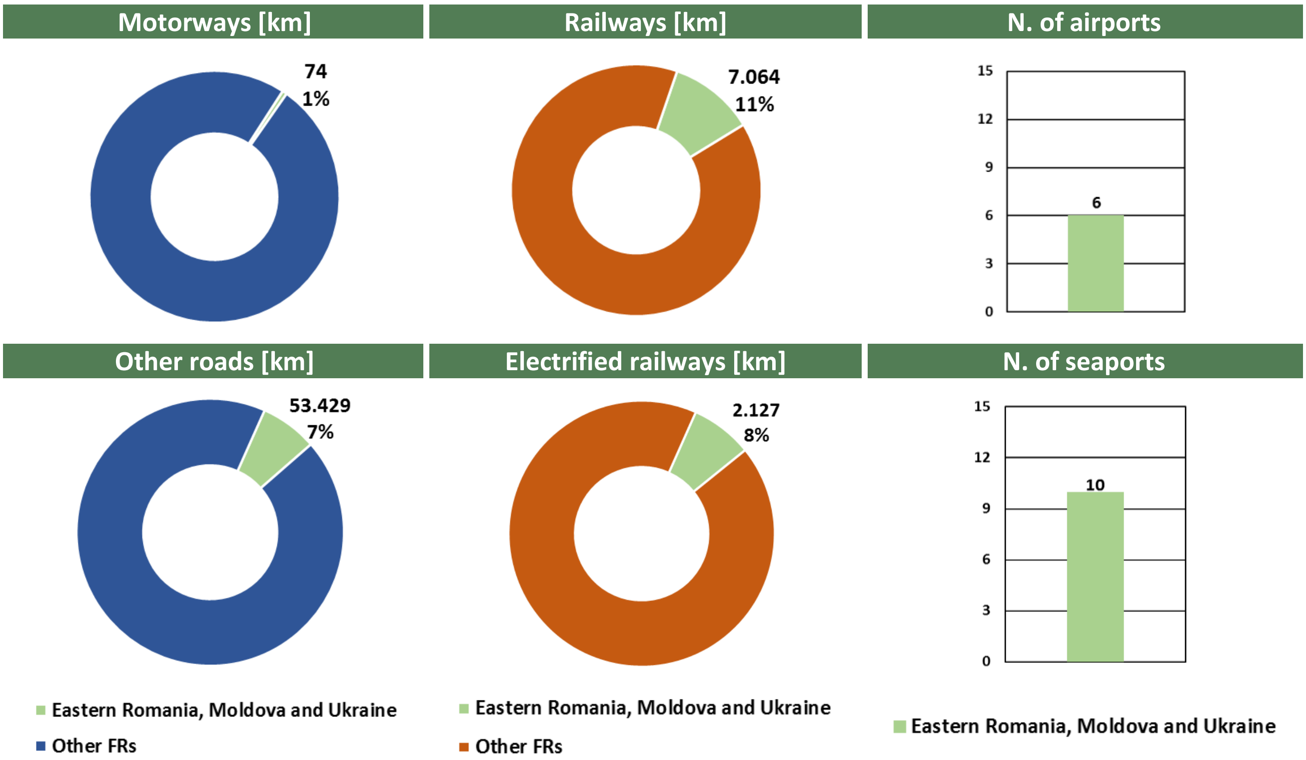
With respect to the inland navigation on the Danube river, the FR9 generates a large part of the entire traffic, namely 35% of the total of the Danube Macro-Region (i.e., 12,5 million tonnes in 2014). The main inland port is in Galati, in Romania, with a 2014 volume of freight handled of 3,5 million tonnes, 10% of the total volume of the Danube Region.

The Figure 5-46 shows the transport network of FR9. The Romanian territory of the FR is not crossed by TEN-T CNCs, while Moldova and the four provinces of Ukraine are crossed by the Eastern Partnership strategic network.

Figure 5-46: Transport network localisation of FR9



Source: TRT elaborations (2017)



Source: Eurostat (2016), National Statistics (2017), Bosnia and Herzegovina (2016), Ministry of Infrastructure of Ukraine (2017), TRT (2017)

5.9.2.1 Bottlenecks

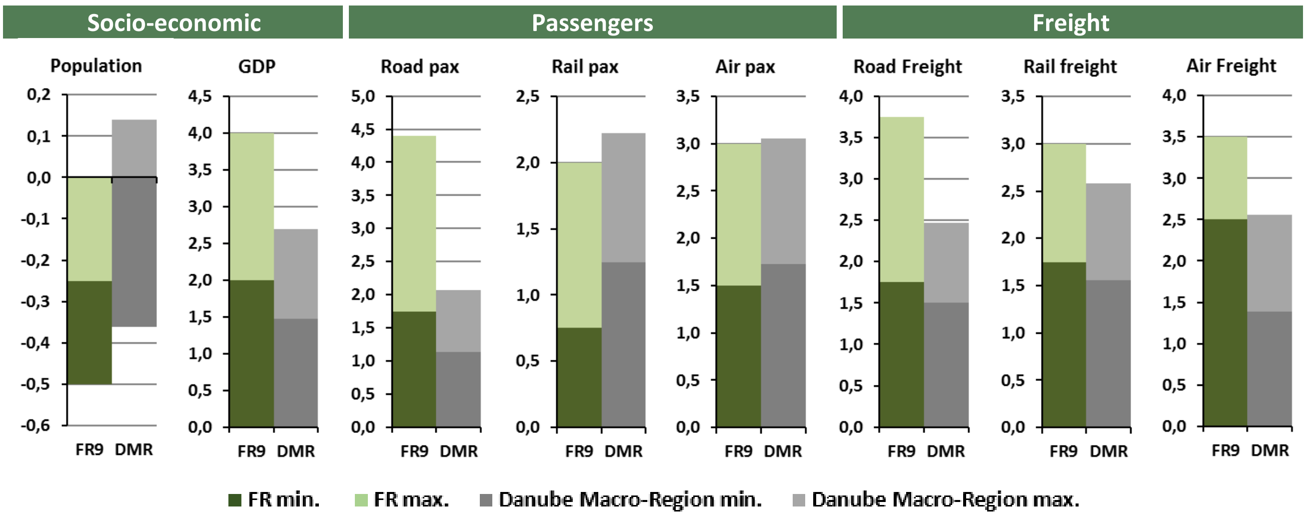
Regarding the road network of the Romanian territory, bottlenecks are localised on the sections Bacau-Suceava, Constanta-Braila and Bacau-Galati (AECOM, 2014). Moldova and Ukraine have a relatively balanced picture of the estimated volume to capacity ratio (TRT et al., 2015), but they suffer from poor network conditions.

With respect to the railway network, the main technical bottleneck for the integration of the railways of Moldova and Ukraine with the network of the other countries of the Danube region is the difference of their track gauge, based on Russian standards (i.e., 1.520 mm) (GETINSA, undated; Kocks et al., 2012). The fact that the Moldovan network is entirely not electrified creates problems for direct connections with Ukraine. As regards non-physical bottlenecks, Ukraine is planning to facilitate the settling of customs clearance procedures at the Odessa region checkpoints for container shipments by rail.

As regards the air transport, Tulcea airport’s runway needs to be upgraded because of the width of the runway (i.e., 30m, while all other airports have a runway width of 45m). As regards passenger terminal constraints, the only airport that will need upgrading measures is Bacau (AECOM, 2014). On the Moldovan side, the airport of Chisinau requires terminal extension (Hochtief, 2009). Ukraine is planning to modernise the Air Navigation System in order to alleviate the bottleneck problems in the airports of concerned provinces[88] (see also DORNIER et al., 2016).

5.9.2.2 Indicative projections of key socio-economic parameters and demand volumes

The population of such mixed FR could experience a reduction pattern, mostly driven by the tendency of contraction of the inhabitants of Romania and Moldova. On the other hand, despite the small size of the three merged economies, the GDP could grow faster than the average pace of the Macro-Region, especially relying on expected growth rates of the Moldova and Ukraine. With respect to demand growth projections, the passengers road mode could experience the highest growth rates, also assuming a steady increase of the motorisation rate. To some extent this would influence the growth rate of rail passengers. Significant growth could be projected for the freight transport across all concerned modes, relying on the expected development of the economic activities.

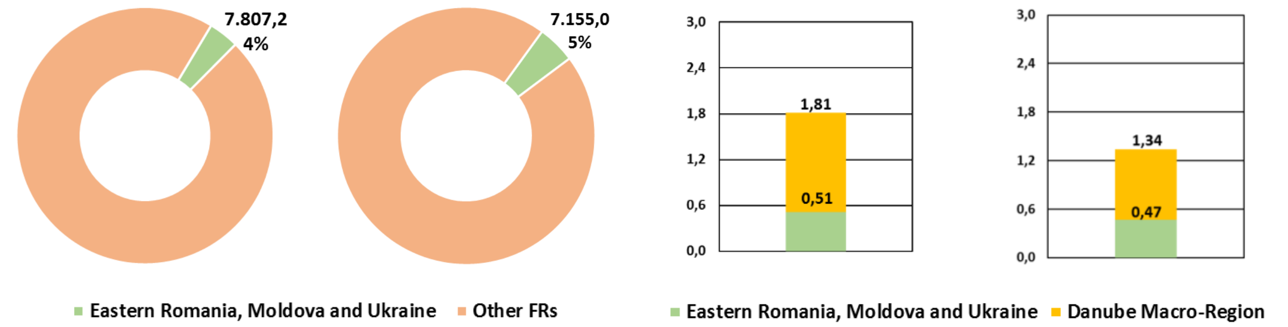


Source: TRT elaborations on Eastern Partnership model, National Transport Plans and Strategies

[88] The project “Equipment for the Air Navigation System (4 airports)” has been identified as a future transport project and the fiche has been identified.

5.9.3 Environmental aspects

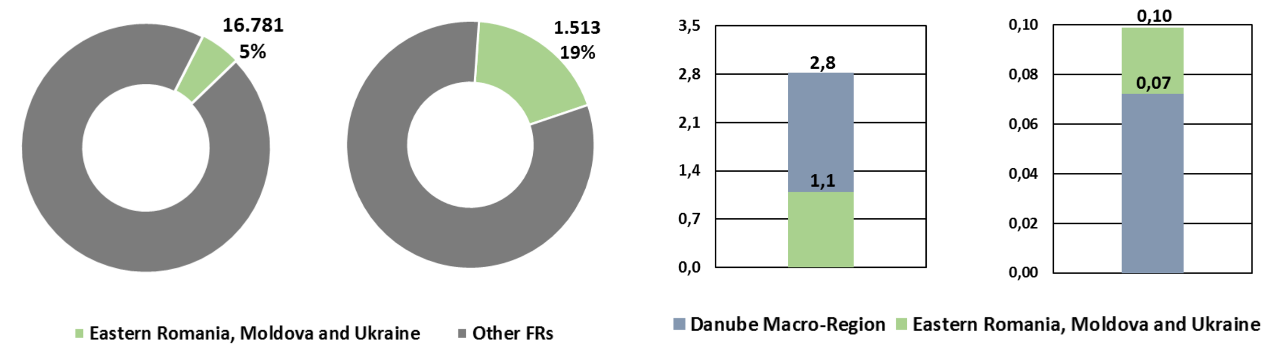
CO_2 emissions		Cars CO_2 emissions per capita	
Total [ths. tons/year]	Cars [ths. tons/year]	Total [tons/year]	Cars [tons/year]



Source: TRT elaborations on the ASTRA and PRIMES models (2016) and the KNOEMA database (2016)

5.9.4 Safety aspects

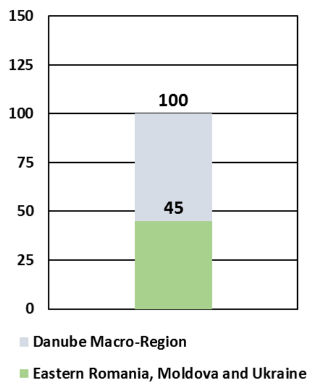
N. of injured people	N. of killed people	N. of injured /1.000 people	N. of killed/1.000 people



Source: TRT elaborations on the OECD (2016), Eurostat (2016) and National Statistics (2016)

5.9.5 Accessibility

The average percentage of accessibility potential to GDP of FR9 is less than one half of the average of the Danube Macro-Region (i.e., 45%).



Source: TRT elaborations from ESPON TRACC (2012)

5.9.6 Key elements

- The FR9 assembles the territory of three countries, but the resulting size of the economy is small. However, the GDP has been increasing through time, especially in Moldova and Romania. The population shows a negative trend, notably in Eastern Romania.
- The estimated rail and road transport demand of FR9 is the lowest observed for the Danube Macro-Region, accounting for 2% of the total for passengers and 4% for freight. The share of the internal

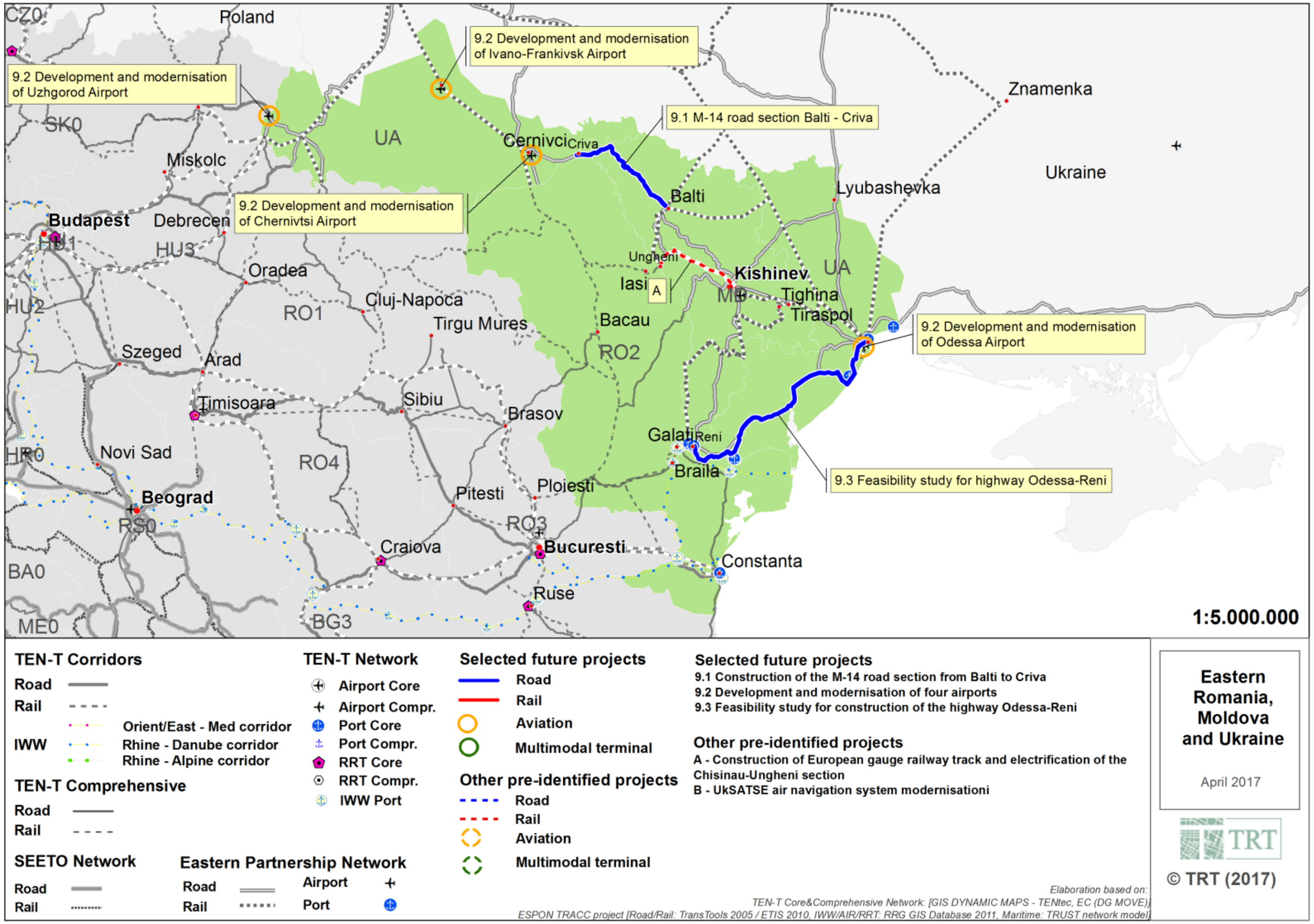
demand is the low, possibly suggesting a more intense interaction with neighbouring territories or national economies of Romania and Ukraine.

- The majority of air traffic is generated by the airport of Chisinau in Moldova.
- The maritime freight volume of FR9 represents more than half of the Danube Macro-Region. The main port is in Constanta.
- The Romanian territory of the FR is not crossed by TEN-T CNCs, while Moldova and the four provinces of Ukraine are crossed by the Eastern Partnership strategic network.
- The motorway network is not significantly extended. The railway network extends for 7 thousand km. The railway network of Moldova is not electrified and almost entirely with Russian track gauge.
- Road bottlenecks are localised in Romania. Moldova and Ukraine have a relatively balanced picture of the estimated volume to capacity ratio. For the railway network, the main technical bottleneck for the integration of the railways of Moldova and Ukraine.
- The emissions of CO_2 are a tiny share of the Danube Macro-Region.
- The index of accessibility potential to GDP is approximately the half of the average of the Danube Macro-Region.

5.9.7 Identified future transport projects

- Construction of the M-14 road section from Balti to Criva
- Development and modernisation of four airports
- Feasibility study of the construction of the highway Odessa-Reni

Figure 5-47: Map of identified projects in FR9

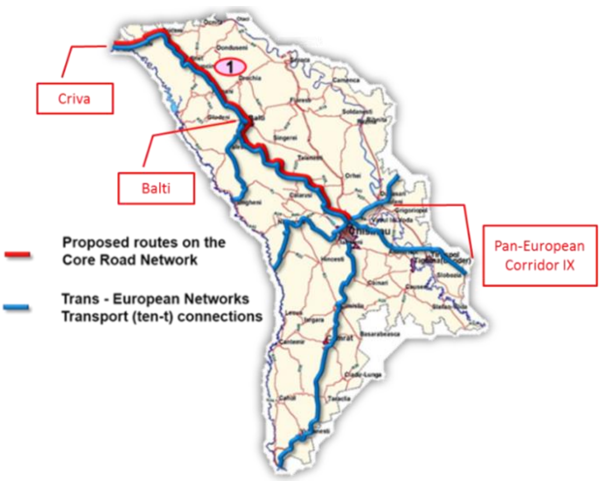


Source: TRT elaborations

5.9.8 FR9 Project 9.1 – Construction of the M-14 road section from Balti to Criva

General information: this project regards the rehabilitation of the road M-14, from Balti to Criva (i.e., 133 km), which is of major importance for the Government of Moldova. It crosses the country from the North-Western border with Ukraine's province of Chernivets'ka to South-Eastern border with Ukraine's province of Odes'ka, passing through the capital city of Chisinau and crossing the Pan-European Corridor IX (see Figure 5-48).

Figure 5-48: Localisation of the section from Balti to Criva of the M-14



Source: Ministry of Transport and Road Infrastructure of Moldova (2016)

According to the project promoter (i.e., the Ministry of Transport and Road Infrastructure), the rehabilitation of the road M-14 would have a direct impact on the improvement of the road connection with Ukraine and would contribute to the integration of Moldova into the transport system of the Eastern Europe.

Regarding the relevance of the project, this section of the M-14 is classified as proposed Route 1 on the national core network. Moreover, the project is mentioned in the list of priority infrastructure projects of the Eastern Partnership regional transport network.

Field reconnaissance activities identifies deteriorated conditions due to poor technical design from former Soviet standards, lack of quality control during construction works, poor quality of material used for the construction and lack of maintenance. The condition of road pavement is in state of degradation. The shoulders are frequently damaged. In some settlements, there are no sidewalks and the lack of road signs.

Technical description: the project proposes to modify the existing three-lane transversal section, reducing to a two-lane single-carriageway or widening to a four-lane dual-carriageway. The alignment of the road is unchanged to avoid additional costs and land acquisition. The project identified the improvements to address dangerous conditions. The costs estimation is summarised equal to € 133,6 million. The cost breakdown by relevant category is not available.

Project implementation: Table 5-31 shows the level of maturity, according to the project identification form made available from consulted stakeholder.

Table 5-31: Status of project implementation of the section from Balti to Criva of the M-14

Available studies and documents	Ready and approved	Being worked on	Not started yet
Pre-feasibility study	X		
Conceptual design	X		
Feasibility study and CBA	X		
EIA study (if needed)			X
Valid spatial planning documents	X		
Land property resolved	X		
Preliminary design	X		
Main design/detailed design		X	
Tender documentation			X
Construction and other permits		X	
Construction contract signed			X

Source: Elaboration from Ministry of transport and Road Infrastructure (2016)

Transport demand: two sources of information have been screened to report on transport demand analysis of the road section from Balti to Criva, (i) the preliminary feasibility study of Moldova roads rehabilitation programme (Nathan et al, 2009) and the Transport and Logistic Strategy of Moldova (Kocks et al, 2012). The annual traffic volumes in Nathan et al. (2009) were estimated starting from daily traffic counts at different locations. The forecasts were elaborated for three scenarios of growth of the national GDP, over the period 2010-2031. Elasticities were assumed equal to 1,65 for passenger cars and 1,61 for freight vehicles and over the period 2009-2019. After 2020, the values of the elasticity were reduced to 1,40 for passenger cars and to 1,20 for freight vehicles to 2030.

Traffic forecasts of Kocks et al. (2012) have been estimated through a modelling exercise. Again, the GDP forecasts assumed three scenarios of growth. Demand elasticity for passenger cars has been assumed equal to 1,2 until 2022 and 1,1 afterwards. Regarding freight vehicles elasticity, it has been assumed equal to 1,1 unit 2022 and 1,0 afterwards. Estimations of Kocks at al. (2012) appear more conservative. Whereas assumptions on GDP growth are relatively similar, the values of elasticity and those of demand growth rate over the long term are lower (i.e., 3,8% against 6,6%) (see Table 5-32).

Table 5-32: Traffic forecasts by sections [vehicles/day] of the section from Balti to Criva of the M-14

Section	Preliminary feasibility study (2009)			Transport and Logistics Strategy (2012)		
	2009	2015	2025	2012	2022	2032
Criva-Briceni	2.049	2.900	4.800	1.400	2.350	3.267
Briceni-Edinet	4.869	6.900	11.450	3.067	5.150	7.167
Edinet-Riscani	5.203	7.400	12.250	3.500	6.100	8.400
Riscani-Balti	4.518	6.400	10.650	5.200	8.850	12.100

Source: Nathan et al. (2009) and Kocks et al. (2012)

In general, road traffic volumes observed and forecasted are low in absolute values. However, it is worth remarking that the city of Balti displays a realtively high rate of attraction. Balti is the second urban area in Moldova in terms of industrial activity and income, after Chisinau.

Financial analysis: the financial analysis has not been carried out. The project is not revenues generating. There is not neither EU or WBIF financial support. The EBRD is reported working closely with the Government to prepare the needed studies. The Ministry of Finance of Moldova has been consulted.

Economic analysis: the economic appraisal has been developed in Nathan et al. (2009). The ENPV was estimated equal to € 9,56 million and the EIRR equal to 14,0%. The economic analysis does not include welfare changes due to safety and environmental condition improvements. Sensitivity and risk analyses are not reported in the preliminary feasibility study.

Environmental issues: according to the latest information the EIA has not started yet. Preliminary reconnaissance activities (Nathan et al., 2009) concluded that the alignment of the M14 is not adjacent to any identified protected area. The rehabilitation works are not expected to have significant negative environmental impact. The amount of disturbance to adjacent sites, raising the risk level for environmental impact was estimated limited. These identified sites were not located close enough to the corridor of the M14 road and not expected to receive negative environmental impacts from project's activities.

Safety issues: pedestrians walk on the road and a lack of road signs and horizontal markings result in a generally unsafe traffic condition. Specific accident data of the road M14 road was collected from national Police authorities. However, it is not possible to clearly identify black spots.

5.9.9 FR9 Project 9.2 – Development and modernisation of four airports

General information: the project regards the development and modernisation of four airports in the four provinces of Ukraine part of the Danube Macro-Region. The overall objective of the project is to increase efficiency, reliability, safety of operations and improve the quality of passengers services.

- Airport of Uzhgorod: the project involves the reconstruction and equipping interventions have been planned involving the runway, taxiways, air navigation system and radio technical support of flights. The airport is of strategic importance for Ukraine, since it is the only aviation complex in the Trans Carpathian region which provides airport services for aircrafts and passengers. Currently, the regional authorities frequently resort to temporary measures to improve the operating conditions of the airport and the safety levels, so as to safeguard the compliance of the airport with the ICAO standards.
- Airport of Chernivtsi: the project envisages reconstruction and modernisation measures with regard to the passenger terminal, the ground handling fleet, the airport fence and the technical base rescue flight support. Currently, airport operates under conditions of significant restrictions related to infrastructures and overall airport complex condition. In addition, the existing fleet of special vehicles for ground handling and the lack of a modern terminal for passengers undermine the services provided.
- Airport of Ivano-Frankivsk: the project plans to involve most of the airport complex, from the airfield facilities, to new technological equipment, from the construction of a rescue station, to the installation of a new airfield radar.
- Airport of Odessa: the project concerns the construction of a new passenger terminal.

The projects promoters are the regional administrations involved.

Technical description

- The International Airport of Uzhgorod involves the following measures: expansion of the runway up to 45 m; reconstruction and expansion of the apron and taxiway; reconstruction of the terminal; construction of a rescue station; installation of the aerodrome lighting equipment; equipping the aerodrome with means of air navigation and radio technical support of flights; equipping the aerodrome with means of meteorological support for flights; reconstruction of the power supply system of the airport and transformer substation.
- With respect to the Airport of Chernivtsi, the main measures envisaged are: development of the project of reconstruction of the airfield complex; reconstruction or construction of a new terminal; modernisation of machinery park; completion of the airport fence repair; modernisation of the technical base of emergency-rescue flight support; reconstruction of the runway and parking spaces for aircraft; modernisation of the fleet of special equipment for ground handling.
- Regarding the development of the International Airport of Ivano-Frankivsk, the measures foreseen are: reconstruction of the terminal with new technological equipment; repair of hard shoulder; replacement of the airfield fence; installation of a new airfield radar; acquisition of instrumental landing system precision with MK 278 and MK 098 (2 units); construction of the airfield internal gravel road; purchase Fire automobile KrAZ N23.2; acquisition of tape loader (2 units); purchase of equipment for lifting emergency aircraft.
- As concerns the new passenger terminal in the Airport of Odessa, it will be built to serve 2,5 million passengers per year with a maximum load of up to 3,5 million.

According to the information provided by the consulted stakeholder, the Table 5-33 summarises with respect to the estimated investment costs of the projects. There is no available information regarding the cost breakdown. The is not available information regarding operating and maintenance costs

Table 5-33: Estimated investment costs for projects of development and modernisation of four airports

Project	Estimated cost [€ million]
Reconstruction and equipping of the Airport of Uzhgorod	10,00
Reconstruction and modernisation of the Airport of Chernivtsi	7,70
Development of the Airport Ivano-Frankivsk	14,18
Development of the Airport of Odessa	28,49
Total	**60,37**

Source: Ministry of Infrastructure of Ukraine (2017)

Project implementation: detailed information on the project implementation is not available. The Table 5-34 summarises the estimated implementation schedule.

Table 5-34: Estimated implementation schedule for projects of development and modernisation of four airports

Project	Construction schedule
Reconstruction and equipping of the Airport of Uzhgorod	2018-2020
Reconstruction and modernisation of the Airport of Chernivtsi	end in 2020
Development of the Airport Ivano-Frankivsk	end in 2018
Development of the Airport of Odessa	end in 2018

Source: Ministry of Infrastructure of Ukraine (2017)

According to the consulted documents and stakeholders, there is no information available on the procurement plans and overall level of maturity of the projects.

Transport demand: there is not a detailed analysis of demand forecast for the projects of the four airports involved. Little information is available regarding the airports of Uzhgorod and Odessa. The Airport of Uzhgorod operated 1.691 flights and handled 19.600 passengers in the period from 2013 to 2016[89].

The Airport of Odessa foresees an increasing passengers demand volume. The new terminal construction is planned to increase the total volume of passengers to 446,7 thousand per year (i.e., up to by 43,2% compared to the last available figure). Once the project will be completed, air transport demand from/to the airport is expected to rise to 5.858 flights/year (i.e., by 49,6% compared with the last available data), of which 2.314 domestic and 3.544 international flights. The strategic objective of the airport is to achieve an annual growth rate of 10%.

Financial analysis: the financial analysis is not available. As regards the source of financing and according to the consulted stakeholders, the project could be financed by IFIs (e.g., World Bank, EBRD, EIB, etc.) together with the state budget.

Economic analysis: the economic analysis is not available.

Environmental analysis: there is no available information regarding neither the completion of the EIA, nor environmental issues of the projects.

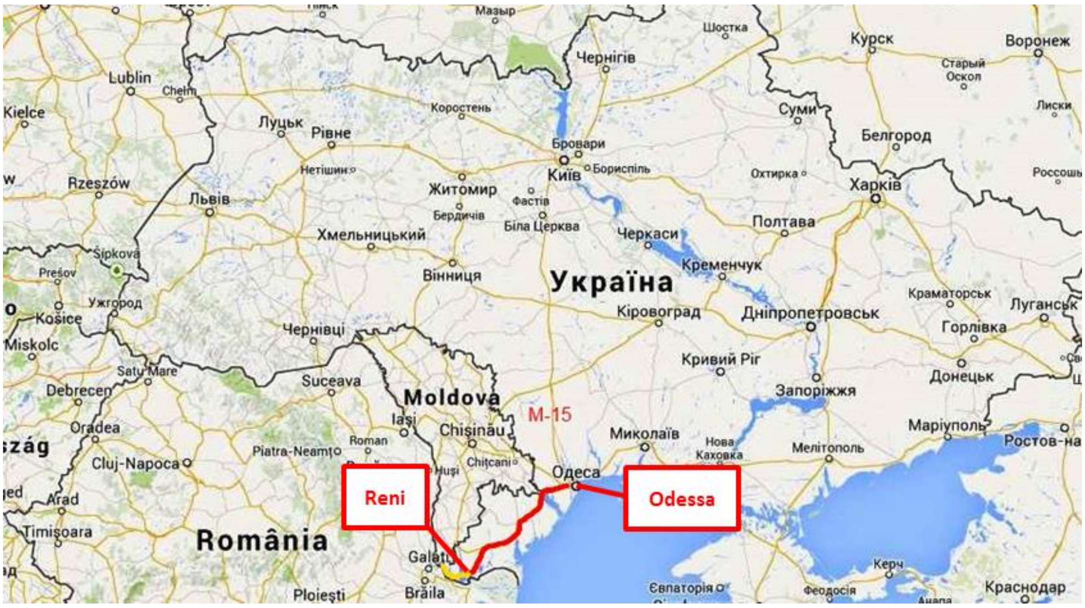
Safety levels: the aviation security services provided by the International Airport of Uzhgorod include a team of paramilitary security, service emergency rescue and fire aviation. The company's activity is regulated by the Civil Aviation regulations and the law of Ukraine. As regards the airport of Odesa, the implementation of the project aims to meet the requirements of the safety rules and regulations operating in Ukraine. A complete description of existing safety levels and specific safety issues is not available.

[89] It has to be acknowledged that in June 2016 the regular flights to/from Kyiv (Zhulyany) have been interrupted.

5.9.10 FR9 Project 9.3 – Feasibility study of the construction of the highway Odessa-Reni

General information: this project regards the feasibility study of the construction of the highway Odessa-Reni part of the Eastern Partnership strategic network (see Figure 5-49).

Figure 5-49: Localisation of the highway Odessa-Reni (in red)



Source: Ministry of Infrastructure of Ukraine (2017)

The construction of the Odessa-Reni highway could connect the Europe, the near East and the Middle East with Ukraine. Furthermore, being located in the Danube Macro-Region and in proximity to important Danube ports (e.g., Reni, Izmail, Ust-Dunaysk), it could lead to an overall increment in transport flows in this direction.

The Ukrainian Government gives priority to the realisation of this project as it is of international relevance. Indeed, the project is in line with the EU Action Plan for Urban Mobility, was included in the list of projects to be financed with private and public partnership schemes and is mentioned amongst the list of priority infrastructure projects on the Eastern Partnership regional transport network

The existing road is in poor conditions. Freight vehicles impair the road pavement. The road has only 2 lanes and, in some parts, it crosses urban areas, resulting in congestions. The road does not comply with the international standards of TEN-T network. Thus - according to the Ministry of Infrastructure of Ukraine and the Odessa Regional State Administration, the implementing bodies - a new road configuration would be needed and equipped with modern technologies.

Technical description: according to the preliminary draft of the project prepared by Ukravtodor[90], the total length of the road is 280 km. In general, transversal section of the highway will be in form of a four-lane (i.e., road category 1-a). The following activities must be conducted with the purpose of the feasibility study elaboration: (i) soil and hydrological analysis, (ii) geological feasibility study, (iii) hydraulic study, (iv) infrastructure interferences analysis, (v) damage prevention for historical and archaeological places and (vi) study of potential areas of development (i.e., industrial, commercial, residential, tourist and logistics).

The construction works will include: (i) construction of the highway, (ii) construction of 2 bridges crossings (across the Dniester estuary (5,7 km), and the Danube river (4,3 km)), (iii) installation of tollhouses, (iv)

90 The national infrastructure manager.

placing of service houses, (v) installation of technological devices (such as telecom, video control, safety electronic systems, etc.) and (vi) ensuring electrical supply.

According to the consulted stakeholder, the latest figure of the estimated investment cost is equal to € 6 billion. The investment costs have been estimated relying on parametric unit values[91] and the high value obtained justified by the envisaged high-tech services and equipment. However, the Consultant deems that the methodology applied for the estimation is not appropriate.

Project implementation: according to consulted stakeholder, only preliminary estimations have been carried out[92] on the timeline for project implementation. The construction works would last 5 years (i.e., from 01/01/2018 to 31/12/2022), starting start after the elaboration of the feasibility study and the preliminary design. The Table 5-35 summarises the expected plan of the activities.

Table 5-35: Planning of activities of the highway Odessa-Reni

Item	Period
Pre-feasibility phase (pre-feasibility studies)	4-6 weeks
Elaboration of feasibility study	6-8 months
Preliminary design phase (including tender for construction)	6-8 months
Construction works	5 years
Highway operation	since 2023

Source: Ministry of Infrastructure of Ukraine (2017)

Transport demand: a detailed demand analysis and future forecasts are not available. According to some preliminary information provided by the consulted stakeholder, the expected traffic flow would be in the interval 18.000-23.000 vehicles/day, depending on summer or winter conditions.

Financial analysis: the financial analysis is needed.

Economic analysis: the economic analysis is needed.

Environmental analysis: the environmental analysis is needed. According to the preliminary project design, the existing Odessa-Reni road directly and indirectly influences the ecologic status of the region. In the proximity of residential areas, noise protection has to be provided with barriers and coverings around the highway, especially where the buildings are too close.

Safety levels: the realisation of the project would improve safety levels, but a detailed quantification of the impact is needed. There is no other specific information related to safety levels and black spots on the concerned road section.

[91] The cost has been estimated relying on the cost/km of the Italian project "Passante di Mestre", multiplied for the length of the Odessa-Reni road and adjusted with a coefficient which takes into account the lower costs of production factors in Ukraine compared with Italy (i.e., by -30% of the cost/km of the Passante di Mestre).

[92] The previous feasibility study was elaborated by Ukravtodor in 2008.

5.10 Summary and main findings

Several information sources have been reviewed, both at national and supranational level to identify future transport projects fitting the objectives of this study (see section 1), consistent with the characteristics of the Danube Macro-Region (see section 2) and coherent with the Functional Regions approach (see section 3). In parallel, a stepwise screening methodology elaborated a starting list of 51 pre-identified projects by the application of general and relevant selection criteria (see section 4).

On this bases, relevant stakeholders have been consulted to check the correctness and relevance of the pre-identified projects for each country. Firstly, this step has been necessary to validate the projects list and eliminate those no longer in the pipeline. Secondly, to identify other projects that did not emerge developing the screening exercise, but deemed relevant at country level. Thirdly, to enlarge the scope of the research also outside the TEN-T CNCs (i.e., comprehensive and national networks). Finally, to obtain and collect suitable documentation to present the projects in the frame of the designed fiche template.

The information obtained shows an heterogeneous picture. The coverage is relatively good concerning general and technical descriptions. The availability of details of the timeline for implementation depends on the level of maturity of the project. Demand analyses and forecasts are available for the majority of the projects. Where developed, the forecasts rely on modelling exercises, based on key socio-economic parameters. In general, the projections elaborated approximately extends to years 2025-2030.

The information about the financial and economic analyses is more limited. Some of the projects are free of charges for the final users and therefore the financial profitability analysis has not been developed. The financial sustainability analysis is reported in few cases. Also the information on the funding mechanisms is limited and only in some cases CEF grants or other IFIs involved are mentioned. Some projects did not yet completed the feasibility study. The content of the analyses of the environmental impacts varies case-by-case depending on the project and the national requirements.

All information utilised for project identification and included in the project fiches were derived from official documents and checked by the countries.

The **future transport projects identified are 23**, of which 13 for the road mode, 6 for the rail mode and 4 for the air transport sector. The majority derives from the list of the pre-identified ones (i.e., 15), whereas 8 are new emerged consulting the stakeholders. In general, the projects address a relatively broad scope of issues and regard existing bottlenecks, missing links, operational capacity and safety issues related to poor infrastructures technical standards or black spots.

During the consultation, 36 pre-identified projects were dropped from the initial list. Quite diverse motivations led to this decision: the project is non-revenue generating, the implementation has already started, the EIB or other IFIs or third countries are already involved, the project is financed through other funding sources (i.e., private, CEF grants of Cohesion Fund), insufficient or not disclosed information and the project is not a priority at country level.

It is worth remarking that a research for new air projects has been necessary. Firstly, to address the limited number of pre-identified projects addressing this mode. Secondly, to replace the projects dropped from the initial list consulting the stakeholders. In this respect, two specific aspects did emerge in the region. Firstly, airports managers could be less incline to consider loans to finance the projects being generally able to rely on own financial revenues. Secondly, the seasonality of summer demand for tourism purposes could make the projects less attractive opportunities.

The main findings about the identified future transport projects are described with respect to the key aspects deserving consideration and concerning (i) modal balance, (ii) geographical coverage and (iii) allocation within the transport network contexts.

The **modal balance** reflects some more interest towards road infrastructures, especially in the light of its dominant share and although it is forecasted in slight reduction in favour of the rail mode. Yet, it is worth remarking that the road projects also involve interventions envisaging the construction of new sections (e.g., missing links), while rail projects foresee only rehabilitation and modernisation measures to addressing current technical limitations. Similarly, air projects concern measures to improve operational capacity both on the air (i.e., runways and aprons) and land (i.e., terminal buildings) sides.

As said, there majority of the identified projects have been conceived to develop infrastructures already operating. This could be an advantage for future consideration, given: the lower degree of uncertainty of transport demand forecasts compared to totally new projects, the chance to rely on previous estimations of investment and management costs and likely a more limited environmental impact (e.g., absence or low land acquisition needs and no interference with Natura 2000 and other designated sites at national level).

The development of existing road sections has been proposed not only to address future demand volumes, but also to tackle low technical standards and states of degradation of the infrastructures, which in turn influence the safety levels. This is an aspect emerged for the projects of the A8 motorway in Germany, the A4 motorway in Austria and the M-14 road section in Moldova.

The projects of new road are localised on sections where demand forecasts suggest future intense volumes, and chiefly along strategic axes, or nearby urban agglomerations. This group includes the projects of the A5 motorway in Austria, the Lot 3.2 of the Struma motorway in Bulgaria and the bypasses of Belgrade, Podgorica and the two identified in Hungary.

Two road projects foresee the need of feasibility studies. The new motorway section Belgrade-Pancevo-Vrsac to Romanian border would be worth of investigation in view of completion of the road axis from the bypass of Belgrade (i.e., section C) towards Romania. The construction of the highway Odessa-Reni needs further consideration. Indeed, the project is a priority for Ukraine in the regional context, but currently based on not appropriately developed estimations of investment costs and lacks of demand analysis.

Amongst the six rail projects, four identified suggest some common interest of bordering countries. In this respect, Bulgaria planned interventions on two railway lines that are adjacent with the networks of Romania and Serbia. Specifically, (i) the modernisation of the line Ruse-Varna would be coherent with the rehabilitation of the line Bucharest North-Giurgiu and (ii) the modernisation of the line Volujak-Dragoman would be the continuation of the line Niš-Dimitrovgrad on the Serbian side.

The four air projects include the investment for the Vienna airport runways layout and a mix of improvements for (i) operational capacity on the air side (i.e., runway, taxiways and aprons), (ii) expansions of capacity on the land side to deal with forecasted demand volumes (i.e., terminal buildings) and (iii) modernisation of air navigation equipment for Tivat, Timosoara and four projects of Ukraine.

Despite the attempt to figure out potential linkages amongst modes, the intermodality aspect did not result prominently. A linkage with inland waterways did result for the river port of Ruse, potentially in connection with the modernisation of the adjacent railway lines Ruse-Varna and Bucharest North-Giungiu.

The **geographical coverage** of the projects in the region provide interesting insights. The road projects are localised with a relatively even distribution, but in Czech Republic and Slovakia and Western Romania. The projects in FRs embedding the Western Balkans countries are localised on Corridors Vc and X - recent extensions of the CNCs - where the most relevant flow patterns have been observed and forecasted.

The rail projects mostly concentrate in the FRs of the Western Balkans and Eastern EU Member States. This reflects the need of more interventions where the infrastructures still lack of appropriate technical standards and where rail transport demand would be expected to growth more significantly.

The localisation of air transport projects fits the current concentration of demand volumes (i.e., in the hub of Vienna) and the projected forecasts of the FRs of the Eastern part of the region (i.e., in Tivat, Timosoara and the four airports of the provinces of Ukraine).

With respect to the **transport network contexts**, the allocation of the projects is in line with the intensity of crossings of the TEN-T CNCs with the FRs. The projects of the EU Member States are localised on the Baltic-Adriatic, Mediterranean Orient/East-Med and Rhine-Danube CNCs. Not surprisingly, the Rhine-Alpine and Scandinavian-Mediterranean CNCs are more marginal in the region.

6 References

Accessibility Improved at Border Crossing for the Integration of South East Europe – ACROSSEE (2014), Ministerial and stakeholders recommendations, 31.12.2014, final.

Achtnicht M., Borell M., Gantert K., Kappler M., Müller B., Boockmann B., Klee G., Krumm R., Neugebauer K., Hunya G., Vidovic H., Römisch R. (2014), Socio-Economic Assessment of the Danube Region: State of the Region, Challenges and Strategy Development, Final Report Part I, Centre for European Economic Research GmbH (ZEW) Mannheim, Institute for Applied Economic Research (IAW) Tübingen, The Vienna Institute for International Economic Studies.

AECOM (2015), Romania General Transport Master Plan Revised Final Report on the Master Plan Short, Medium and Long Term, Report for the Government of Romania, Ministry of Transport, September 2014.

ASFINAG (2016), Statusbericht ausgewählte Projekte Technische Einvernehmens Herstellung IIP 2017-2022. Auszug.

ASFINAG (2017), project official website: http: www.asfinag.at.unterwegs.bauprojekte.niederoesterreich.

Brown L. A. and Holmes J. (1971), The Delimitation of Functional Regions, Nodal Regions, and Hierarchies by Functional Distance Approaches, Journal of Regional Science, Vol. 11, No. 1, 1971.

Busek E. and Gjoreska A. (2010), The Danube Region: transformation and emergence, Eastern Journal of European Studies, Volume 1, Issue 1, June 2010.

Capros P. (E3M-Lab), De Vita A., Tasios N., Siskos P., Kannovou M., Petropoulos A., Evangelopoulou S., Zampara M., Papadopoulos D., Nakos C. et al. (PRIMES model), Paroussos L., Fragiadakis K., Tsani S., Karkatsoulis et al. (GEM-E3), Fragkos P., Kouvaritakis N. et al. (Prometheous model and PRIMES gas), Höglund-Isaksoson L., Winiwater W., Purohit P. and Gomez-Sanabria A. (IIASA-GANIS model), Frank S., Forsell N., Gusti M., Havlik P. and Obersteiner M. (IIASA-GLOBIOM/G4M models) and Witzke H. P., Kesting M. (Eurocare) (2016), EU Reference Scenario 2016 Energy transport and GHG emissions – Trends to 2050. Publication prepared for the European Commission, the Directorate-General for Energy, the Directorate-General for Climate Action and the Directorate-General for Mobility and Transport.

Central Commission for the Navigation of the Rhine (2016), Inland navigation in Europe, Annual report 2016, Market Observation.

Central Commission for the Navigation of the Rhine (2016), Inland navigation in Europe, Annual report 2016, Market Observation.

Central Commission for the Navigation of the Rhine, European Commission, Panteia (2014), The Inland Navigation Market in 2013 and perspective for 2014/2015, Market Observation report nr.18.

CIP (2008), Belgrade bypass, Sector C, Conceptual Design, Feasibility Study and Traffic Study.

Club Feroviar (2013), Romania Railway Business Opportunities, Infrastructure Development - A Market Analysis.

Danube Commission (2015), Danube navigation statistics in 2013-2014, Budapest.

DORNIER Consulting and EGIS International (2016), Updated National Transport Strategy of Ukraine, Part 2 – Transport Sector Analysis, September 2016, project funded by the European Union.

Drobne S. and Bogataj M. (2012), Evaluating Functional Regions, Croatian Operational Research Review (CRORR), Vol. 3, 2012.

Ecorys (2011), Assessment of the Bulgarian General Transport Master Plan, Final Report for the European Commission, DG Regional Policy, Rotterdam, July 2011.

ESPON (2015a), TRACC Transport Accessibility at Regional/Local Scale and Patterns in Europe, Final Report, Volume 1, Programme partly financed by the European Regional Development Fund.

ESPON (2015b), TRACC Transport Accessibility at Regional/Local Scale and Patterns in Europe, Final Report, Volume 4, Programme partly financed by the European Regional Development Fund.

European Commission (2003), Regional Balkans Infrastructure Study, Final Report, July 2003.

European Commission (2004), Directive 2004/54/EC of the European Parliament and of the Council of 29 April 2004 on minimum safety requirements for tunnels in the Trans-European Road Network, Offical Journal of the European Union, 30.04.2004.

European Commission (2010), Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, European Union Strategy for the Danube Region, Brussels, 8.12.2010, COM(2010) 715 final.

European Commission (2011), Directive2011/92/EU of the European Parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on environment, Official Journal of European Union, 28.1.2012.

European Commission (2013), Regulation 1315/2013 of the European Parliament and of the Council of 11 December 2013 on Union Guidelines for the development of the trans-European transport network and repealing Decision No 661/2010/EU, Journal of the European Union, 20.12.2013.

European Commission (2014a), Baltic-Adriatic Core Network Corridor Study, Final report.

European Commission (2014b), Mediterranean Core Network Corridor Study, Final report.

European Commission (2014c), Orient/East-Med Core Network Corridor Study, Final report.

European Commission (2014d), Rhine-Danube Core Network Corridor Study, Final report

European Commission (2014e), Rhine-Alpine Core Network Corridor Study, Final report.

European Commission (2014f), Scandinavian-Mediterranean Core Network Corridor Study, Final report.

European Commission (2015) Connectivity Agenda, Co-financing of Investment Projects in the Western Balkans in 2015 (Vienna Summit).

European Commission (2016a) Connectivity Agenda, Co-financing of Investment Projects in the Western Balkans in 2016 (Paris Summit).

European Commission (2016b), Construction of the second tunnel tube for the Karawanks road tunnel on the cross-border section Austria-Slovenia, Connecting Europe Facility 2014-2020, Transport Calls for Proposal 2016.

Eurocontrol (2010), Eurocontrol Long-Term Forecast, Flight Movements 2010-2030.

European Parliament (2014), Regulation 231/2014 of the European Parliament and of the Council of 11 March 2014 establishing an Instrument for Pre-accession Assistance (IPA II), Official Journal of the European Union, 15 March 2014.

European Parliament (2014), Regulation 232/2014 of the European Parliament and of the Council of 11 March 2014 establishing a European Neighbourhood Instrument, Official Journal of the European Union, 15 March 2014.

Feldman O, Simmonds D. and Troll N. (undated), Creation of a System of Functional Areas for England and Wales and for Scotland.

Fox K. A. and Kumar T. K. (1965), The Functional Economic Area, Delineation and Implications for Economic Analysis and Policy, Papers of the Regional Science Association.

Framework Transport Strategy of Bosnia and Herzegovina (2016), Draft for submission, July 2016.

German Minister for Transport and Digital Infrastructures (BVWP) (2016), Projektinformationssystem (PRINS) zum Bundesverkehrswegeplan 2030. Project official webpage: http:..www.bvwp-projekte.de.strasse.A008-G010-BY.A008-G010-BY.html.

GETINSA (undated), Support to the Preparation of a Transport Sector Strategy for the Republic of Moldova, Main Report, I Present Situation Analysis of the Transport Sector in Moldova, Consulting services Financed under a World Bank executed Trust Fund.

Hochtief (2009), Chisinau Airport Draft Master Plan, December, 2009.

Hungarian Transport Administration (2013), National Transport Strategy, Strategic document, October 2013.

IATA (2008), Air Travel Demand, Measuring the responsiveness of air travel demand to changes in prices and incomes, IATA Economics Briefing No 9, April 2008.

International Civil Aviation Organisation (2016), Safety Report, 2016 Edition.

International Bank for Reconstruction and Development (2015), The Regional Balkans Infrastructure Study (REBIS) – Update Enhancing Regional Connectivity, Identifying Impediments and Priority Remedies Main Report, September 2015.

International Transport Forum (2015), a New Hinterland Rail Link for the Port of Koper, Review of Risks and Delivery Options, Case-Specific Policy Analysis.

ISPA-IGH (2006), Feasibility Study Motorway in Corridor Vc, Final Report, Sarajevo.

Karlsson C. and Olsson M. (2006), The identification of Functional Regions: theory, methods and applications, Annuals of Regional Science, 40, 1-18.

Kocks Consult GmbH, TransCare and Universinj Chisinau (2012), Support to the Government of Moldova for the Preparation of a Transport and Logistics Strategy, Technical Report – Traffic Forecast, The World Bank and Government of Moldova.

Louis Berger (2008), General Design of the Bar-Boljare motorway.

Michniak D. (2015), Main problems of transport infrastructure development in Slovakia and effects on regional development, Geographia Polonica.

Ministry of Economic Development of Montenegro (2008), Spatial Plan of Montenegro until 2020.

Ministry of Environmental and Spatial Planning, Republic Agency for Spatial Planning (2010), Spatial Plan of the Republic of Serbia 2010 – 2014 – 2020, abridged version, Belgrade, November 2010.

Ministry of Transport, Maritime Affairs and Infrastructure, IDOM and OTP (2014), Transport Development Strategy of the Republic of Croatia (2014-2030), October 2014.

Ministry of the Maritime Affairs, Transport and Infrastructure of Republic of Croatia (2012), Operational Programme Transport 2007-2013, Draft Working Document, April 2012.

Ministry of Transport, Maritime Affairs and Telecommunications of Montenegro (undated), Transport Development Strategy of Montenegro.

Ministry of Transport, Information Technology and Communications of Bulgaria (2010), Strategy for the Development of the Transport System of the Republic of Bulgaria until 2020, March 2010.

Ministry of Infrastructure of Slovenia[93] (2014), Transport Development Strategy in the Republic of Slovenia, Proposal, October 2014.

Ministry of Transport and Road Infrastructure of Moldova (2015), Financing proposals of road rehabilitation, Presentation.

Ministry of Transport and Road Infrastructure of Moldova (2016), Rehabilitation of the national road M14, section from Criva to Balti, Project Identification Form.

93 Ministrstvo za Infrastruckturo.

MonteCEP and CEP (2013), State Location Study "Airport Tivat" Sector 24, Adopted Plan, March 2013.

Nathan , URS and Universcons and Universinj (2009), MCC Moldova Roads Rehabilitation Program – Road M14, Final Feasibility Study and Preliminary Design Report, December 2009.

OECD (2002), Redefining Territories – The Functional Regions.

OECD (2013), Measuring regional economies in OECD countries, OECD Regions at a Glance 2013

OPD (2013), Transport Sector Strategies, 2nd Phase The Medium-Term Plan of Transport Infrastructure Development with a Long-Term Outlook Summary Document, Final version, report for the Ministry of Transport of the Czech Republic.

NCSIP (2016), Multi-Criteria Analysis of the Struma Motorway Lot 3.2.

NCSIP (2016), Struma Lot 3.2 EIA Development, Working Document, Revision 1, 3 February 2016.

Rietveld P. (2012), Barrier Effects of Borders: Implications for Border- Crossing Infrastructures, EJTIR 12(2), 150-166.

SEE (2011), "Natura 2000" Programme within the Danube river Network of Protected Areas - Danube Parks, Danube Delta Biosphere Reserve Authority Tulcea – Romania.

SEE (2013), South East Europe 2020, Jobs and Prosperity in a European Perspective, Regional Cooperation Council, November 2013.

SEETO (2005), Agreement on the establishment and operation of SEETO, Skopje 10 November 2005.

SEETO (2010), South-East Europe Core Regional Transport Network Development Plan 2011. Multi Annual Plan 2011 to 2015. Common problems – Sharing solutions.

SEETO (2011), SEETO Comprehensive Network Development Plan 2012. Multi Annual Plan 2012-2016. Common problems – Shared solutions.

SEETO (2012), SEETO Comprehensive Network Development Plan- Five Year Multi Annual Plan 2013. Common problems – Shared solutions.

SEETO (2013), SEETO Comprehensive Network Development Plan 2014. Multi Annual Plan 2014-2018. Common problems – Sharing solutions.

SEETO (2014), SEETO Comprehensive Network Development Plan. Five Year Multi Annual Plan 2015. Common problems – Sharing solutions.

SEETO (2015), Multi Annual Development Plan. Common problems – Shared solutions. Five Year Multi Annual Plan 2016.

SEETO (2016), Air Connectivity Study, December 2016, Vienna.

Snizek + Partner (2017), Karawanken Tunnel – Construction of a second tunnel tube, Cost-benefit analysis for the application of for EU funding, Vienna, January 2017, report prepared for DARS and ASFINAG.

TRT, Panteia Group, Dornier Consulting GmbH and Lutsk University (2015), Eastern Partnership regional transport study, Final report, June 2015, document prepared by the IDEA II project funded by the EU.

van de Riet O., de Jong G. and Walker W. (2008), Drivers of Freight Transport Demand and their Policy Implications.

Vienna International Airport (2013), a Gateway to the East, Airports Council International.

Wadud Z. (2014), Simultaneous modeling of passenger and cargo demand at an airport, Transportation Research Record, Journal of the Transportation Research Board, 2336, 63-74.

END OF THE DOCUMENT