Republic of Croatia
MINISTRY OF THE SEA, TRANSPORT AND INFRASTRUCTURE

Transport Development Strategy of the Republic of Croatia (2017 - 2030)

August, 2017

OPP operativni program promet

FONDOVI STRUKTURNI I INVESTICIJSKI

European Union
Investing in future

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ABBREVIATIONS

AGIN	European Agreement on Main Inland Waterways of International Importance
ARZ	Autocesta Rijeka-Zagreb d.d.
ATM	Air traffic management
GDP	Gross domestic product
CETC	Central European Transport Corridor
DPSIR	Driving forces, pressures, states, influences and responses
DZS	Croatian Bureau of Statistics
EASA	European Aviation Safety Agency
EAU	Ex-ante condition
EC	European Commission
ECAA	European Common Aviation Area
ERTMS	European Rail Traffic Management System
ESI	European Structural and Investment Funds
ETCS	European Train Control System
EU	European Union
EUSAIR	The European Union Strategy for the Adriatic-Ionian Region
EUSDR	The European Union Strategy for the Danube Region
GHG	Greenhouse gasses
GT	Gross tonnage
HAC	Hrvatske autoceste d.o.o.
HAC-ONC	Hrvatske autoceste održavanje i naplata cestarine d.o.o.
HC	Hrvatske ceste d.o.o.
HUKA	Croatian association of toll motorways concessonaires
HŽC	HŽ Cargo d.o.o. (Limited liability company for cargo transport)
HŽI	HŽ Infrastruktura d.o.o (Društvo s ograničenom odgovornošću za upravljanje, održavanje i izgradnju željezničke infrastrukture)
HŽPP	HŽ Putnički prijevoz d.o.o. (Limited liability company for public transport of passengers)
ICAO	International Civil Aviation Organization
IPA	Instrument for Pre-Accession Assistance
ISPA	Instrument for structural policy for pre-accession
ITS	Intelligent transport systems
JASPERS	Joint Assistance to support projects in European regions
PT	Public transport
KPI	Key performance indicators
LNG	Liquefied natural gas
MARPOL	International Convention for the Prevention of Pollution from Ships
MET	Education and training of seafarers
MSTI	Ministry of the Sea, Transport and Infrastructure

N/A	Not available
OG	Official Gazette
NTM	National traffic model
OPT	Operational program Traffic
POUM	Sustainable mobility plan
P&R	Park & Ride systems
PSC	Public service contract
RC	Republic of Croatia
RIS	River Information Services
RRT	Railway-road terminal
SAR	Search and rescue
SEETO	South East Europe Transport Observatory
SESAR	Single European Sky ATM Research
SPUO	Strategic Environmental Impact Assessment
SWOT	Strengths, weaknesses, opportunities, threats
TAC	Infrastructure Access Charge
TEN-T	Trans-European Transport Networks
TEU	Standard container load unit
Government of the Republic of Croatia	Croatian Government
VTMIS	Vessel Traffic Monitoring and Information System

Note:

In accordance with the methodology of the European Commission, the development of the Transport Strategy of the Republic of Croatia took place in three phases:

- The first phase is the preparation of the Transport Development Strategy of the Republic of Croatia for the period 2014-2030, which was adopted by the Government of the Republic of Croatia at its session on 30 October 30 2014 (Official Gazette no. 131/14)).

The adoption of the Republic of Croatia's transport development for the period 2014-2030 by the Government of the Republic of Croatia enabled the conditional use of funds from the Operational Program "Competitiveness and Cohesion".

- The second phase is the development of the National Traffic Model which was successfully completed in June 2016. The reference year for the analysis of the existing traffic sector situation in the National Traffic Model was 2013, since data were collected in 2014 and 2015, and the only year for which all data were then available was the year 2013.

- The third phase of the development of the Transport Strategy of the Republic of Croatia for the period from 2017 to 2030 includes the harmonization of the National Traffic Model and the first phase of the Transport Development Strategy of the Republic of Croatia for the period 2014-2030. Displays from the National Traffic Model in the Transport Development Strategy of the Republic of Croatia for the period from 2017 to 2030 show the situation based on the base model that is in 2013. For the purposes of creating graphs and tables that are not part of the display from the traffic model, the most recent data was used. Strategies represent a comprehensive national strategic document that contains a number of graphical displays and maps that serve the purposes of this document and which in no way prejudices the definition and designation of boundaries.

1. INTRODUCTION

1.1 INTRODUCTION AND CURRENT DEVELOPMENT OF THE NATIONAL TRANSPORT DEVELOPMENT STRATEGY

Republic of Croatia applied for membership in the European Union in March 2003, and officially became a candidate country for membership in June 2004. The accession negotiations between the European Union and the Republic of Croatia started in October 2005 and ended in June 2011.Republic of Croatia has signed the accession treaty with the European Union Member States on 9 December 2011. Since being granted the status of a candidate country in June 2004, the Republic of Croatia is a beneficiary of EU pre-accession funds that important for the transport sector, primarily the ISPA and IPA programs.The Croatian Parliament ratified the accession treaty in March 2012, and the Republic of Croatia became a member state of the European Union on 1 July 2013.

Regulation (EU) No. 1303/2013 of the European Parliament and of the Council of 17 December 2013 laying down common provisions on the European Regional Development Fund, the European Social Fund, the Cohesion Fund, the European Agricultural Fund for Rural Development and the European Maritime and Fisheries Fund and laying down general provisions on the European Regional Development Fund, the European Social Fund, the Cohesion Fund and the European Maritime and Fisheries Fund and repealing Council Regulation (EC) No. 1083/2006 prescribes the common provisions of European Structural and Investment Funds (ESI Funds) as prerequisites (so-called ex-ante conditions) for the programming period of the sectoral strategies for the period 2014-2020. Ex-ante traffic conditions are considered fulfilled when the following objectives have been achieved:

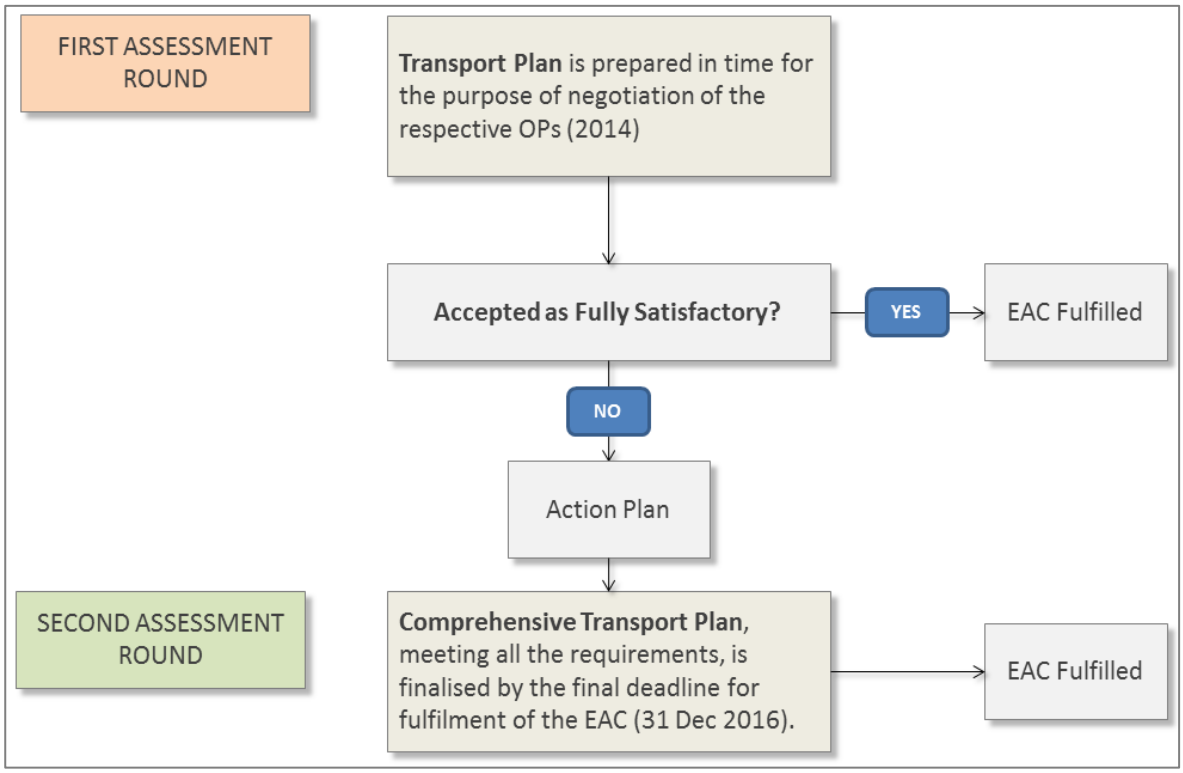
- The existence of a comprehensive traffic investment plan (national transport development strategy)
- The plan is in line with the Strategic Environmental Impact Study
- The traffic plan contributes to the single European transport area
- The existence of realistic and sufficiently mature projects for which the Cohesion Fund and the European Regional Development Fund support can be requestedThe development of measures that provide sufficient capacity for the bodies in the system and users of transport projects.

In its ex-ante conditions guidelines, the European Commission describes the way in which the fulfillment of these conditions is based on key processes and components.In case the ex-ante

conditions for the transport sector are not fulfilled, it is necessary to draw up an Activity Plan (Action Plan) containing the necessary actions to fulfill these conditions by the end of 2016 at the latest (in agreement with the European Commission the deadline has been extended).

The same may include cases where the national traffic development strategy is not satisfactory or when other ex-ante conditions have not been fulfilled.

Figure 1: Diagram of ex-ante conditions fulfillment



The development of transport infrastructure in the Republic of Croatia is considered to be extremely important for economic and social growth as well as for international connectivity. Transport infrastructure is an instrument of regional development that drives the exchange of goods and better accessibility to all economic, health, tourist and other amenities. The state administration body responsible for developing the Transport Development Strategy of the Republic of Croatia is the Ministry of the Sea, Transport and Infrastructure (hereinafter: MSTI). The MSTI has already undertaken actions to fulfill the ex-ante conditions by developing the Transport Development Strategy of the Republic of Croatia for the period 2014-2030, which was adopted by the Government of the Republic of Croatia at its session on 30 October 2014 (Official Gazette no. 131/14), hereinafter referred to as “Strategy (2014)”. The methodology used in developing this strategy is in line with European and JASPERS guidelines and recommendations (JASPERS-Joint Assistance to Support Projects in European Regions, www.jaspers-europa-info.org).

For the purpose of preparing the Strategy (2014), the MSTI has organized 6 sectoral working groups with the aim of developing concepts for sectoral strategies for rail, road and air transport, maritime and inland navigation, and for the first time in the Republic of Croatia, in terms of strategic planning of the national transport sector, the concept of sectoral strategy for the public urban, suburban and regional mobility sector has also been developed.

The result of this approach was the development of concepts of sectoral strategies for the above mentioned forms of traffic that were prepared in June 2013. The process of merging concepts of sectoral strategies into a unified national transport development strategy began in August 2013, taking into account the functional regional and sectoral approach. The functional regional approach implies the division of the territory of the Republic of Croatia into functional regions based on the demand for traffic and the real interactions of mobility, regardless of the boundaries of counties or state borders, and they can also overlap. The sectoral approach is an analysis of key aspects of transport, i.e. rail, road and air traffic, maritime and inland navigation, in terms of national and international mobility. Finally, the results of the functional regional approach analysis and sector analysis served as a basis for determining the multi-modal goals and measures for achieving these goals, which were established for each individual transport sector.

In September 2013, in parallel with the Strategy (2014) preparation process, the process of drafting a Strategic Environmental Impact Study was launched, with the aim of constant interaction and harmonization of both documents, which resulted in an environmental impact assessment of the objectives and measures of the Transport Development Strategy. The final proposals of the Transport Development Strategy of the Republic of Croatia for the period 2014-2030 and Strategic Environmental Impact Studies were prepared in June 2014. During the period from 26 June to 27 July 2014, the MSTIconducted a public debate with the interested public for both documents, and a public presentation was held on 1 July 2014.

The Ministry of Environmental Protection and Energy (then the Ministry of Environmental Protection and Nature) approved the Environmental Impact Assessment Procedure on 29 October 2014.

The process of adopting the national transport development strategy of the Republic of Croatia was completed on 30 October 2014, when the Government of the Republic of Croatia adopted the Transport Development Strategy of the Republic of Croatia for the period from 2014 to 2030, providing input data from the traffic domain for the preparation of program documents for the period 2014-2020, (Operational Program “Competitiveness and cohesion”).

The adoption of the Transport Development Strategy of the Republic of Croatia for the period 2014-2020 (Official Gazette no. 131/14) marked the completion of the first phase of the development of the Strategy. In accordance with the to the Activity Plan (Action Plan) for fully fulfilled ex-ante conditions, and due to the lack of traffic data and the absence of a national traffic model at the time of the adoption of the Transport Development Strategy (Official Gazette no. 131/14) by the Government of the Republic of Croatia, it had to be upgraded by implementing the second preparation phase.

This document represents the second phase of the development of the Transport Development Strategy of the Republic of Croatia for the period 2014-2030 and can be considered a complete national strategic document based on comprehensive traffic data and national traffic model, which means full fulfillment of ex-ante conditions in terms of comprehensive traffic plan for the transport sector.

1.2 OBJECTIVES OF THE TRANSPORT DEVELOPMENT STRATEGY OF THE REPUBLIC OF CROATIA

The Transport Development Strategy of the Republic of Croatia for the period 2017-2030, hereinafter “Strategy (2017)”, will evaluate and define future measures (infrastructure, work and organization) in the transport sector related to international and internal traffic in all transport segments, irrespective of the source of funding.

The Strategy (2017) will provide a framework for developing interventions and define interfaces with other strategies or assessments (Functional Regions Concept, major plans, sector strategies, etc.).

The Strategy (2017) will take into account European strategies and requirements (TEN-T, ERTMS, TSI, environmental protection, climate protection, etc.), and will be based on a comprehensive analysis of the state in Croatia (specific objectives for the Republic of Croatia).

The Strategy (2017) will identify the need for further data collection/generation and define the steps that need to be taken for a future audit of the Strategy.

1.3. REVISION OF THE STRATEGY (2014)

With the completion of the National Traffic Model for the Republic of Croatia (NPM - supported by OPP 2007 to 2013), additional data are available that enable the Transport Development Strategy of the Republic of Croatia (2014-2030), adopted by the Government in October 2014, to be updated. The Strategy (2017) will take into account the results of the above-mentioned documents or models

and the information obtained from the adopted feasibility studies and other sectoral strategies.Methodology for the development of the Strategy (2017)

1.4 METHODOLOGY OF STRATEGY (2017)

The Strategy (2017) is based on a detailed analysis of the transport sector, as well as the main drivers of transport development in the Republic of Croatia (main findings). Numerous hypotheses have been identified from previous estimates at the strategic level or project level, which, if confirmed by data or analysis, will be converted into major findings. If the hypotheses are not confirmed, they will either be discarded or remain hypothesized for further research.

The main findings have been converted into goals, which consequently leads to measures in the area of investments, labor and organization.

2. ANALYSIS

2.1 GENERAL ASPECTS OF TRANSPORT

2.1.1. HYPOTHESIS

In the last twenty years, there has been a steady population decline in the Republic of Croatia.

Source

Croatian Bureau of Statistics (Census 2011); Proposal of the Spatial Development Strategy of the Republic of Croatia (2017)

Key findings

- In the period between 1991 and 2001, the number of inhabitants of the Republic of Croatia decreased from 4.8 million to 4.4 million. Since 2001, it has been almost stagnant, with a slight decline to 4.2 million inhabitatnts in 2015.

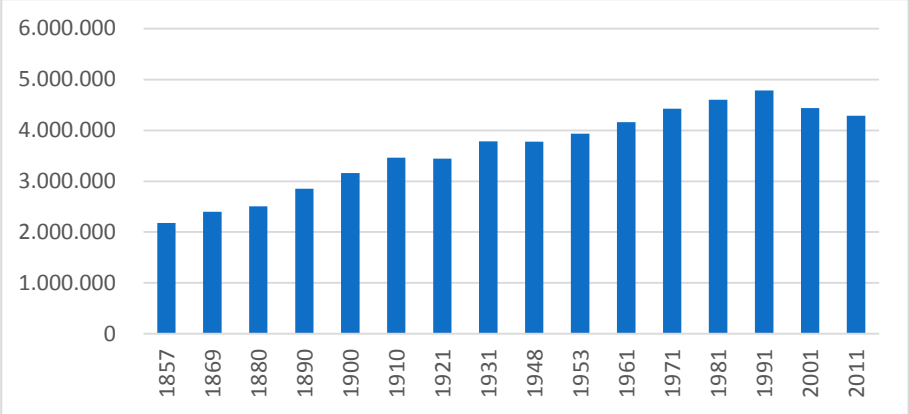
Note

The main determinants of population dynamics are population growth, natural population movement and migration, as well as the geographic mobility of the population.

Compared with the basic demographic indicators of other European Union countries, the Republic of Croatia recorded a negative population growth, a negative balance of net migration and a general decline in total population in the period between 2008 and 2011. Due to all the above negative

indicators, the Republic of Croatia is part of the group of only five European Union member states that had both a negative natural growth and a negative balance of migration in the period between 2008 and 2012. It can be concluded from this that not even a moderate increase in fertility would stop further decline of the population of the Republic of Croatia in the next few decades. According to the latest census of 2011, there were 4,284,889 inhabitants in the Republic of Croatia. This means that the number of inhabitants from the previous census of 2001 decreased by 152,571 (index 96.56).

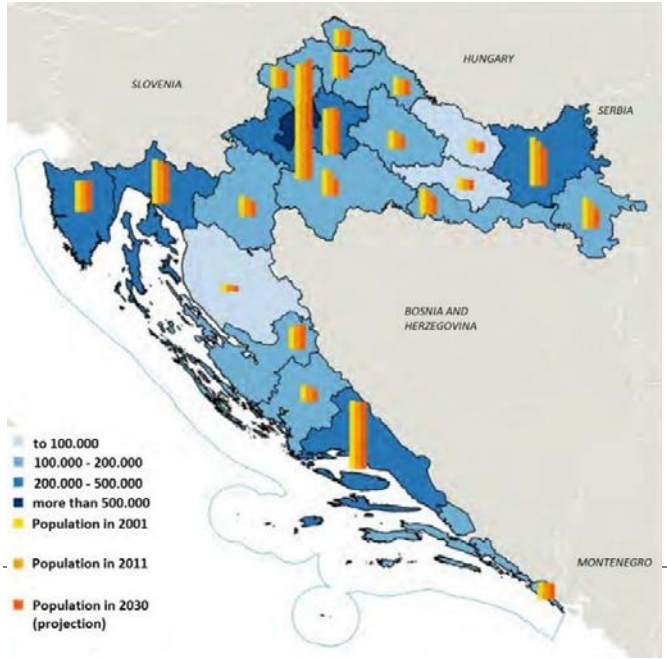
Figure 2: Population of the Republic of Croatia



Source: Croatian Bureau of Statistics

The birth rate in the Republic of Croatia has in the past few decades been so low that depopulation is inevitable even without emigration. The analysis of natural population trends in the Republic of Croatia for 2013 showed a negative natural growth of 10,447 persons, with 39,939 live births and 50,386 deaths. It is highly likely that the number of inhabitants of the Republic of Croatia will reduce to less than 4.000.000 by 2030.

Figure 3: Changes in the population in the period 2001 - 2011 and projections to 2030



Source: Spatial Development Strategy of the Republic of Croatia

It is very likely that these projections will be realized, and in an optimistic variant, the number of inhabitants will remain at the level of 2013, but only with substantial immigration, i.e. 350,000 more immigrants than emigrants in the same period, i.e. less positive net migration combined with a significant increase in fertility. However, both options are unlikely, and the population reduction is most likely.

Negative demographic prognoses directly affect the movement of mobility, i.e., the smaller the population is, the less need there is for mobility, so demographic forecasts need to be considered in the further development of the transport system.

2.1.2. HYPOTHESIS

Population trends in the Republic of Croatia differ according to the specificity of the region.

Source

Croatian Bureau of Statistics (Census of Population of 2011); Technical basis for the preparation of the Spatial Development Strategy, Faculty of Economics and Business, University of Zagreb (September 2014); National Traffic Model for the Republic of Croatia (NTM)

Key findings

- The analysis by counties shows that only four out of twenty-one counties have population growth: Zagrebačka County, City of Zagreb, Zadarska County and Istria County.
- The population in the Zagrebačka and Zadarska counties increased between 1998 and 2013 by more than 10%.
- The population in Ličko-senjska, Karlovačka, Sisačko-moslavačka, Bjelovarsko-bilogorska and Virovitičko-podravska counties decreased between 1998 and 2013 by more than 10%.

Note

Population analysis by counties shows that population growth has been recorded only in four out of twenty-one counties: Zadar County (index 104.92), Zagreb County (index: 102.55), City of Zagreb

(index: 101.40) and Istria County (index: 100.83). The largest decrease in population has been recorded in Vukovar-Srijem County (index 87.67).

In most counties, the number of inhabitants has decreased since 1998, with a prominent negative natural growth. In the period from 1998 to 2013, only seven counties recorded a positive sum of natural growth balance and net migration, all of them along the Adriatic coast, except the Primorje-Gorski Kotar County, City of Zagreb and Zagreb County. In relative terms, the Zagreb County and Zadar County recorded the highest population growth, more than 10% of the total population. General depopulation, or more than 10 percent decrease of population, is most prominent in the Lika-Senj, Karlovac, Bjelovar-Bilogora and Virovitica-Podravina County. These are also the most economically underdeveloped counties that have been experiencing a negative natural growth for several years.

Table 1: Population of the Republic of Croatia by counties

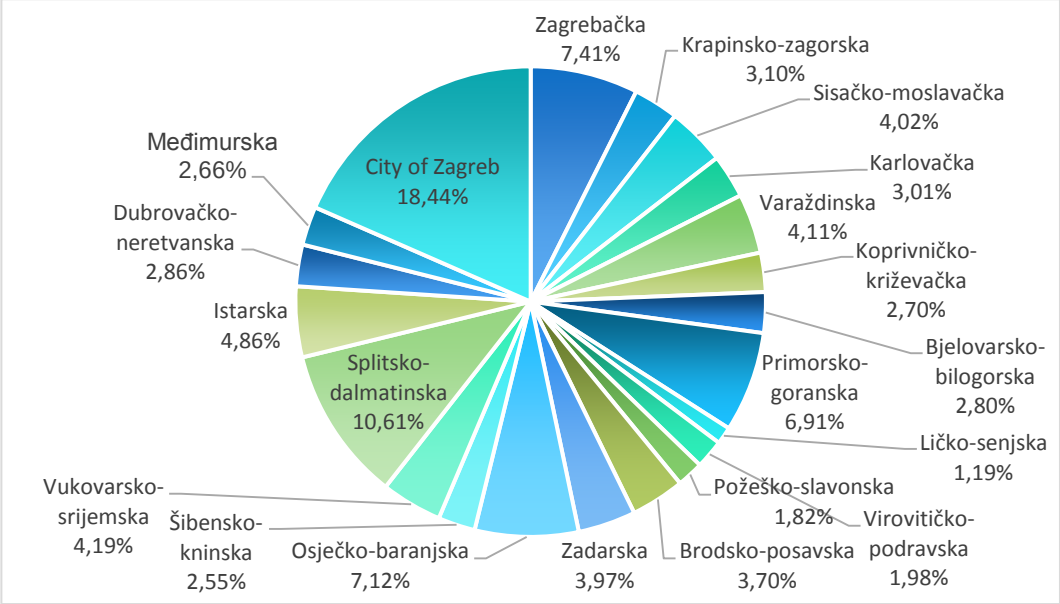
County	1971	1981	1991	2001	2011
Zagrebačka	232,836	259,429	282,989	309,696	317,606
Krapinsko-zagorska	161,247	153,567	148,779	142,432	132,892
Sisačko-moslavačka	258,643	255,292	251,332	185,387	172,439
Karlovačka	195,096	186,169	184,577	141,787	128,899
Varaždinska	184,380	187,495	187,853	184,769	175,951
Koprivničko-križevačka	138,994	133,790	129,397	124,467	115,584
Bjelovarsko-bilogorska	157,811	149,551	144,042	133,084	119,764
Primorsko-goranska	270,660	304,038	323,130	305,505	296,195
Ličko-senjska	106,433	90,836	85,135	53,677	50,927
Virovitičko-podravska	116,314	107,339	104,625	93,389	84,836
Požeško-slavonska	101,745	99,096	99,334	85,831	78,034
Brodsko-posavska	164,065	167,667	174,998	176,765	158,575
Zadarska	190,356	194,098	214,777	162,045	170,017
Osječko-baranjska	351,164	356,470	367,193	330,506	305,032
Šibensko-kninska	161,199	152,128	152,477	112,891	109,375
Vukovarsko-srijemska	217,115	223,919	231,241	204,768	179,521
Splitsko-dalmatinska	389,277	436,680	474,019	463,676	454,798
Istarska	175,199	188,332	204,346	206,344	208,055
Dubrovačko-neretvanska	108,131	115,683	126,329	122,870	122,568
Međimurska	115,660	116,825	119,866	118,426	113,804
City of Zagreb	629,896	723,065	777,826	779,145	790,017
Total	**4,426,221**	**4,601,469**	**4,784,265**	**4,437,460**	**4,284,889**

Source: Croatian Bureau of Statistics

The analysis of natural growth in the Republic of Croatia for 2013 showed a negative natural growth of 10,447 persons, with 39,939 live births and 50,386 deaths. No Croatian county had a

positive natural growth in that year. The Sisak-Moslavina County had the highest rate of negative natural growth (-1,116), followed by Osijek-Baranja County (-1,039) and Primorje-Gorski Kotar County (-1,018). The lowest rate of negative growth was recorded in Međimurje County (-26) and Dubrovnik-Neretva County (-62).

Figure 4: Population of the Republic of Croatia by counties



Source: Croatian Bureau of Statistics

In a number of counties, migrations have a greater impact on the number and structure of the population, than the difference between births and deaths do. Thus, the negative growth recorded in the Republic of Croatia in the period from 1998 to 2013 was almost neutralized by positive net migrations. In that period ten counties and the City of Zagreb achieved a positive balance of total migrations. Zagreb County and Zadar County dominated in this regard, where positive net migrations accounted for almost 15% of the total population in 1998. At the same time, due to the negative balance of total migrations, the Vukovar-Srijem County and Požega-Slavonia County lost about 5% of their population from the initial period.

Despite the negative growth, the Zagreb County, Istria County and Šibenik-Knin County, due to migration, have not recorded a total population decline.

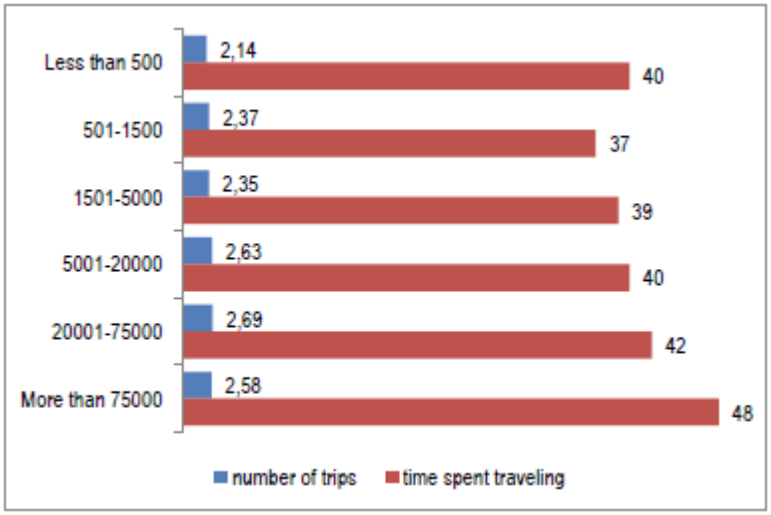
Zones of population growth in some counties are mainly a consequence of migration, which will continue to increase in the future, especially if there is a greater population growth in these parts.

An above-average share f immigration is visible in the City of Zagreb (46.7%) and the Zagreb County (40.8%), which have the largest share of immigrants in their population, and the lowest

share of immigrants is recorded in Međimurje County (12.9%), Krapina-Zagorje County (13.7%) and Varaždin County (14.8%).

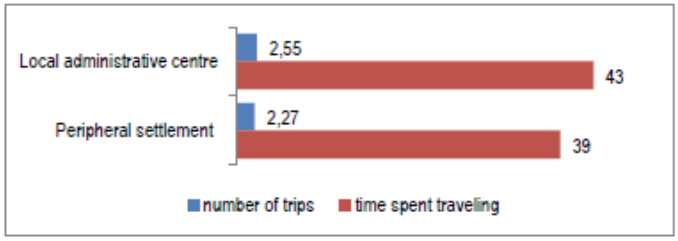
According to the results of general mobility from the National Traffic Model, the share of travel does not linearly follow the increase in the number of inhabitants. Specifically, towns with less than 500 inhabitants have had the lowest share of travel (2.1), followed by towns with between 501 and 5,000 inhabitants (about 2.4). In the three largest groups of towns (more than 5,000 inhabitants), the share of travel is similar (2.6-2.7), but travel time is the longest in the largest towns (48 minutes a day). In this category, towns differ according to their administrative role. As the name implies, local administrative centers are also local self-government seats, which often implies that they have better communal and social infrastructure compared to towns located on the periphery that have no administrative role. Respondents from local self-government centers on average travel more (2.55 vs. 2.27) and spend more time traveling (43 minutes vs. 39 minutes) than respondents from peripheral towns.

Figure 5: Travel share and travel time according to the size of the town (blue - number of trips, red - time spent on the road)



Souce: NPM

Figure 6: Travel share and travel time according to the size of the town (blue - number of trips, red - time spent on the road, the first graph refers to a local administrative center and the second to a peripheral town)



Souce: NPM

According to the census of 2011, the number of weekly passengers between two counties was below 1%, and is therefore not relevant for making traffic conclusions.

In conclusion, it can be said that if nothing is done to make life in counties more attractive with the decline in population, it is likely that the depopulation trend will continue.

2.1.3. HYPOTHESIS

The average age of the population is increasing.

Source

Proposal of the Spatial Development Strategy of the Republic of Croatia (2017)

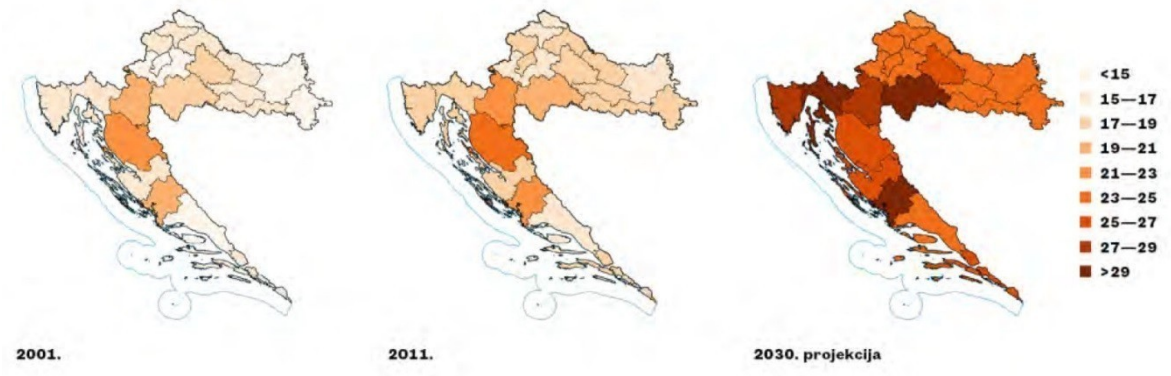
Key findings

- The average age of population increased from 39.3 in 2001 to 41.7 in 2011, and to 42.6 in 2015.
- The highest average age of citizens has been recorded, and still remains, in Lika-Senj County, Karlovac County and Šibenik-Knin County.

Note

The aging index, the ratio of the elderly population (65 years of age and more) and young population (0-14 years of age), is one of the best indicators of population aging, because it is the most sensitive to differences or changes in the age structure of the population.

Figure 7: Share of elderly population (65+) by counties (source: Proposal of the Spatial Development Strategy of the Republic of Croatia (2017))

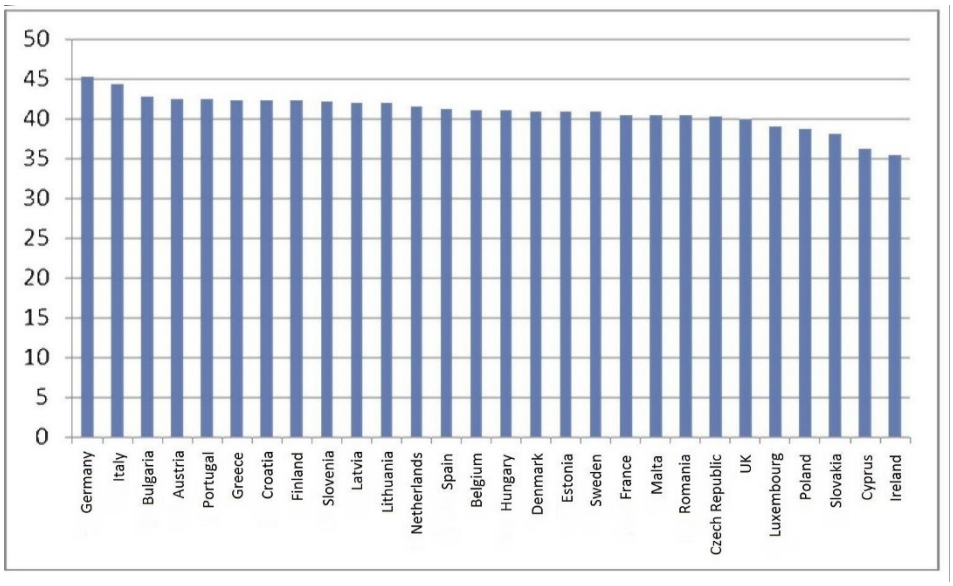


Source: Proposal of the Physical Development Strategy of the Republic of Croatia (2017)

Demographic aging of the population has been present in the Republic of Croatia for a long time, with a tendency to increase. The number of young people is decreasing, and the number of older people is increasing.

Longer life expectancy in the Republic of Croatia derives from the fact that in the period from 2001 to 2014, the number of the oldest population (80 years of age and more) has almost doubled, from 98,802 to 189,923.

Figure 8: Average population age in the European Union and Croatia in 2013

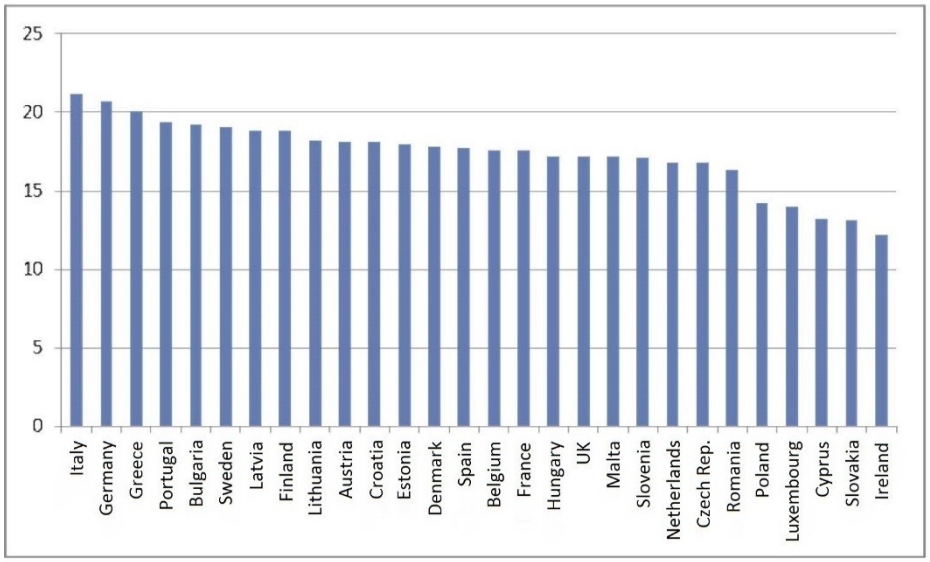


Source: Faculty of Economics and Business, University of Zagreb, "Technical basis for the preparation of the Spatial Development Strategy", September 2014

According to demographic aging indicators, the Croatian population is among the 10 to 15 oldest populations of the world.

According to the latest population census, the one from 2011, elderly population is living in Croatia, i.e. deeply old population with the aging index of 115,0%.

Figure 9: Share of population of 65 years of age and more in the European Union and Croatia in 2013 (%)



Source: Faculty of Economics and Business, University of Zagreb, "Technical basis for the preparation of the Spatial Development Strategy", September 2014

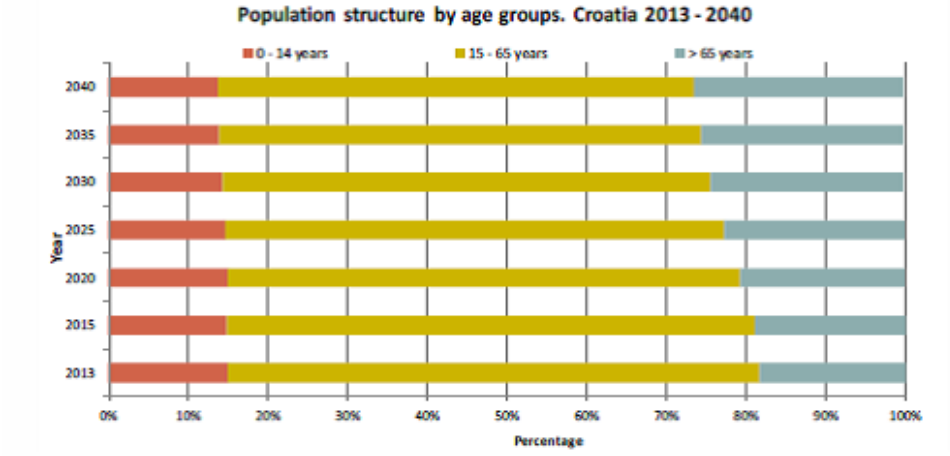
At the regional level, three Croatian counties have more than 20% of persons aged 65 and more in their population: Lika-Senj County, Karlovac County and Šibenik-Knin County. Međimurje County, Zagreb County and Split-Dalmatia County have the lowest share of the elderly in their population.

Primorje-Gorski Kotar County, Istria County and Karlovac County have the lowest numbers of children under 15 years of age in their total population. This is due to a lower fertility rate, migration of young people into larger cities and above-average age in these counties. Brod-Posavina County and Vukovar-Srijem County have the largest share of children in their total population, given that they have a higher fertility rate and shorter life span.

Accelerated aging of the population in the Republic of Croatia is indicated by the fact that, according to the census of 2001, most counties, 14 of them, had more young than elderly inhabitants. Only a decade later, according to the census of 2011, only the Zagreb County and Međimurje County had more young than elderly inhabitants in their population. On the other hand, Primorje-Gorski Kotar County, Šibenik-Knin County and Karlovac County had fifty and more percent of elderly than young persons in their population, especially the Lika-Senj County, with more than 80 percent of the elderly in their population.

According to EUROSTAT projections, in the period from 2013 to 2040, the average age of the population should increase by 2.4 years. Figure 10 describes population structure by age groups for the Republic of Croatia in the period from 2013 to 2040.

Figure 10: Projections of population structure by age groups - Republic of Croatia (red - 0-14 years of age, yellow - 15-65 years of age, blue - more than 65 years of age, x-axis shows percentage of population, and the y-axis shows the projection year



Source: EUROSTAT

According to demographic indicators, the growing population aging trend is reflected in the mobility and needs of the population, and there is a decline in the working population, and thus there is a smaller number of trips to and from the workplace, while the number of trips related to recreation, entertainment and health will increase.

2.1.4. HYPOTHESIS

Uneven economic development of certain regions.

Sources

Proposal of the Spatial Development Strategy of the Republic of Croatia (2017)

Key findings

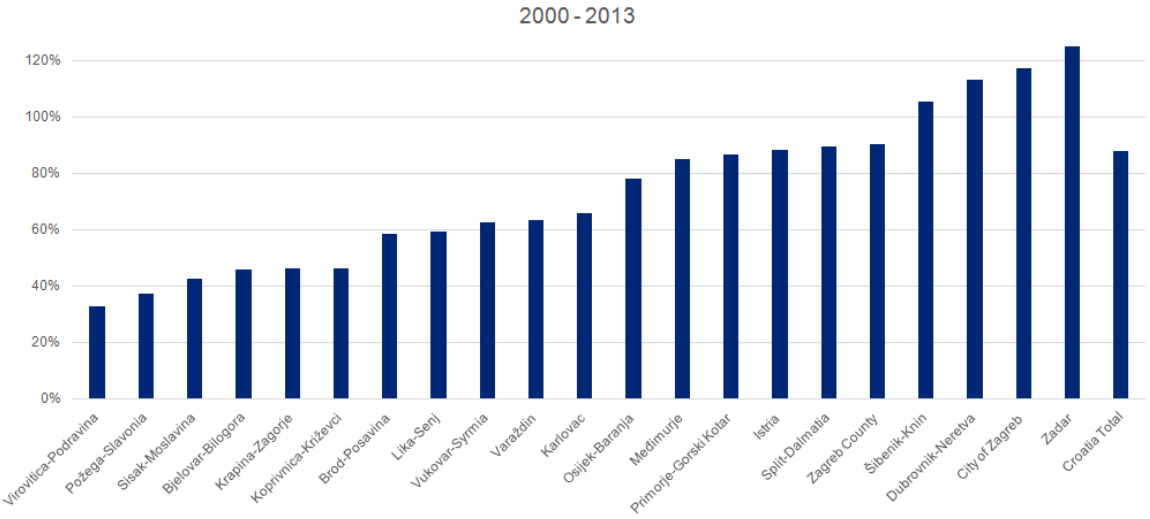
- The highest values of development indexes were recorded in the following counties: City of Zagreb (index higher than 180), Zagreb County, Primorje-Gorski Kotar County, Dubrovnik-Neretva County and Istria County (index value of 120–180).
- The lowest values of development indexes were recorded in Virovitica-Podravina County, Vukovar-Srijem County and Brod-Posavina County.
- The concentration of urbanization has led to uneven regional development and deepened the differences between urban and rural areas.
- Significantly weaker economic development of smaller regional centers resulted in the depopulation of large parts of the Republic of Croatia.

- The concentration of infrastructure for economic activities (traffic, energy, communication systems, utility services) and non-economic activities (education, health, science, culture, social protection and administration) also caused the concentration of the labor force with higher education.

Note

Population indices and demographic trends directly affect the regions' development indices. Northwestern Croatia has the highest regional development index and GDP, while the index in Slavonia and other regions in the interior parts of the country is significantly lower. Higher index values are recorded in Istria and other regions on the coast, thanks to tourism and with it related investments in development.

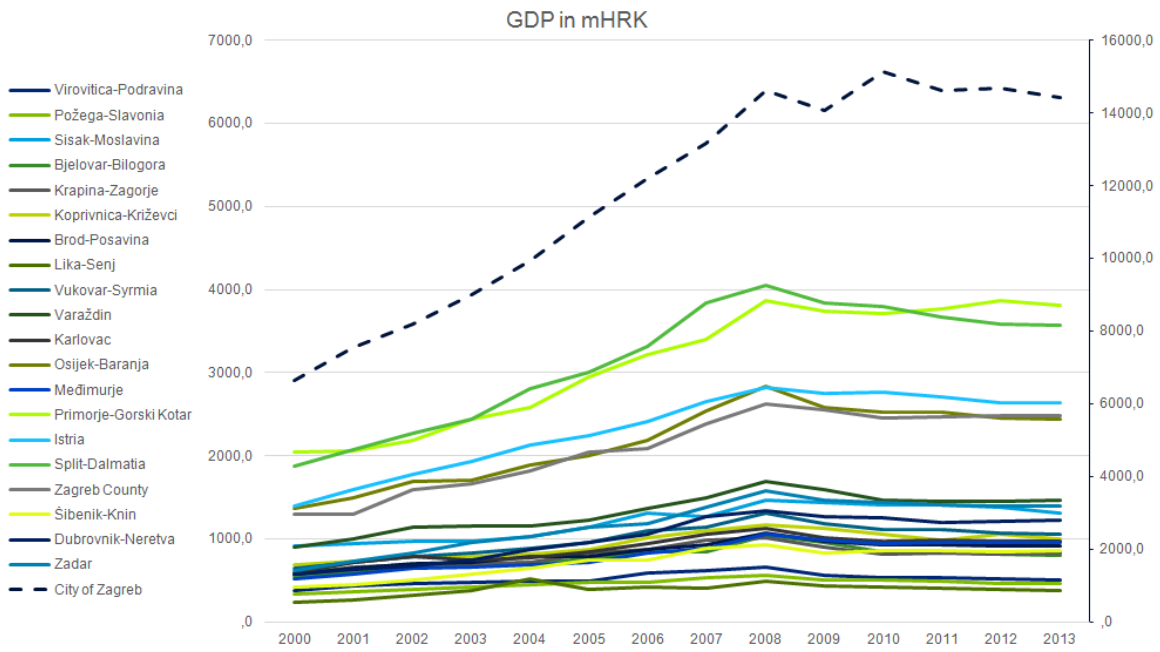
Figure 11: Counties in the Republic of Croatia according to GDP growth in the period from 2000 to 2013



Source: Croatian Bureau of Statistics

Figures 11 and 12 give an overview of the counties in the Republic of Croatia according to the GDP growth rate, i.e. the GDP expressed in amounts (HRK million) in the period from 2000 to 2013. There is a large gap between the fastest growing counties, such as the coastal parts of the counties in Dalmatia and the City of Zagreb and the poorest ones in the interior of the Republic of Croatia: Virovitica-Podravina County, Požega-Slavonia County and Sisak-Moslavina County.

Figure 12: Counties in the Republic of Croatia according to the level of GDP in millions of EUR GDP, mHRK



Source: Croatian Bureau of Statistics

The uneven economic development is a consequence of the different state of the economy in the continental and coastal parts of the Republic of Croatia in relation to the City of Zagreb. The former have been significantly affected by depopulation, poor job supply, and the absence of a positive migration balance. The coastal part of the country records tourist growth year after year, and great resources are also being invested to increase the duration of the tourist season. The population density of 78 inhabitants per square kilometer is quite below the average of 27 European Union countries, which is about 115 inhabitants per square kilometer. Northwestern Croatia is the most populous part of the country with the population density of 191 inhabitants per square kilometer. Regions with not so favorable demographic trends record a much weaker development.

2.1.5. HYPOTHESIS

The availability of cars in Croatia is increasing.

Source

EUROSTAT; National Traffic Model for the Republic of Croatia (NTM)

Key findings

- The number of cars per 1,000 inhabitants has been increasing for the past several years. The number increased from 160 cars per 1,000 inhabitants in 1991 to over 275 cars per 1,000

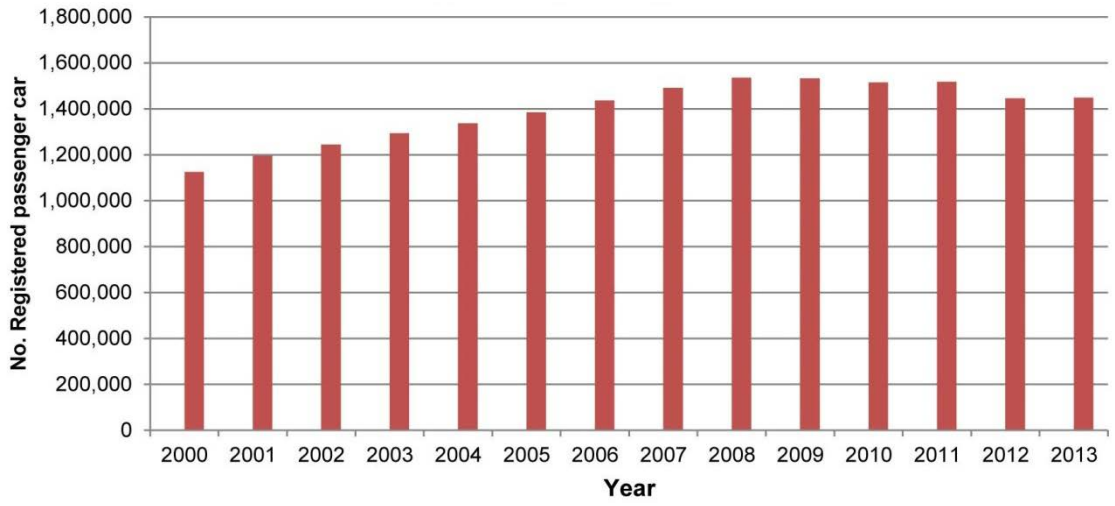
inhabitants in 2001, up to 360 cars in 2008. More recently, as of 2008, there has been a slight decrease in the motorization rate as a result of the global economic crisis (for example, in 2012, there was a decrease to 339 cars per 1,000 inhabitants), and in 2015 there was a total of 381 cars per 1,000 inhabitants.

- The counties with a higher motorization rate (2015) are Istarska (487 cars/1,000 inhabitants), Primorsko-goranska (430 cars per 1,000 inhabitants) and Dubrovačko-neretvanska with 391 cars per 1,000 inhabitants. The counties with a lower motorization rate are Vukovarsko-srijemska (275 cars per 1,000 inhabitants), Osječko-baranjska (291 cars per 1,000 inhabitants), Brodsko-posavska (283 cars/1,000 inhabitants and Virovitičko-podravska (302 cars per 1,000 inhabitants).
- Over the last decade, the number of personal cars in Croatia increased from about 1.2 million in 2001 to 1.535 million in 2008, when the trend was reversed resulting in 1.45 million personal cars in 2013.
- The Zagrebačka County had a motorization rate of 359 cars per 1,000 inhabitants in 2011., and the City of Zagreb had a motorization rate of 408 cars per 1,000 inhabitants in 2011.

Note

Generally the same as in Europe, the motorization rate has had an important growth due to the increase of the purchase power of the families and the change in life styles of the population (e.g. tendency to move to the suburban areas of the main cities), which is linked to an increase in the daily mobility needs of the population. the lasest global economic crisis has led to a slight slowdown in the growth of the motorization rate, but the numbers from 2014 show again an positive tendency. Cars have been de-registered during the economic crises; and used car import from other European countries is significantly growing during the recent years.

Figure 13: Movement of the number of registered passenger cars in the Republic of Croatia (x-axis shows the years in which the movement was monitored, and y-axis the number of registered passenger cars)

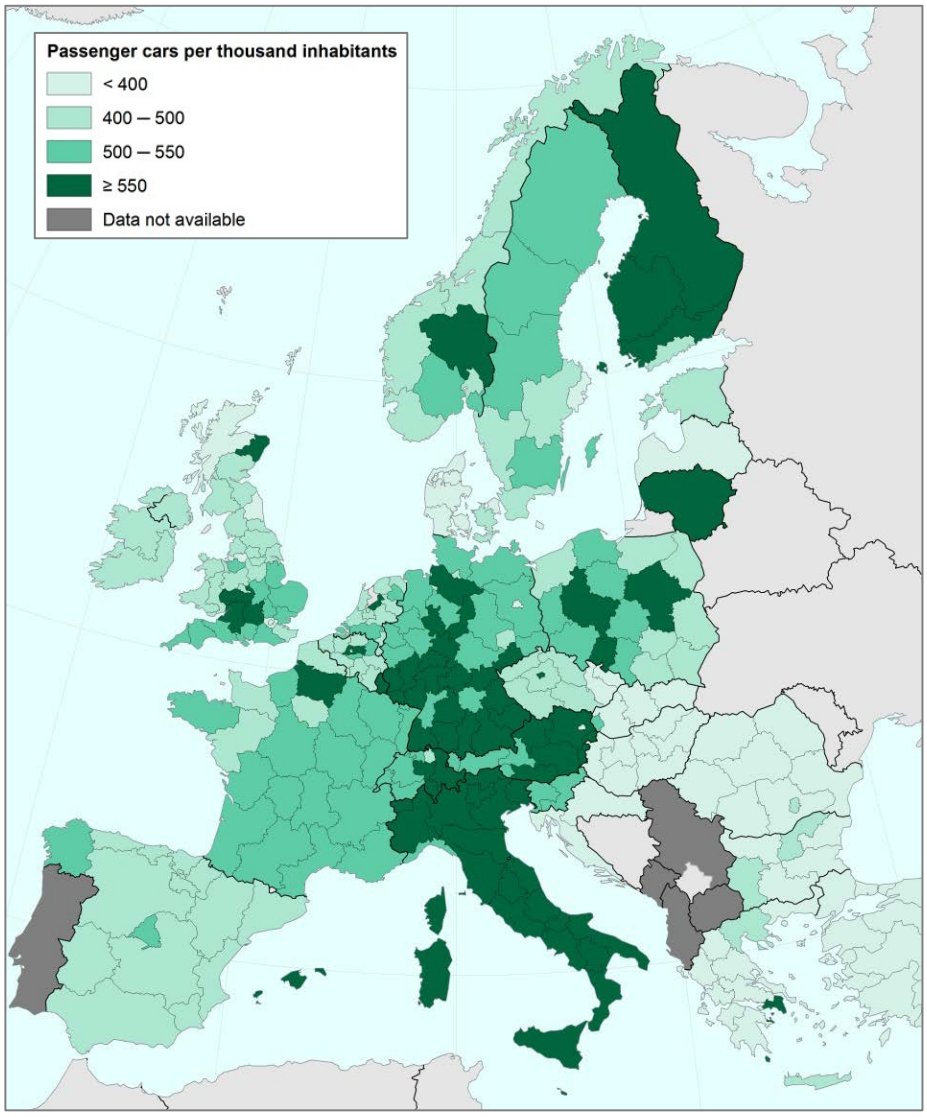


Source: NTM

Over the last decade, the number of personal cars in Croatia increased from about 1.2 million in 2001 to 1.535 million in 2008, when the trend was reversed, and the number of personal cars fell to 1.45 million in 2013. In spite of that fact, car ownership increased from 275 in 2001 to 354 in 2011, an increase of 31.2% over that period. Still, it is below the average motorization rate in Europe where – according to EUROSTAT– the average rate in EU-28 was 490 in 2013.

The following figure shows passenger cars per thousand inhabitants in EU-28 countries by NUTS2 region. As established before, the average car ownership for Republic of Croatia amounts to < 400 pc/1,000 inhabitants, currently below the European average.

Figure 14: Number of passenger cars per thousand inhabitants by NUTS2 region. 2013

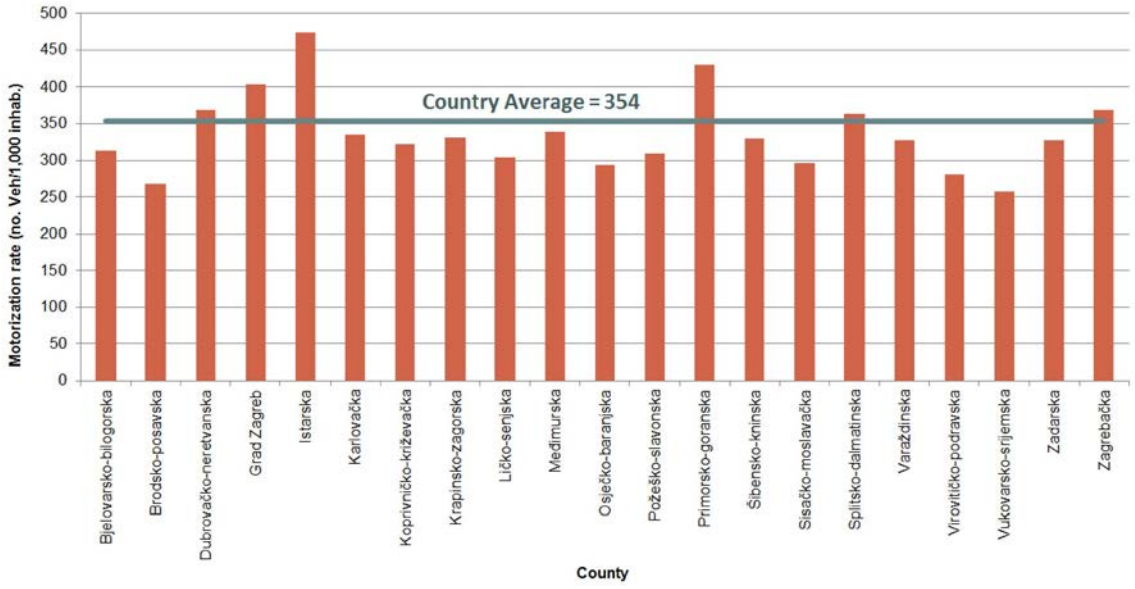


Source: EUROSTAT

The counties with a higher index value of development have generally higher motorization rates, being the City of Zagreb and Zagrebačka County.

According to the NTM, the following figure shows the motorization rate along the Croatian counties. The Istarska and Primorsko-goranska counties as well as the City of Zagreb account for the highest values of car ownership rate, which not surprising as higher levels of motorization are usually found in regions that are adjacent to those in which capital or larger cities are situated. This suggests that these regions are characterised by large numbers of people commuting to work.

Figure 15: Motorisation rate at County level. 2011 (the average of the state is 354, on the x-axis are shown counties, and on the y-axis the rate of motorization per thousand inhabitants)



Source: NTM

2.1.6. HYPOTHESIS

The traffic numbers in the Republic of Croatia are much higher during the touristic season, especially along the Adriatic coastline.

Source

National Traffic Model for the Republic of Croatia (NTM); Tourism in numbers (2015)

Key findings

- The traffic volumes along the main touristic routes double during the tourist season compared with the off-season period.
- The number of people and tourists during the tourist season and the off-season is increasing by factor 1.5.
- In the areas with a high number of tourists, it is necessary to plan a completely different transport system for the summer season, with season-specific solutions.

Note

The Republic of Croatia is largely oriented towards tourism. As a whole, the share of tourism in the economy of the Republic of Croatia was above 18 percent in 2015. More than 92 percent of total accommodation capacities is located in the Adriatic region. More than a quarter of total accommodation capacities is located on the Istrian peninsula.

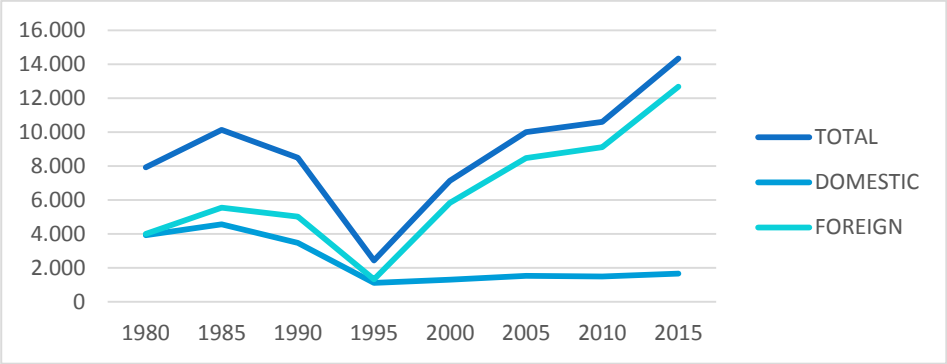
Table 2: Accommodation capacities in the Republic of Croatia in 2015

County	Number of beds in 2015
Zagreb	1,595
Krapina - Zagorje	2,396
Sisak - Moslavina	992
Karlovac	6,941
Varaždin	2,367
Koprivnica - Križevci	591
Bjelovar - Bilogora	749
Primorje - Gorski Kotar	180,988
Lika - Senj	37,925
Virovitica - Podravina	578
Požega - Slavonija	407
Brod - Posavina	800
Zadar	137,261
Osijek - Baranja	2,034
Šibenik - Knin	79,215
Vukovar - Srijem	1,312
Split - Dalmatia	213,803
Istria	266,491
Dubrovnik - Neretva	76,684
Međimurje	1,464
City of Zagreb	14,719
TOTAL	**1,029,312**

Source: Tourism in numbers, 2015

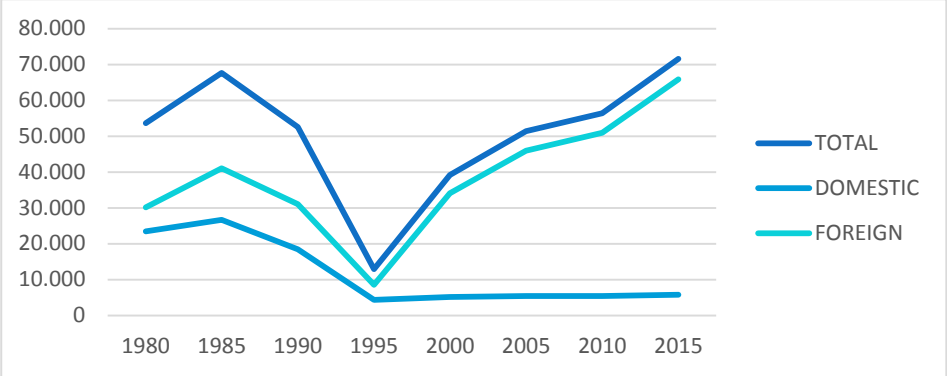
Looking at the total number of tourist visitors, the Republic of Croatia has more and more foreign tourists every year, while the number of domestic tourists stagnates. According to official statistical data of the Ministry of Tourism, in 2015, the Republic of Croatia was visited by more than 14.3 million tourists, out of which 12.6 million were foreign, and 1.6 million were domestic tourists. In the same year, fewer than 66 million overnight stays of foreign tourists were recorded, which averaged 5.2 overnight stays per guest, while domestic tourists accounted for 5.7 million overnight stays, on average 3.5 overnight stays per guest.

Figure 16: Tourist arrivals



Source: Tourism in numbers 2015

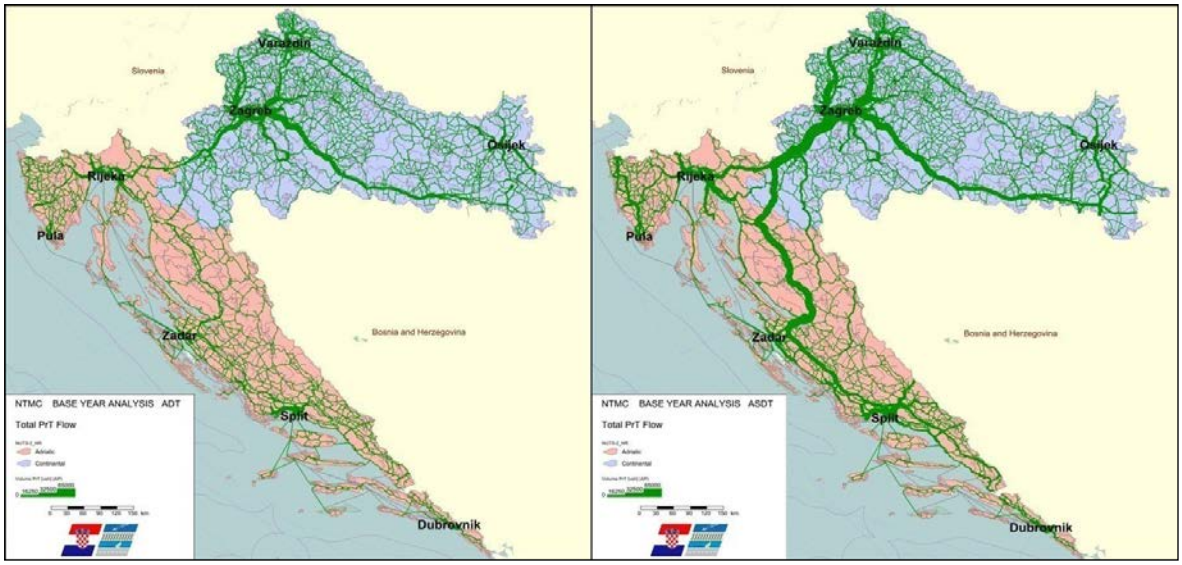
Figure 17: Overnight stays



Source: Tourism in numbers, 2015

Two models were developed within the National Traffic Model of the Republic of Croatia, one for average daily traffic (PDP), covering the off-season period, and one for the average summer daily traffic (PLDP). By comparing these two models, it can be concluded that, at the state level, during the season, the total demand is 20 percent higher than off-season demand. Given that during the main season educational institutions are not working and that more than 92 percent of the total accommodation capacities are placed in the Adriatic region, the demand in the Adriatic region during the main season is 3.1 times higher than in the off-season. Demand during the season represents about twice the traffic demand on major tourist routes, especially highways leading to the Adriatic coast and main roads in the Adriatic region.

Figure 18: Road traffic - average daily traffic for the entire year (PDP) and during the season (PLDP) (the blue marks the continental region, the pink marks the Adriatic region and the green marks the volume of daily traffic on particular roads)



Source: NPM

2.1.7. HYPOTHESIS

The average age of private cars is increasing.

Source

Centre for vehicles in Croatia; National Traffic Model for the Republic of Croatia (NTM)

Key findings

- The average age of passenger cars in the Republic of Croatia increased from 10.47 years of age in 2010 to 12.52 years of age in 2015.

Note

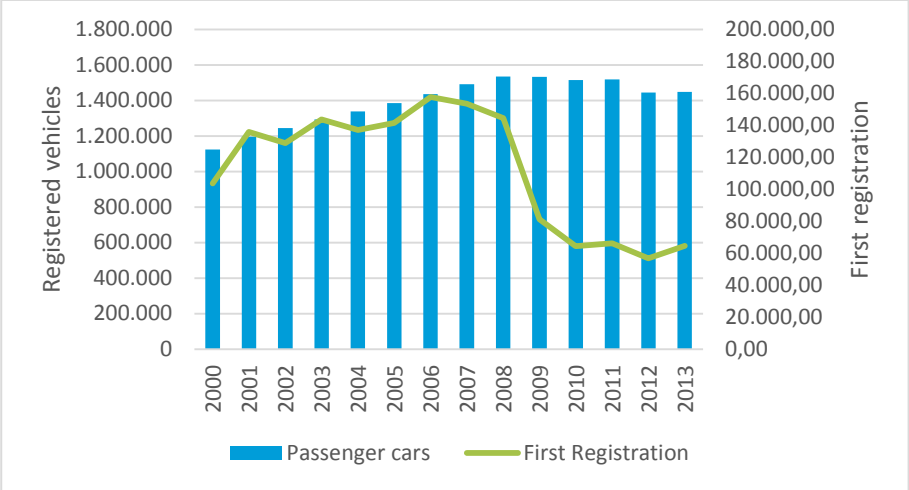
More recently, as a result of the global economic crisis, there has been a change in the rate of motorization, which is currently declining. This is partially due to the fact that no new vehicles were purchased during the economic crisis, and partially due to the fact that the import of used cars to the Republic of Croatia increased.

Table 3: The average age of passenger cars

Year	Average age
2010	10.47
2011	10.87
2012	11.38
2013	11.80
2014	12.14
2015	12.52

Source: Croatian Vehicle Center

Figure 19: Passenger cars – first registration



Source: NTM

The graph in Figure 19 shows the difference between the number of registered vehicles and first-time registered vehicles, suggesting that the number of first-time registered vehicles has considerably decreased in the last ten years, compared to the total number of registered vehicles.

Following the Republic of Croatia's accession to the European Union, the trend of importing used vehicles from European Union countries, whose average age is ten years, emerged.

2.1.8. HYOPOTHESIS

Better harmonization of spatial development and the Transport Development Strategy offers a great opportunity to reduce the impact of traffic on the environment.

Source

Proposal of the Spatial Development Strategy of the Republic of Croatia (2017), Transport Development Strategy of the Republic of Croatia for the period 2014-2030 and the National

framework of policy for the establishment of infrastructure and development of alternative fuels market in transport (2017).

Key findings

- Spatial Development Strategy of the Republic of Croatia – final proposal has been prepared in 2015, by the Ministry of Construction and Physical Planning. Following the completion of the public debate, it was adopted by the Government of the Republic of Croatia and is currently in the parliamentary procedure.
- The draft of the Proposal of the Spatial Development Strategy of the Republic of Croatia (2017) was accepted by the Government of the Republic of Croatia in April 2017.
- The Transport Development Strategy of the Republic of Croatia for the period 2014-2030 was prepared in June 2014, by the then existing Ministry of the Sea, Transport and Infrastructure.
- The goals, objectives and measures set out in the Spatial Development Strategy of the Republic of Croatia and the Transport Development Strategy of the Republic of Croatia for the period 2014-2030 are the starting point for spatial planning of smaller spatial units, i.e. the development of master plans for functional regions and "new generation" spatial plans. The national policy framework for the establishment of infrastructure and the development of alternative fuels markets has defined the main objective of establishing infrastructure for alternative fuels for the development of a sustainable transport system, with minimal negative environmental and social impacts, and ensuring interoperability with neighboring countries and member states of the European Union.

Note

Compatibility and coherence in the process of making strategic decisions is a fundamental and important tool for achieving general and specific goals, such as sustainable development, environmental protection and the development of transport infrastructure in the Republic of Croatia and its regions.It is therefore extremely important to consider all of the above strategic documents when defining sectoral action plans as a contribution to consistent and coordinated national development.

The Physical Development Strategy adopted by the Government of the Republic of Croatia in April 2017 is the foundation of the future development of planning, protection and spatial planning systems, and is based on:

- the values of Croatian space deriving from the mosaic of spatial basis and spatial identity determined on the basis of natural, cultural, landscape and social values and the culture of building, editing and shaping space;
- international context, first of all on the one accepted by the Republic of Croatia in the pre-accession period together with the status of the 28th member state of the European Union.

Spatial planning in the Republic of Croatia is carried out in accordance with the laws and regulations, strategic documents and spatial plans of the national, regional and local level, applying the principles of vertical and horizontal coordination and harmonization.

The Spatial Development Strategy of the Republic of Croatia is the fundamental state document for the direction of spatial development, and spatial plans, sector strategies, plans and other development documents of certain economic and administrative areas and activities can not be in contrast with it.

Physical plans are adopted at national, regional and local levels. Spatial plans of the national level are the following: State Spatial Development Plan, The ZERP Spatial Plan, Spatial Plan of the Epicontinental Belt of the Republic of Croatia, spatial plan of areas with specific characteristics and urban planning plan of state importance. Spatial plans of the regional level are the following: County Spatial Plan, Spatial Plan of the City of Zagreb and urban planning plan of county importance. Spatial plans of the local level are the following: city spatial planning plan, i.e. municipality, general urban planning plan and urban planning plan. All units of local and regional self-government have adopted spatial plans of counties, cities and municipalities.

The Transport Development Strategy of the Republic of Croatia for the period 2014-2030 was prepared in June 2014 with the following main guideline: strategic planning as the basis of the development of the transport sector was defined as a tool in the service of higher goals of economic and social policy. As a result, in regards to strategic planning, traffic is regarded as a basic system that will meet the needs of Croatian citizens in terms of mobility, and that is, at the same time, an effective and significant means of promoting economic development, social and territorial cohesion, guaranteeing the greatest benefit in the service of society.

These are two strategies that were developed at different times for the adoption of the Final Proposal of the Spatial Development Strategy of the Republic of Croatia in the Croatian Parliament and the revision of the Transport Development Strategy of the Republic of Croatia for the period 2014-2030, and it is therefore necessary to harmonize them by linking the main goals.

Spatial planning in the Republic of Croatia is based on the Spatial Planning Act defining the system of spatial planning and hierarchy of spatial plans of the national, county and local levels.

It is necessary to harmonize the strategies at the state and regional level as a contribution to the sustainable development of the country as a whole, as well as each of its regions. The goals, objectives and measures set out in the proposal of the new Spatial Development Strategy of the Republic of Croatia and the Transport Development Strategy of the Republic of Croatia for the period 2014-2030 are the basis for planning spatial planning of smaller spatial units, i.e. making master plans for functional regions and a new generation of spatial plans. All spatial and master plans should be designed in accordance with the possibilities of their realization and implementation.

The master plans of functional regions should define measures for the reduction of major regional development differences and identify ways to strengthen the development potential of regions, increase competitiveness of the entire country, while simultaneously recognizing the existing and future needs. Therefore, for a consistent and coordinated preparation of sectoral plans, it is extremely important to take into account all strategic documents.

It can be concluded from this that in the process of making spatial plans at all levels, it is necessary to consider the elements defined as desirable by the national strategy.

The national policy framework for the establishment of infrastructure and the development of alternative fuels markets, the Decision on the adoption of which was adopted by the Government of the Republic of Croatia at its session on 6 April 2017, on the basis of the Act on Establishment of Alternative Fuels Infrastructure (Official Gazette no. 120/16) and the Directive no. 2014/94/EU of the European Parliament and of the Council of 22 October 2014 on the deployment of alternative fuels infrastructure (OJ L 307, 28 October 2014), define the goals of establishing infrastructure for alternative fuels. The purpose of the National Policy Framework is to define and develop national goals and measures for the establishment of infrastructure and development of alternative fuels markets in transport. The main objective of establishing alternative fuels infrastructure is the development of a sustainable transport system, with minimal negative environmental and social impacts, and ensuring interoperability with neighboring countries and member states of the European Union.

Reducing the negative environmental impacts of traffic, among other things, will be defined by the measures needed to achieve national goals (in the context of construction of infrastructure for the use of electricity, liquefied and compressed natural gas, hydrogen, liquefied petroleum gas and biofuels in transport), and the measures will periodically be revised within the framework of the National Policy Framework for the establishment of infrastructure and the development of alternative fuels market in transport.

The Horizon 2020 Framework Programme, which was established by Regulation (EU) no. 1291/2013 of the European Parliament and of the Council provides for the provision of support to research and innovation related to alternative fuels vehicles and related infrastructure, in particular within the social challenge of "Smart, Green and Integrated Transport".

Electricity can increase the energy efficiency of road vehicles and contribute to reducing CO2 in traffic. It is a source of energy necessary for the introduction of electric vehicles, including category L vehicles, as specified in Directive 2007/46 / EC of the European Parliament and of the Council and in Regulation (EU) No. 168/2013 of the European Parliament and of the Council, which can contribute to improvement of air quality and reduction of noise in urban/suburban aglomerations and densly inhabited areas.

Such an approach has a great potential to achieve the ultimate goals that can contribute to the economic development of the Republic of Croatia in accordance with the principles of sustainable development (reduction of the environmental impact caused by traffic development).

2.1.9. HYPOTHESIS

The Republic of Croatia consists of 6 functional regions, which reflect the majority of daily commuting trips.

Source

National Traffic Model for the Republic of Croatia (NTM)

Key findings

- Six functional regions, with 2 of them having a functional sub-region, the Varaždin area inside Central-Croatia FR and Istria inside North-Adriatic FR

Note

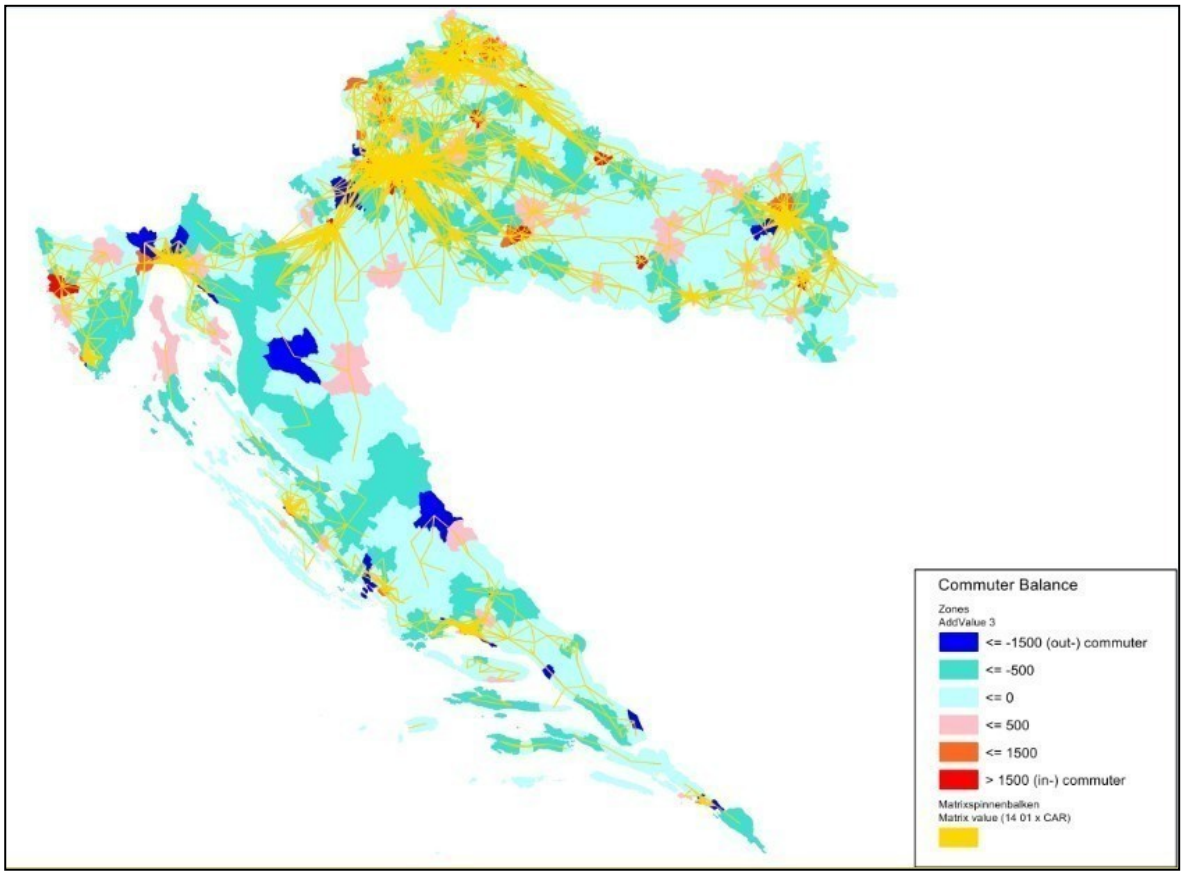
Functional regions are areas with a high frequency of internal regional interaction. The concept of functional regions is used worldwide to understand and define functionally connected areas that need to administer the transport system across administrative borders, (but they cannot be considered as constant in the spatial sense, and need to be constantly monitored and adapted.). The most common approach to define functional regions is analizing data about population commuting

to work and school because daily migracions can serve as quality base for staging other types of interaction.

Analysing desire lines for daily commuting (figure 20), the following 6 functional regions have been defined:

- Central-Croatia
- Eastern-Croatia
- Northern-Adriatic
- Northern-Dalmatia
- Central-Dalmatia
- Southern-Dalmatia

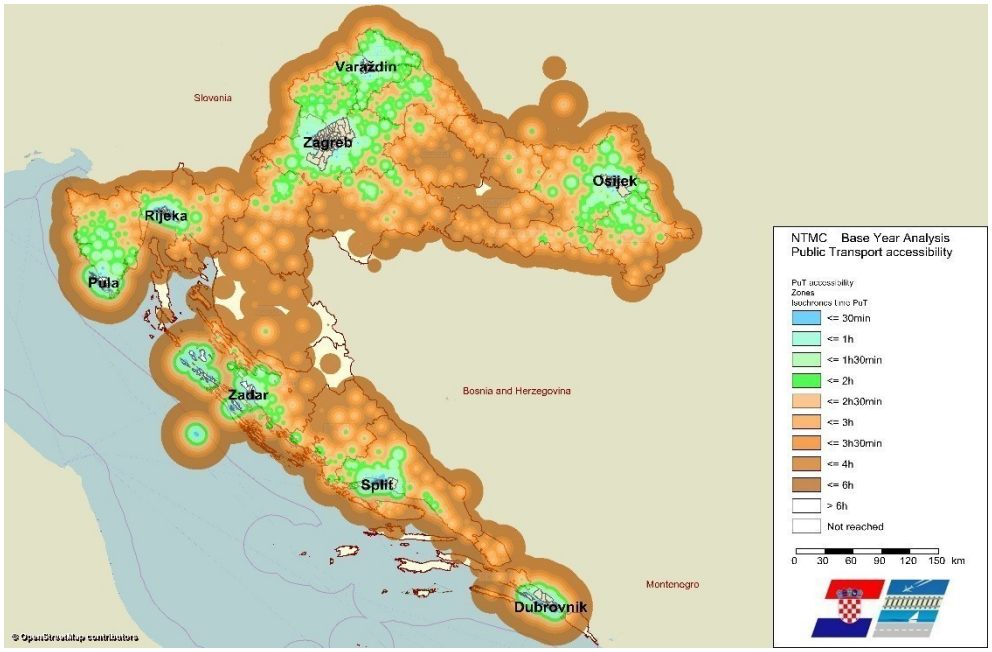
Figure 20: Display of Commuter Flows for the definition of Functional Regions



Source: NTM

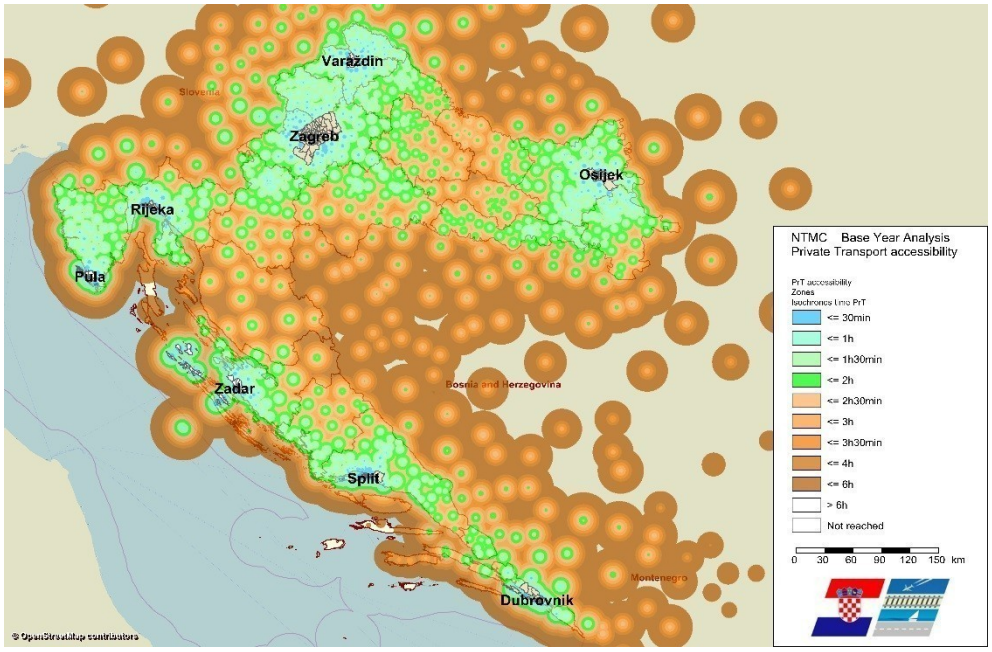
The shape of functional regions is not necessarily identical with shape of administrative regions and can overlap with neighbouring regions, even on the national level. Using the National Traffic Model, an analysis of accessibility of each regional centre by public (figure 21) and private transport (figure 22) has been performed and the shape of each functional region has been determined.

Figure 21: Accessibility of regional centres using public transport (the colors are marking the availability of regional centers with public transport in time)



Source: NTM

Figure 22: Accessibility of regional centres using private transport (the colors are marking the availability of regional centers with passenger transport in time)



Source: NTM

Central-Croatia

Given its geographic position, Central-Croatia plays a prominent role in the transport network of the Republic of Croatia and Central-Eastern Europe. To the north, the region borders Hungary, Slovenia to the west and Bosnia and Herzegovina to the south.

The region also borders two of the other functional regions, the Northern-Adriatic and Eastern-Croatia. The City of Zagreb, the capital and largest city, is the most important economic centre of the country. The next most important cities are Varaždin, Čakovec, Koprivnica, Bjelovar, Sisak and Karlovac. Varaždin together with the towns of Čakovec and Koprivnica and the settlements that gravitate to these towns, with the population of over 50.000 inhabitants, can be identified as an individual functional sub-region inside Central-Croatia FR.

Eastern-Croatia

The functional region borders Hungary to the north, Serbia to the east and Bosnia and Herzegovina to the south. The functional region of Central-Croatia is to the west. Eastern-Croatia FR is a polycentric region, as none of the settlements in the region dominates the others.

The main cities of the region are Osijek and Slavonski Brod. While Osijek is located close to the Serbian and Hungarian border, Slavonski Brod is on the border with Bosnia and Herzegovina; therefore, they are important transport/economic nodes in the international network.

Northern-Adriatic

The functional region covers three territories, the Istrian peninsula with the City of Pula, the Kvarner Bay with the port in Rijeka, third largest city in the Republic of Croatia, and the hinterland territory. The region borders Slovenia to the north, the Central-Croatian FR to the east and Northern-Dalmatia FR to the south.

The Istrian peninsula, with Pula as its centre, has around 60.000 inhabitants and can be identified as a separate functional sub-region inside the functional region of Northern-Adriatic.

Northern-Dalmatia

This functional region includes the northern part of Dalmatia, a territory between the Northern-Adriatic and Central Dalmatia functional regions. The region covers the territories of two counties, Zadarska and Šibensko-kninska. The major cities of the region, Zadar and Šibenik, have port infrastructures.

Central-Dalmatia

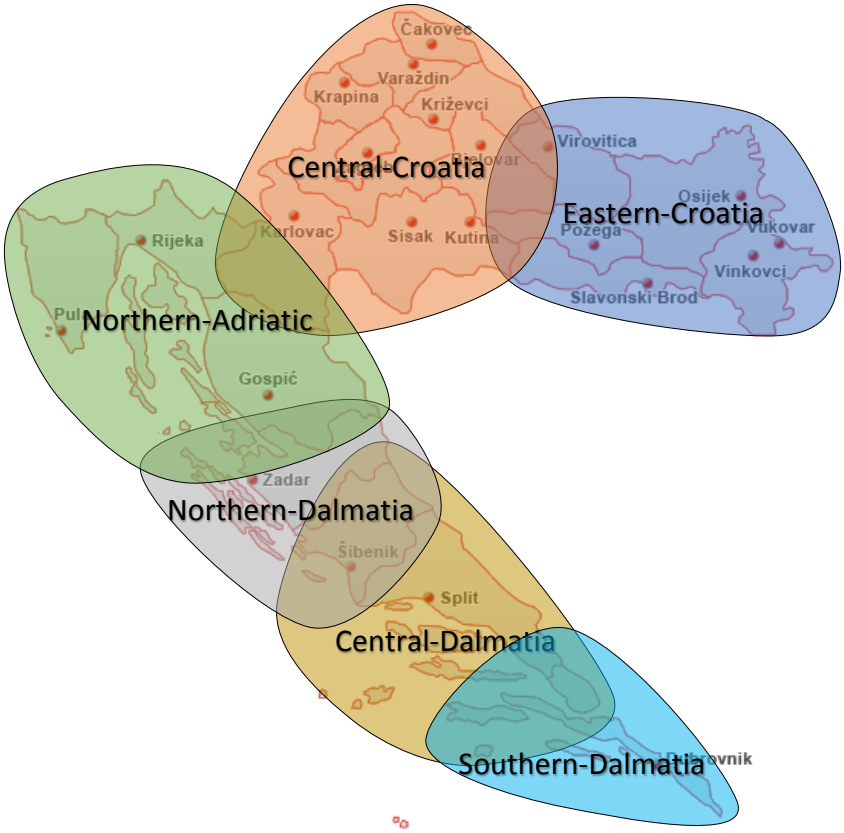
Geographically, Central-Dalmatia Functional Region borders with Northern-Dalmatia FR to the west, Southern-Dalmatia FR to the south and Bosnia and Hercegovina to the north. The functional region covers the Splitsko-dalmatinska and Šibensko-kninska counties and the northern part of the Dubrovačko-neretvanska County.

The main regional centre and port is the City of Split, the second-largest city in the Republic of Croatia, with around 180.000 inhabitants.

Southern-Dalmatia

The functional region Southern-Dalmatia comprises mainly the territory of the Dubrovačko-neretvanska county. It is a coastal region which has the peculiarity of being surrounded almost entirely by Bosnia and Herzegovina and physically separated from the rest of the Croatian territory due to fact that the territory of the Republic Bosnia and Herzegovina, at the town of Neum, intersects the territory of the Republic of Croatia and thus its territorial integrity. The City of Dubrovnik is the most important settlement of the region, and Ploče is one of the most important ports.

Figure 23: Functional regions in the Republic of Croatia



2.2. PUBLIC TRANSPORT AND ZERO-EMISSION MODES

2.2.1. HYPOTHESIS

The number of passengers in PT has increased in the recent years.

Source

Croatian Bureau of Statistics (CBS)

Key findings

- Number of passengers in PT using buses and trams has increased over the recent years.
- Overall, the number of passengers using public transport has increased.
- The number of passengers using railways in the Republic of Croatia was falling constantly from 2009 when it reached the maximum (approximately 74 million passengers, to 2015 with approximately 22 million passengers per year); such a sharp decline is due to changes in the methodology of assessing the numbers of passengers carried
- Regarding urban and suburban PT, which includes buses and trams, the maximum number of passengers was transported in 2007, approximately 426 million. From 2008 to 2012 the number of users decreased to approximately 363 million passengers per year; in the period from 2012 to 2015 the number of passengers increased again to approximately 398 million passengers in 2015

Note

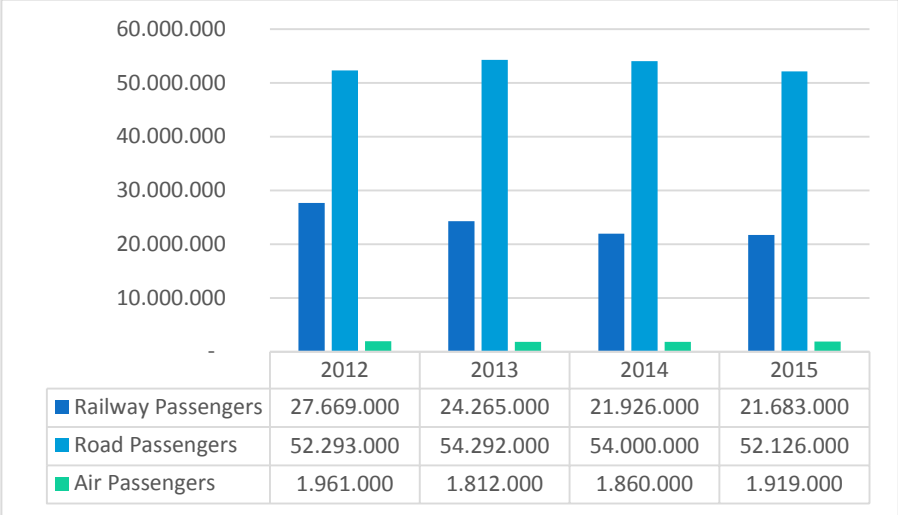
Generally, the decrease in the use of PT has to be looked at in relation to the increase of the motorization rate in the country and the effects of the global economic crisis, which has impacted the mobility in general.

Regarding railway and urban/suburban transport, the big fluctuations in the recent years can be explained by modification in the method of counting passengers carried by ZET and HŽPP. Based on an agreement between ZG Holding, ZET and HŽ Passenger Transport, starting from 1st of March 2017 common freight tickets of ZET + HŽ in the public transport of the City of Zagreb reduced about 35%, thus prices were practically brought to the level before the abolition of subsidies. The reduction of the City and national subsidies to certain population groups for the purchase of tickets was another contributing factor to the lower number of passengers carried.

Though the overall figures for the Republic of Croatia show an increase of the total number of passengers in urban and suburban PTs, the increase is largely due to biggest agglomerations of Zagreb and North West Croatia, while most of the other continental regions see a decrease of number of passengers carried in PT systems. The decrease in these regions is much related to depopulation and a decrease in job offerings.

A look at the data for the last 4-5 years shows a steady growth of passengers carried by trams and buses.

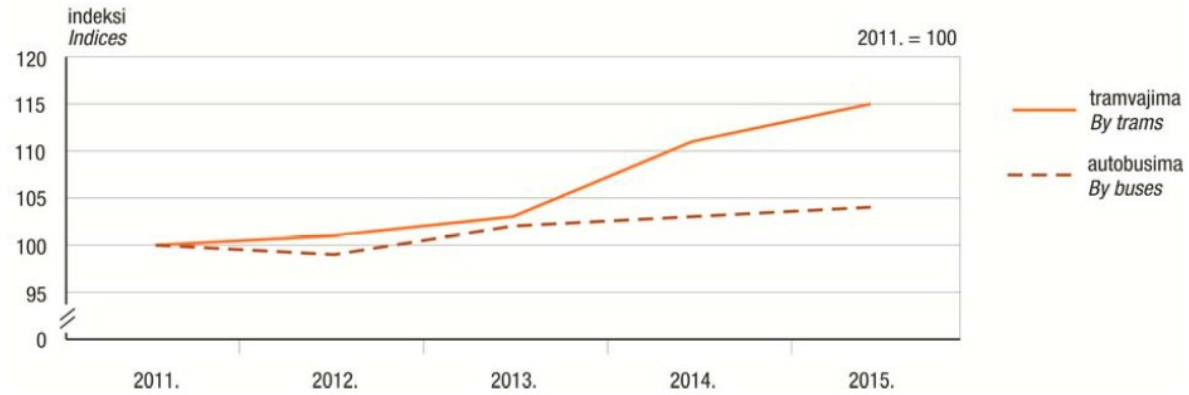
Figure 24: Number of passengers carried in the Republic of Croatia for period 2012-2015 (dark blue - number of passengers in rail traffic, lighter blue - number of passengers in road traffic, green - number of passengers in air traffic)



	2012	2013	2014	2015
Railway Passengers	27.669.000	24.265.000	21.926.000	21.683.000
Road Passengers	52.293.000	54.292.000	54.000.000	52.126.000
Air Passengers	1.961.000	1.812.000	1.860.000	1.919.000

Source: CBS

Figure 22: No. of passengers carried in urban and suburban PT



Source: CBS

Figure 24 shows that the number of passengers carried by railway has been decreasing constantly, though the latest decline from 2014 to 2015 is very modest; from 21.92 million in 2014 to 21.68 million in 2015. During the same period road and air transport fluctuated, but remained within the 3-point margin throughout the period observed.

Figure 25 shows the trend line of the number of passengers carried by trams and buses in urban and suburban PTs in Croatia. The reference year is 2011, and the indices are given accordingly. The number of passengers carried by trams has increased over the last years, with a surge in 2014 and 2015. Bus transport has also increased over the last three years. Table 4 shows the indices for the tram and bus PT in the period from 2011–2015.

Table 4: Indices of tram and bus PT; 2011 - reference year

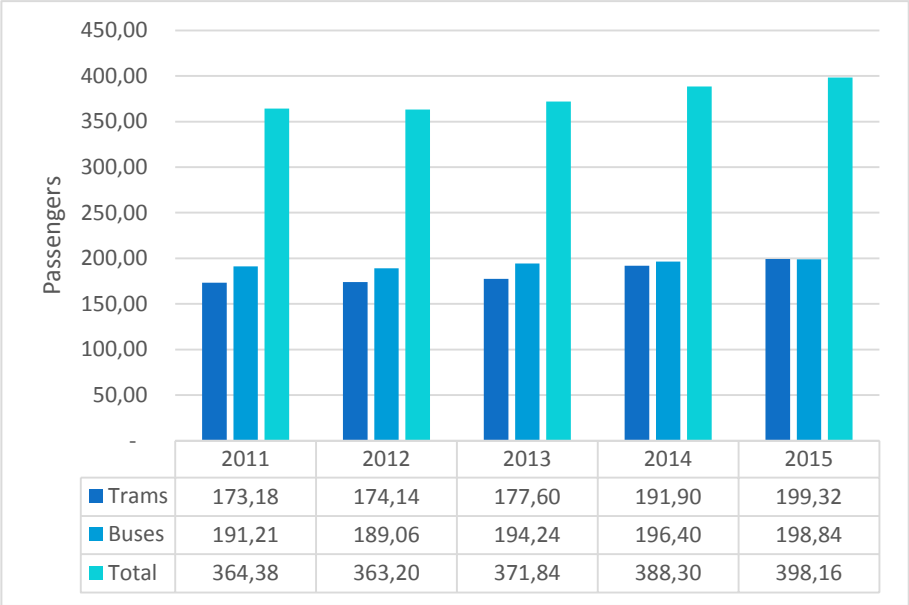
Year	Index tram	Index bus
2011	100.00%	100.00%
2012	100.56%	98.88%
2013	102.55%	101.59%
2014	110.81%	102.71%
2015	115.10%	103.99%

The index of passengers carried in each year by reference to 2011 represents a key indicator showing that the number of users of PT is increasing. There was just a slight drop (1.12%) in bus PT usage in 2012, but the overall trend in the following three years is positive, with a constant growth of approximately 1.5% a year.

The growth of PT passengers using trams rose from 2011 by 10% in 2014 and by 15% in 2015.

At present, public transport in the Republic of Croatia is not integrated, as there are no coordinated timetables or single tickets for different modes of transport. Intermodal terminals, which enable transit from one mode of transport to another, do not exist or are extremely rare. On certain lines, bus and rail carriers have "parallel routes". The contribution of rail transport is penalized by the fact that the average age of the rolling stock is close to the end of its service life, while in the road transport the average age of buses is approximately 15 years.

Figure 23: No. of passengers carried in PTs for period 2011-2015 (darker blue - number of passengers in trams, lighter blue - number of passengers in buses, green - total number of passengers in public transport)



	2011	2012	2013	2014	2015
Trams	173,18	174,14	177,60	191,90	199,32
Buses	191,21	189,06	194,24	196,40	198,84
Total	364,38	363,20	371,84	388,30	398,16

Source: DZS

In real terms, the number of passengers in all PT modes was increasing in the last three years. However, the modal split has increased in favour of private traffic during the recent years since the increase of private traffic is much bigger than in PT. This trend is due to higher availability of personal cars and public transport systems that are not integrated. Poor infrastructure of certain PTs also impacts to this negative trend in modal split.

2.2.2. HYPOTHESIS

There is a strong potential for the development of Public Transport of local and regional functionality around the main agglomerations.

Source

Proposal of Spatial Development Strategy of Republic of Croatia (2017); Croatian Bureau of Statistics (CBS); National Traffic Model for the Republic of Croatia (NTM)

Key findings

- The highest by far number of daily migrants is to be found in the wider agglomeration (Functional Region) of Zagreb.
- Other relevant daily commuting destinations are Osijek, Split and Rijeka and subregion Varaždin.

Note

The main role of transport is to connect spatially separated areas for the household and business sectors, for both person and commodity movements. Transport has a great impact on the territorial balance. Investment in infrastructure in the form of efficient transport and communication is required in order to reduce geographical disparities and make peripheral areas attractive locations for people and businesses.

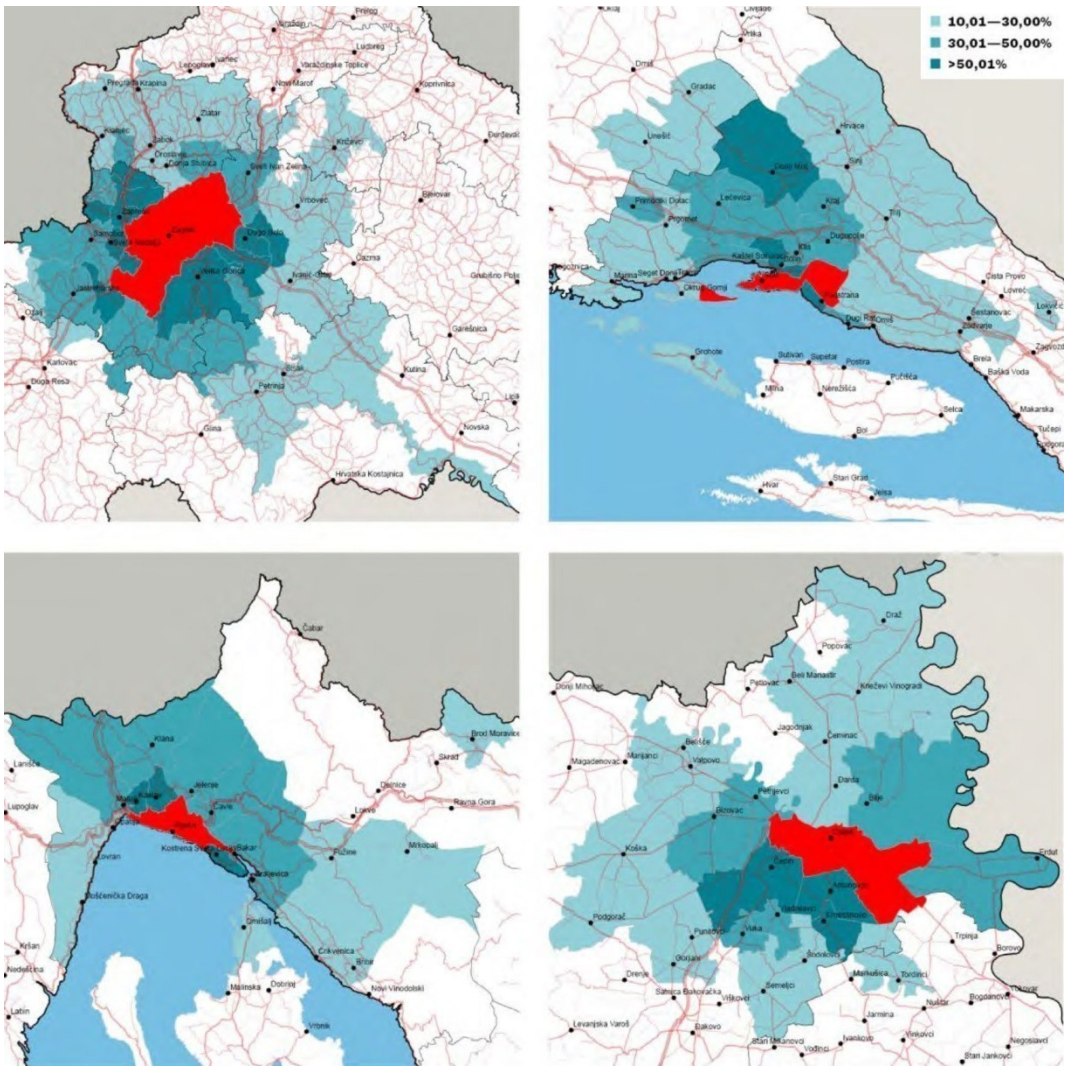
Public service transport is ruled by the Ministry of Sea, Transport and Infrastructure.

For the time being, there is only one operator of public service transport by rail in the Republic of Croatia, HZ Putnički prijevoz d.o.o. (HZ Passengers). However, according to Eurostat data, there are 44 operators involved in rail, tram and bus transport with an annual turnover in the public transport sector of approximately 47.7 million euros.

The four large urban regions in the Republic of Croatia are found around the largest cities: Zagreb, Split, Rijeka and Osijek, with a total of 1,661,924 inhabitants or 38.8% of the Croatian population. The main cities in most regions have up to 95% workplaces, and around them is only 5 to 10%. This indicates that the development of the Republic of Croatian urban regions is at an early stage. However, large urban regions are increasingly decentralized, and the surroundings takes over the demographic and functional development.

The surroundings of Zagreb, Split and Rijeka report a population growth, which affects the total positive development of these urban regions. In contrast, the number of residents in the Osijek region has decreased, both in the city and its surrounding areas.

Figure 24: Daily migrants in Zagreb, Split, Rijeka and Osijek in relation to the total number of employees in local government



Source: Proposal of Spatial Development Strategy of the Republic of Croatia

The main transport operators are concentrated in the cities of Zagreb, Rijeka, Split, Dubrovnik, Pula, Osijek and Zadar. These operators are owned by the Cities and Municipalities.

Outside the urban transport, there are 15 private operators in charge of the public transport service on national roads; some of them are experiencing serious financial problems.

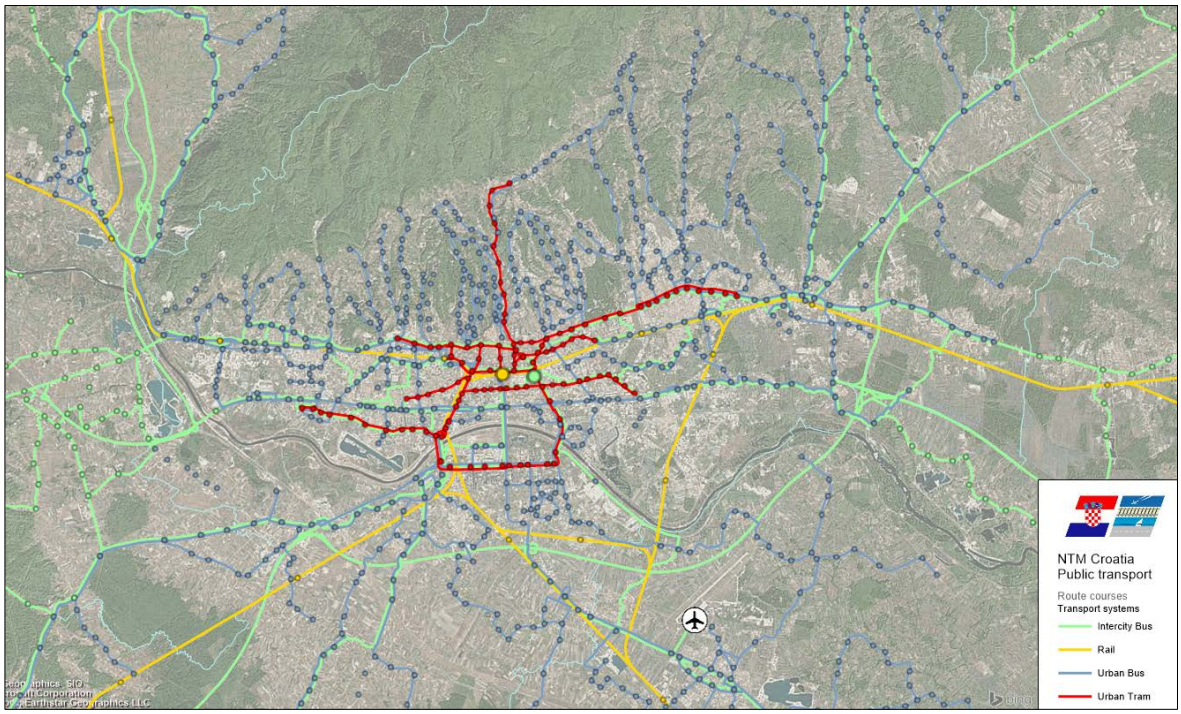
Licenses for lines in bus line transport last 5 years but only 45% or 50% are currently on operation, which is the result of complete liberalization of the market..

The public transport system has a deficit balance. It is estimated that public transport cover only 20% of the total costs.

In the City of Zagreb, the operator Zagreb holding Ltd. Branch ZET operates 129 bus and 15 tram lines serving 2,171 stops. Promet Ltd. Split operates 41 bus lines serving 1,717 stops in wider area

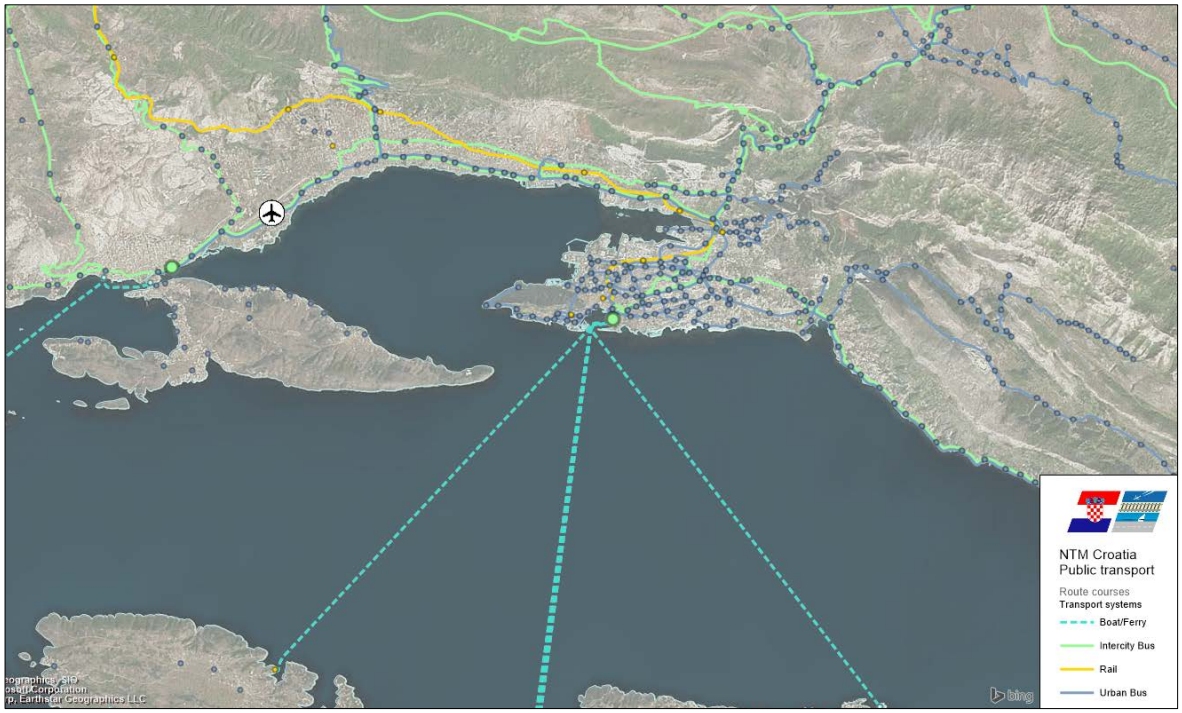
of Split. In Rijeka 81 bus lines are operated by Autotrolej Ltd. Rijeka. GPP Osijek Ltd. operates 15 bus and 2 tram lines in Osijek.

Figure 25: Tram and bus routes and stops in Zagreb (red - tram lines, blue - bus lines, yellow - rail lines, green - intercity bus lines



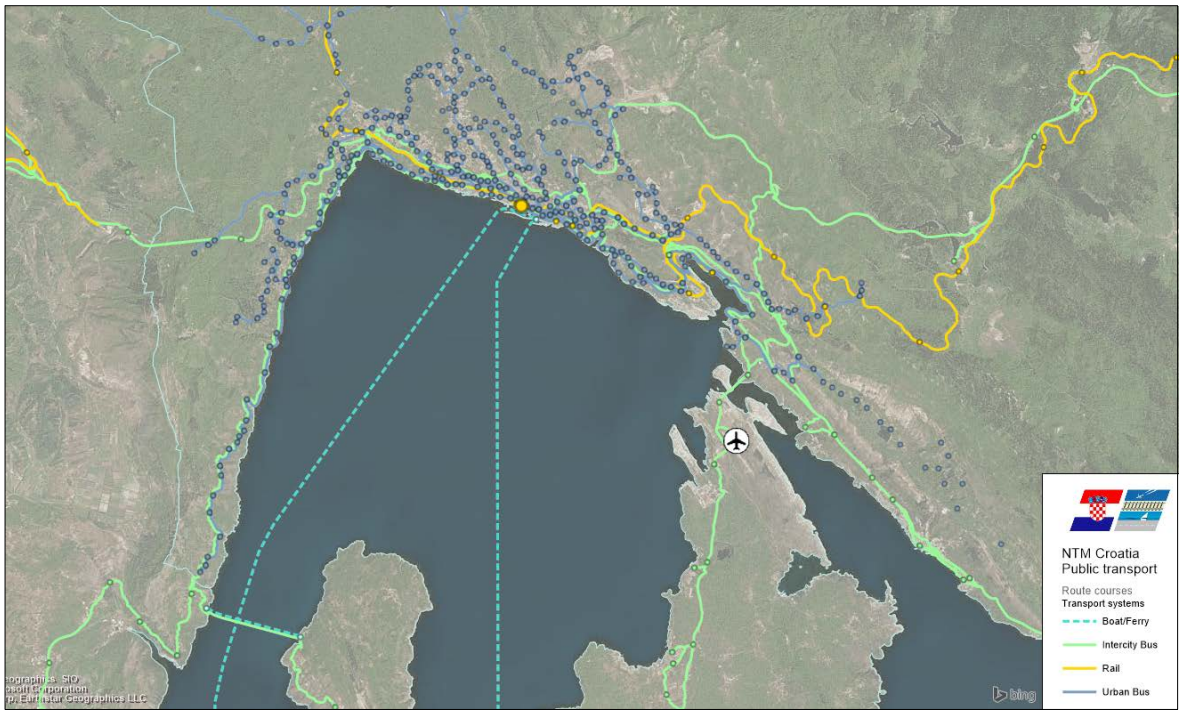
Source: NTM

Figure 26: Bus routes and stops in Split (blue - bus lines, yellow - rail lines, green - intercity bus lines, intermittent line - ship lines



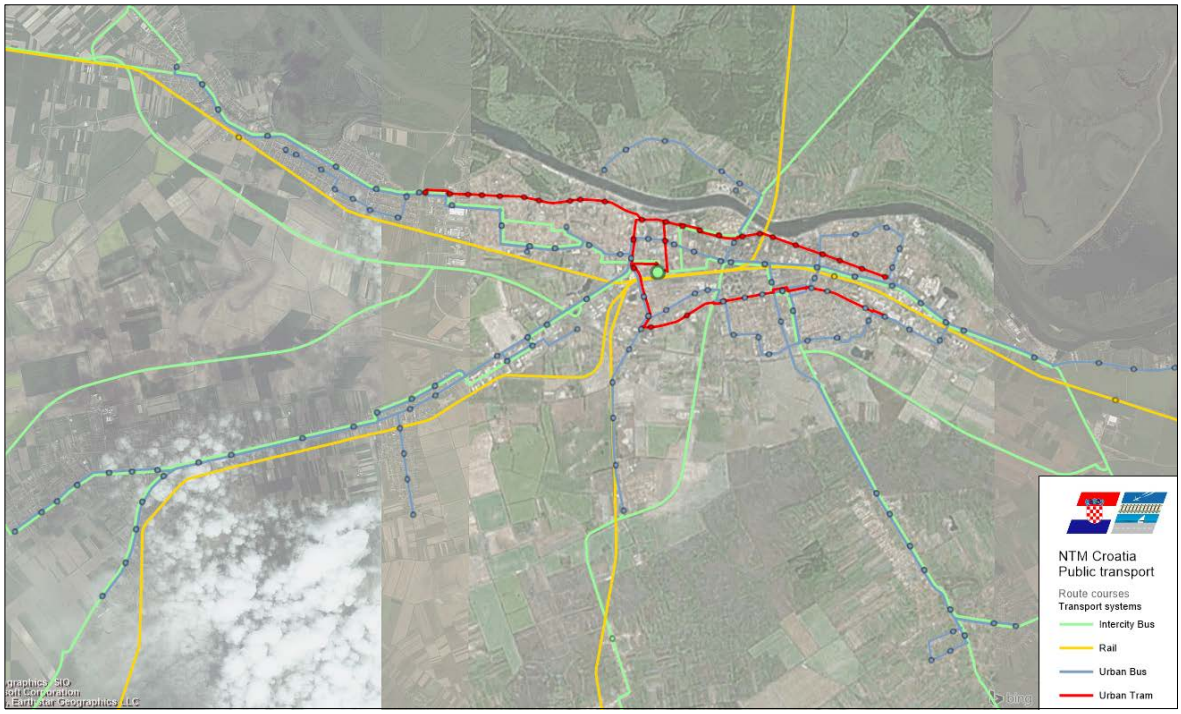
Source: NTM

Figure 27: Bus routes and stops in Rijeka (blue - bus lines, yellow - rail lines, green - intercity bus lines, intermittent line - ship lines



Source: NTM

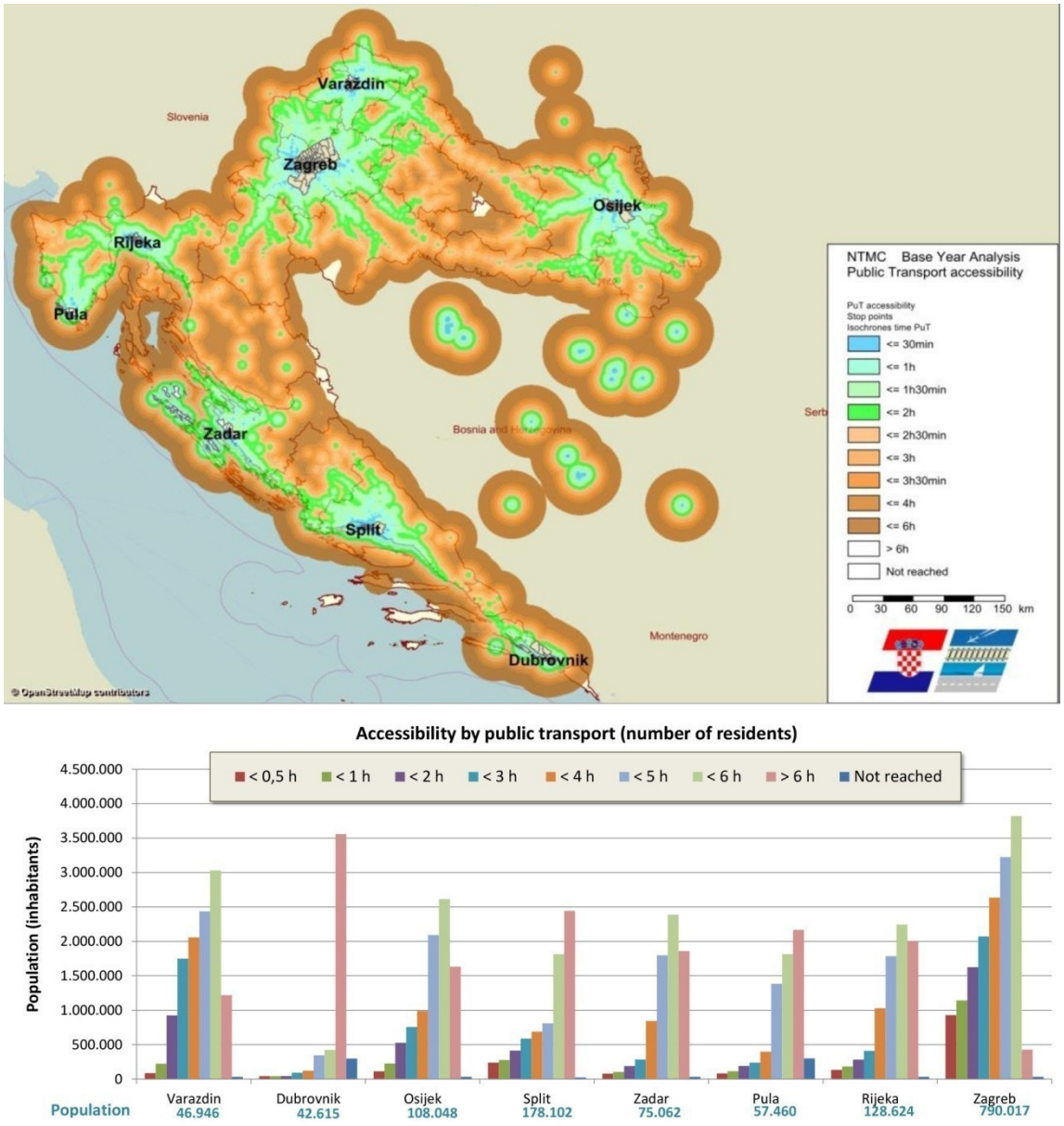
Figure 28: Tram and bus routes and stops in Osijek (red - tram lines, blue - bus lines, yellow - rail lines, green - intercity bus lines)



Source: NTM

Accessibility provided by public transport around the metropolitan areas seems good and comparable to private transport, particular along the public transport corridors clearly identifiable on the map below, some gaps can be identified between these major metropolitan areas. However, the latter are areas with very low population densities.

Figure 32: Public transport accessibility (the x-axis shows the cities and the y-axis population)



Source: NTM

2.2.3.HYPOTHESIS

The local/regional bus system has a strong relevance for areas of low and medium population, working place density, developed road network and also for touristic areas.

Source

Spatial Development Strategy of Republic of Croatia (adopted by the Government of the Republic of Croatia in April 2017); Public Transport in rural areas (2015); Croatian Bureau of Statistics (CBS); National Traffic Model for the Republic of Croatia (NTM)

Key findings

- Areas with lower population and lower working place density have a tendency to use personal motorized transport instead of public transport.
- Rural areas with a low population density have a potential for on-demand PT services.
- The high level of flexibility of regional and national bus services allows responding to the significant difference in operational requirements between the main season and the off-season.

Note

Transport has a great impact on the territorial balance. The main role of transport is to connect spatially separated household and business sector areas for both person and commodity movements. It involves access from/to businesses and their input sources in the business sector, or business-to-business access, and from/to businesses and their markets. For the household sector, it means connecting people with their place of work, educational or medical centres, stores or recreational facilities.

The table below shows some examples of modal split and PT usage in comparison with population density. According to Table 5, areas with a lower population and lower working place density have a tendency to use personal transport instead of public transport.

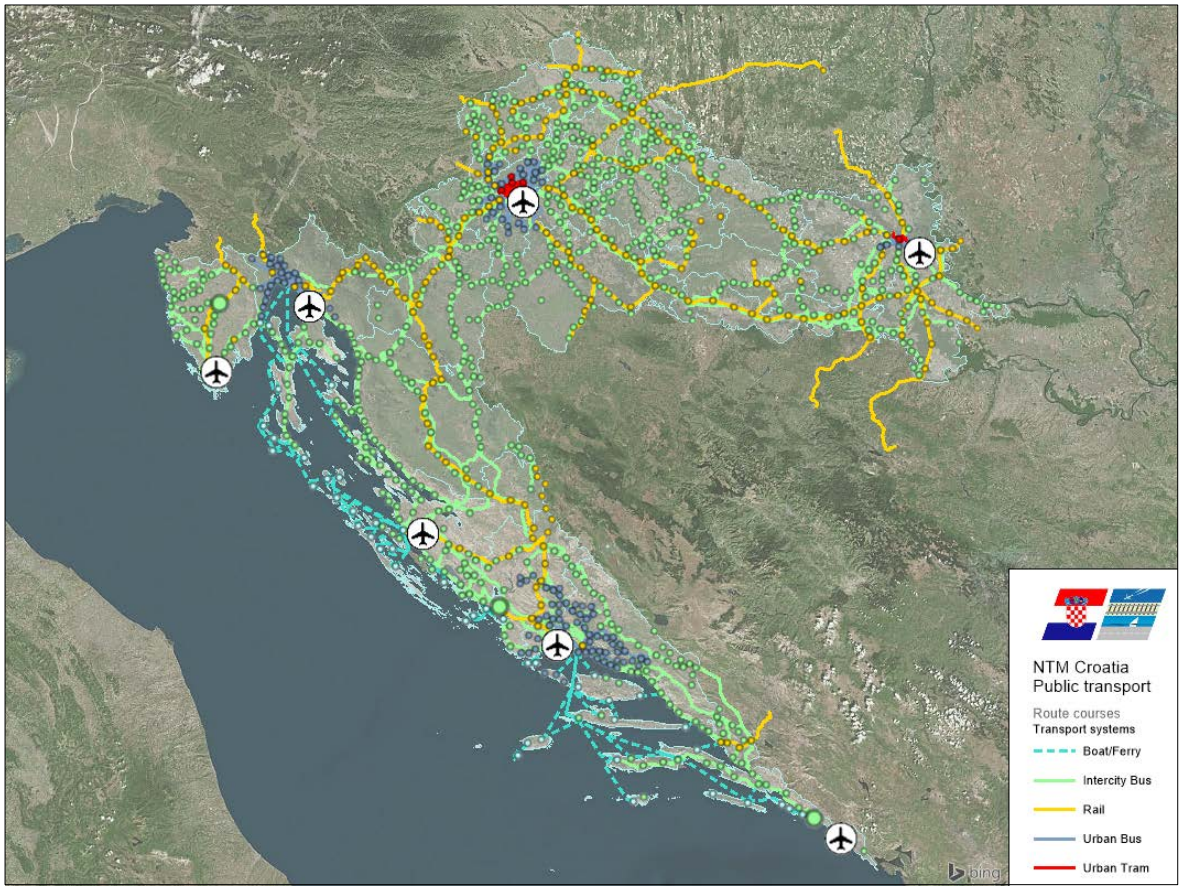
Table 5: Modal split and PT usage with regard to population density

	Australia and New Zealand	USA	Canada	Western Europe	High Income Asian Countries
Urban Density (persons/ha)	15.0	14.9	26.2	54.9	134.4
Proportion of Jobs in Central Business District	15.1%	9.2%	15.7%	18.7%	20.1%
Modal split					
Non-motorised modes	15.8%	8.1%	10.4%	31.3%	29.1%
Motorised private modes	79.1%	88.5%	80.5%	49.7%	38.6%
Motorised public modes	8.1%	3.4%	9.1%	19.0%	32.3%
Proportion of total motorised pkm in public transport	7.5%	2.9%	9.8%	19.0%	50.3%

Efficient transport is a key component of the economy and a common tool used for development. Improvement in local/regional public transport system encourages both jobs and population growth.

The principle enabling access to all public services for all citizens in the context of traffic, means providing access to public transport and other forms of mobility. For residents of areas with a low population density, using public means of transportation should be easier, faster, more cost-effective and sustainable.

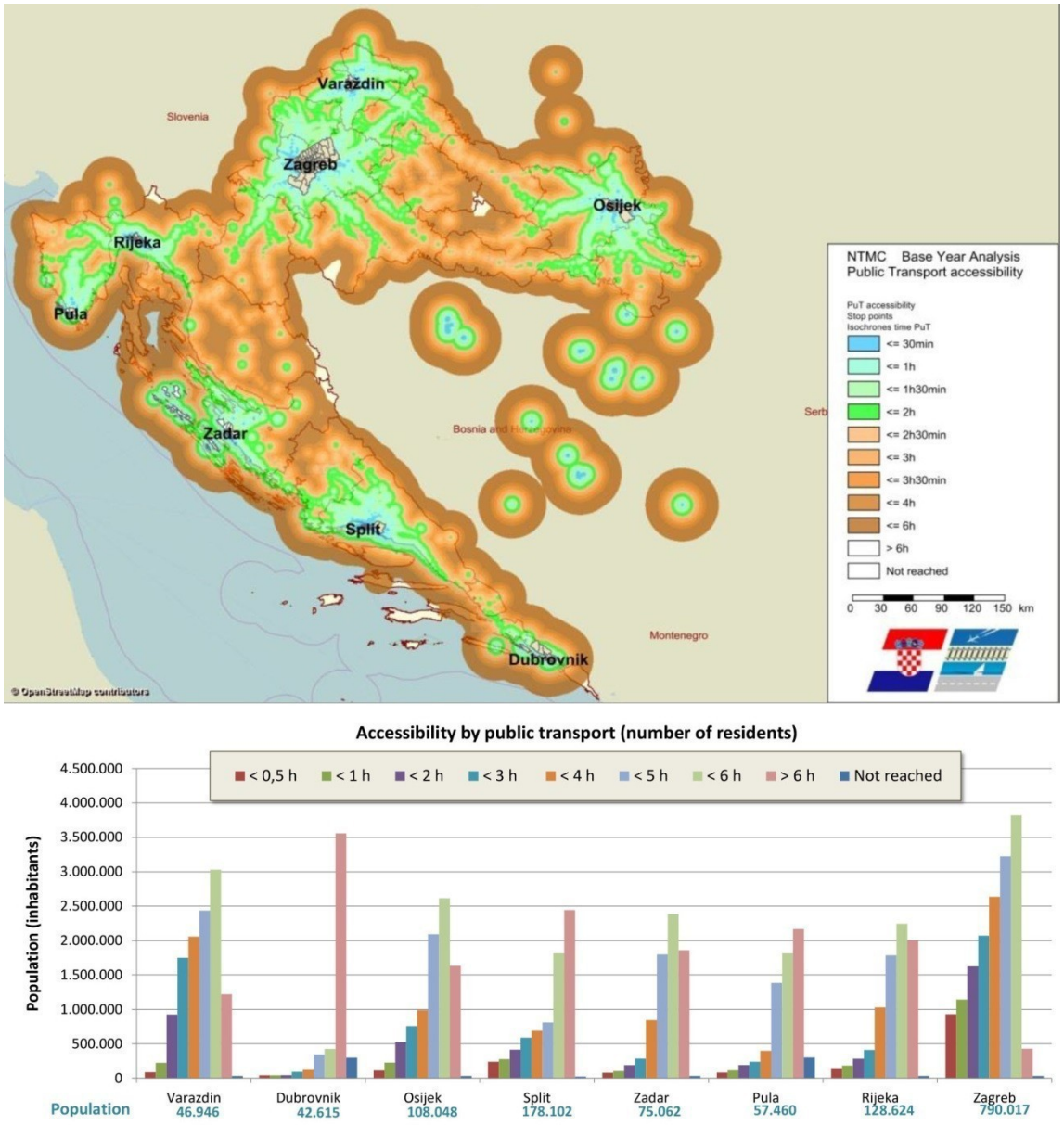
Figure 33: Public transport routes in Republic of Croatia (red - tram lines, blue - bus lines, yellow - rail lines, green - intercity bus lines, broken lines - ship lines)



Source: NTM

Accessibility provided by public transport around the metropolitan areas seems good and comparable to private transport. However, some gaps can be identified between these major metropolitan areas, particularly along the public transport corridors, as clearly seen from the map below. Still, the latter are areas with very low population densities.

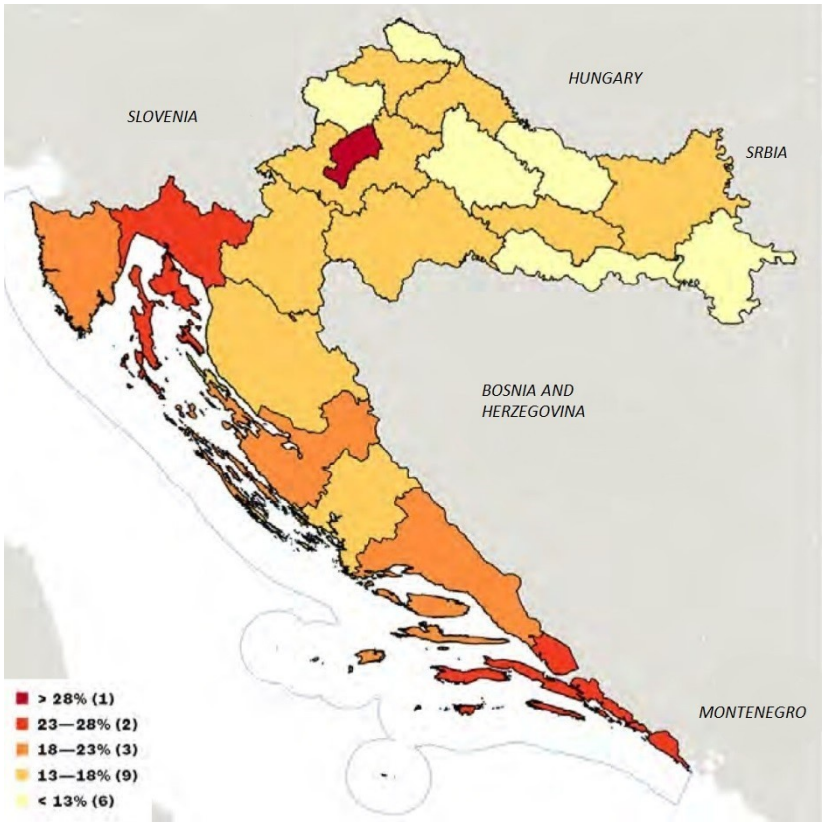
Figure 34: Public transport accessibility



Source: NTM

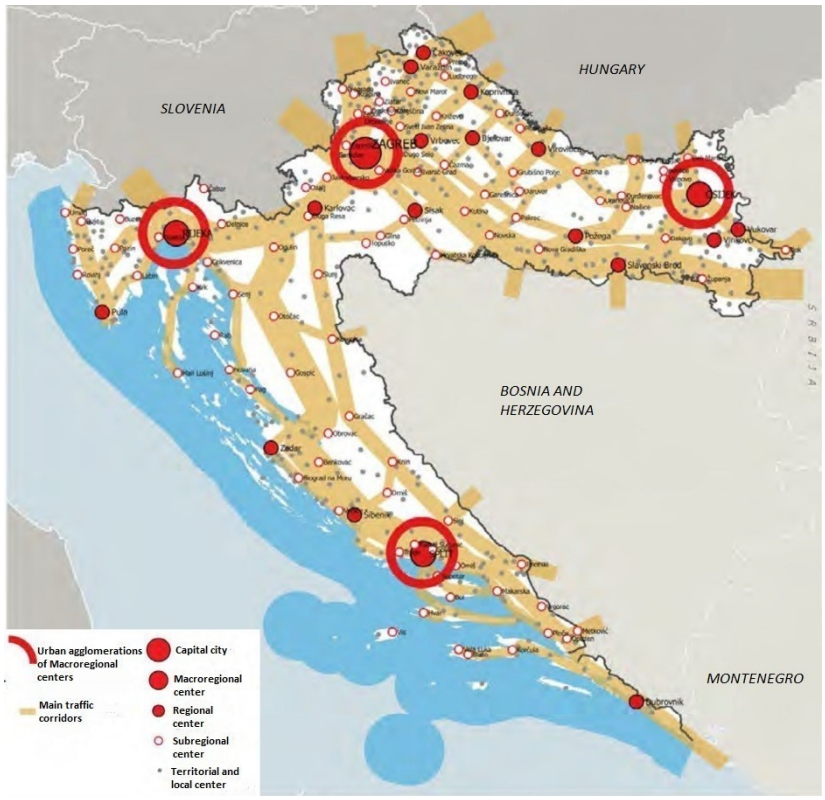
When it comes to the share of the employed population in the total population according to Census 2011, the counties in the north-west and west of the Republic of Croatia had a larger share, especially the City of Zagreb (47.8%), Istria (46%) and the Zagrebačka County (45.8%). On the other hand, the number of employed persons in the Brodsko-posavska and Vukovarsko-srijemska counties constitutes less than a third of the total population.

Figure 35: The share of highly educated working age population



Source: Proposal of Spatial Development Strategy of the Republic of Croatia (2017)

Figure 36: City region and spatial transport corridors



Source: Proposal of Spatial Development Strategy of the Republic of Croatia (2017)

By comparing and overlapping the images 35 and 36, areas can be identified with a noticeable low population density, low availability of public transport, low share of the working population and lack of road infrastructure at the same time. Population density is lowest and its decrease highest in rural areas and part of the Republic of Croatia with poor transport communication such as Ličko-senjska, Primorsko-goranska, Bjelovarsko-bilogorska, Virovitičko-podravska and Požeško-slavonska counties, and islands and areas along the national borders. In those areas the existing PT is not well organized and is too expensive for majority of inhabitants; which leads to further deterioration and isolation of rural areas.

All these areas feature a lack of the road network connectivity, particularly eastern part of the Republic of Croatia which is characterized by two main routes, north and south, with a lack of vertical connections between them. In Ličko -senjska and Primorsko-goranska counties the bigger problem for road network are challenging terrain morphology and bed condition of county and local roads, inappropriate for conducting local public transportation (inappropriate geometric characteristics, the lack of bus stations, etc. ...). At the same time, all these areas have great potential to generate active tourism (fishing, hunting, and biking) and enhance gastronomic tourism. Viniculture is quite developed. The cultural heritage of a number of settlements makes them interesting destinations.

In response to the demographic change in rural areas, one solution could be implementation of a more flexible and customized innovative transport like Demand Responsive Transport. For example, in Bavaria, which has more than 12 million ingabitants, there are already a number of bus services on demand, such as BAXI (a bus in combination with taxi), which covers the entire Tirshenrautha area of approximately 1.100 km^2. The same principle of on-demand public transport services could be applied in Croatian areas that are rarely populated and with with poor access to public transport.

Public service transport is ruled by the MSTI. The MSTI is in charge of determining the scope of public service operations and concluding related contracts with operators. Almost the entire domestic passenger traffic can be classified into a public service obligation, an example of which being the subsidy for student passengers.

The Republic of Croatia, which is categorized as a touristic country, has a great difference in public bus transportation demand between the main season and the off-season, which results in a high level of flexibility on the part of public bus service operators. Outside the tourist season regional bus passenger transport can be used in areas with low population densities for student passengers, and

the same buses can be used for tourist transportation during the summer holidays, or during the tourist season.

2.2.4. HYPOTHESIS

A better integration of the transport modes will allow to optimize the efficiency and environmental and climate impact of the transport system.

Source

National Traffic Model for the Republic of Croatia (NTM)

Key findings

- The use of integrated IT systems between rail and road as well as other PT modes (maritime along the coast lines) is lagging behind comparable countries
- The idea of developing P&R facilities along the railway lines as well as the establishment of passenger transport hubs (regional buses, rail, PT system) is not strongly developed in the Republic of Croatia
- The ITS system on the motorway network is well developed, however the integration into the local and regional ITS system is lagging behind.

Note

The Transport Development Strategy observes the citizen mobility in the sense of the use of public transport (rail, tram, bus, waterborne, etc…), as well as individual mobility (transport by car or bicycle and walking). The emphasis is put on public passenger transport and zero emission modes for the purpose of daily migrations.
Regarding urban and suburban PT, which includes buses and trams, the maximum number of passengers was transported in 2007, approximately 426 million. From 2008 to 2012 the number of users decreased to approximately 363 million passengers per year; in the period from 2012 to 2015 the number of passengers increased again to approximately 398 million passengers in 2015.

At the same time, an increase in the number of registered cars, passenger car mileage and the general use of passenger cars has been observed. The predominance of private transport is evident through the big traffic jams on access roads to urban centres, which contribute to increased pollution and noise level, lack of parking space and rising costs for citizens. At present, public transport in the Republic of Croatia is not integrated, as there are no coordinated timetables or single tickets for the different modes of transport. Intermodal terminals, which enable transit from one mode of transport to another, do not exist or are extremely rare. On certain lines, bus and rail

carriers have "parallel routes". The contribution of rail transport is penalized by the fact that average age of the rolling stock is close to the end of its service life, while in road transport; the average age of buses is approximately 15 years. PT services exist in the areas of the major cities such as Zagreb, Rijeka, Osijek, Split and their agglomerations, as well as Varaždin, Karlovac, Zadar and Pula.

PT by tram exists in Zagreb and Osijek, while PT by railway is operated in Zagreb and Split. In inland waterways transport, public passenger transport for the purpose of daily migrations does not exist at all, while public transport in the maritime sector is focused on connecting the islands with the mainland.

Cities suffer most from congestion, poor air quality and noise exposure. Urban transport is responsible for about a quarter of green house gases emissions from transport and 69% of road accidents occur in cities. These issues are felt in the main urban nodes/metropolitan areas of the Republic of Croatia, while the solutions differ due to the existing infrastructural provision, the geomorphologic characteristics and mobility patterns (e.g. presence of the sea and needs for connections to islands, etc.). In order to improve the situation, it is necessary to increase the modal split in favour of public transport and soft modes (pedestrians and cyclists). To achieve that, it is a priority to increase the efficiency and physical, operational and organisational integration of all the modes: railway, tram and bus. It is also necessary to provide good public transport connections to the main demand generator centres (such as airports, ports, cultural centres, city centres, etc.). In cities, switching to cleaner transport is facilitated by usually higher availability of public transport services and higher population density. Pre-trip/on-trip users' information, electronic booking and integrated ticketing covering all transport modes should facilitate multimodal travel. The support to public transport and soft modes should start at the policy level, by committing to prioritise these modes, at the same time limiting/restricting private cars usage especially in the city centres. An appropriate set of passengers' rights has to accompany the wider use of collective modes.

Hrvatske autoceste d.o.o. are equipped with information and communication systems for data exchange. Supervision and traffic management on the respective motorway section if performed at the traffic maintance and control centers. Central traffic management system consists of several subsystems: traffic data exchange systems, traffic workstations, information systems for weather conditions, video surveillance systems, subsystem for remote management and control of energy facilities in tunnels, ventilation control and monitoring subsystems in tunnels, etc.

However, the situation with state and local roads is not on satisfied level and there are no completely developed IT systems. Therefore, significant investments in this part of the road network are expected in the near future.

Further implementation of the ITS development strategies will stimulate the implementation of significant projects in the fields of transport systems, especially in urban areas (adaptive traffic management, management of public transport, parking management, intermodal transportation in big cities and ferry ports, management of fleets of vehicles, etc.). Development of ITS in the Republic of Croatia can be considered as a direct investment in the economic and tourism sector, by increasing the level of transport services and security.

2.2.5.HYPOTHESIS

There is a potential for the development of a specific bike system (infrastructure and bikes) in particular in relation to e-mobility.

Source

European Cyclist Federation; Croatian Bureau of Statistics (CBS); National Traffic Model for the Republic of Croatia (NTM), EuroVelo

Key findings

- Travel behaviour research that was conducted within the NTM project shows that around 5% of all trips is by bikes
- Koprivnica, Varaždin and Osijek are good examples of the use of bicycles in the Republic of Croatia
- The use of e-bike has a great potential for the development of bike system in cities with unfavourable morphology

Note

A bicycle is a very useful means of transport that can be implemented for transport on shorter distances and in urban areas. In Copenhagen and Amsterdam more than 30% of all trips are done by bike.

There is a great potential to change the travel behaviour in favour of bicycles, public transport, e-mobility etc., which would bring a significant reduction of greenhouse gas emissions and enable the application of multi-modal transport systems.

The following table shows the statistics from the database of European Cyclist Federation. The cyclist modal share of 10% in 2012, which fairly corresponds with the results of mobility research conducted within the NTM project (7.1% in Continental Croatia), positions Zagreb on the 6th place among all EU capitals. A comparison with other EU cities leads to a conclusion that a better integration of the bike system in PT and the improvement of infrastructure offer a big potential for improving the modal split in favour of bikes.

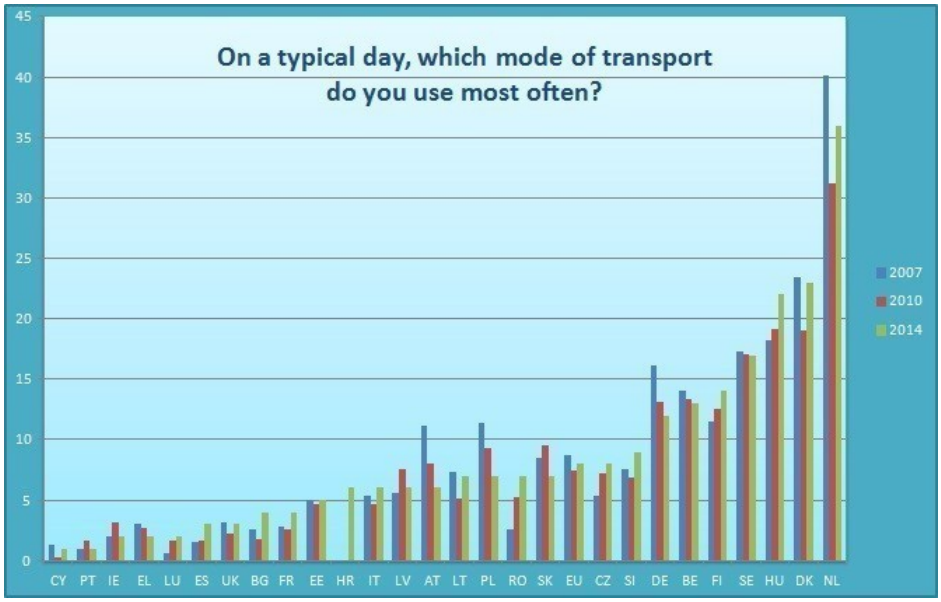
Table 6: Cycling modal share in European Cities

EU Capitals	Cycling modal share	Year
Copenhagen	35%	2010
Amsterdam	32%	2012
Berlin	13%	2008
Ljubjjana	12%	2013
Helsinki	11%	2013
Zagreb	10.1%	2012
Stockholm	9%	2013
Dublin	7.9%	2013
Vienna	6%	2013
Riga	4%	2014
Brussels	3.5%	2013
Luxembourg	3.5%	2011
Sofia	3%	2010
Nicosia	2%	2010
Paris	2% (2nd source: 5%)	2013
Athens	2%	2005
Budapest	2%	2014
Bratislava	2%	2012
London	2%	2009
Prague	1%	2013
Tallinn	1%	2012
Vilnius	1%	2010
Warsaw	1%	2009
Lisbon	1%	2013
Bucharest	1%	2007
Rome	0.6%	2012
Madrid	0%	2011

Source: European Cyclist Federation

Combined use of the roads for vehicles and bikes negatively affects the safety and attractiveness of bikes. This can be seen from the number of cyclist accidents on Croatian roads in the last 10 years (table 7). To increase the safety and attractiveness of bike rides it is a necessary to plan and construct bicycle infrastructure.

Figure 37: Cycling - a typical mode of transport in the EU countries



Source: European Cyclist Federation

Table 7: Bicycle accidents on Croatian Roads 2005 to 2014

Year	INJURED PERSONS IN ROAD TRAFFIC ACCIDENTS			KILLED PERSONS IN ROAD TRAFFIC ACCIDENTS		
	Total	Bicycle riders	%	Total	Bicycle riders	%
2005	21,773	1,006	4.6%	597	34	5.7%
2006	23,136	1,065	4.6%	614	50	8.1%
2007	25,092	1,148	4.6%	619	28	4.5%
2008	22,395	1,015	4.5%	664	47	7.1%
2009	21,923	1,050	4.8%	548	29	5.3%
2010	18,333	936	5.1%	426	28	6.6%
2011	18,065	1,171	6.5%	418	28	6.7%
2012	16,010	1,133	7.1%	393	21	5.3%
2013	15,274	1,097	7.2%	368	23	6.3%
2014	14,222	1,185	8.3%	308	19	6.2%

Source: CBS

The Republic of Croatia has adopted two Rulebooks relating to cycling infrastructure:

- Rulebook on functional categories to determine a network of bicycle routes (OG no. 91/13)
- Rulebook on cycling infrastructure (OG no. 28/16).

They enable the development of the cycling infrastructure on the State, county and local levels and represent the basis for a detailed design of cycling infrastructure.

EuroVelo, the European cycle route network, is a project managed by the European Cyclists' Federation (ECF) in cooperation with national and regional partners. EuroVelo incorporates

existing and planned national and regional cycle routes into a single European network. The following map provides an overview of the EuroVelo bike network.

Figure 29: European bike network

Source: EuroVelo

An increasing number of European countries have put in place and implemented national strategies on cycling. For the most part, these national strategies and/or action plans set clear activities and precise goals for the development of cycling at the national level. The Republic of Croatia has not yet adopted the National Cycling Strategy. An overview of the national cycling strategies in Europe is given in the table below.

Table 8: Overview of the national cycling strategies in Europe

Countries	Eurobarometer 422a 12/2014	Modal share for cycling (National resources)	Existence of a National strategy and targeted modal share	Name of national cycling strategy	Total annual investment (estimated) and amount per capita	Investment from the national state annually (estimated) and amount per capita
Netherlands	36%	26% (2010)	No (most recent strategy: Masterplan Bicycle 1990 - 1997)		410 mil. EUR (2010) 24.4 EUR per capita	35 mil. EUR (2010) 2.1 EUR per capita
Denmark	23%	16% (2010-2013)	Yes	A new national bicycle strategy: "Denmark on your bike"	67.5 mil. EUR annually (2009-2014) 12 EUR per capita	27 mil. EUR annually (2009-2014) 4.8 EUR per capita
Hungary	22%	19% (2013)	Yes	National Cycling concept 2014-2020	36.4 mil. EUR (2007-2013 - 67% from EU) 3.7 EUR per capita	6.4 mil. EUR annually (2007-2013) 0.64 EUR per capita
Sweden	17%					
Finland	14%	8% (2010-2011)	Yes 20% increase by 2020 (as compared to 2005)	National Strategy for Walking and Cycling 2020		
Belgium	13%	8% (2010)	Yes (not officially adopted)	Total Plan - Get Belgians on the bikes		
Germany	12%	10% (2012)	Yes (15% by 2020)	National Cycling Plan 2020 - Joining forces t o evolve cycling		93 mil. EUR in 2015 1.15 EUR per capita
Slovenia	9%	6.7% (2005)	Yes Doubling cycling (mid-long term objective)	National Cycling Network Development Strategy in the Republic of Slovenia		
Czech Republic	8%	7% (2013)	Yes 10% by 2020 and 25% by 2025	Czech National Cycling Development Strategy for 2013-2020	17 mil. EUR annually (2001-2010 - 67% from EU) 1.6 EUR per capita	4 mil. EUR annually (2001-2010) 0.38 EUR per capita
Lithuania	7%		No			
Poland	7%		No			
Romania	7%					
Slovakia	7%	1.5% - 2% (2012)	Yes 10% by 2020	National Strategy of Development of Cycling Transport and Cycle Touring in the Slovak Republic	average of 15 mi. EUR per year (EU funds 10 mil. EUR) 2.78 EUR per capita	1.5 mil. EUR (2015) 0.28 EUR per capita
Austria	6%	7% (2010)	Yes 10% by 2015	Cycling Master Plan implementation successes and new priorities 2011-2015	27 mil. EUR annually (2007-2012) 3.2 EUR per capita	4.14 mil. EUR annually (2007-2012) 0.52 EUR per capita
Croatia	6%		No			
Italia	6%	4.7% (2013)	No			
Latvia	6%		Yes	Latvian cycling development program		
France	4%		Yes	Action plan for soft mobility - walking and cycling	470 mil EUR (2009 -) mostly from regional	10 mil. EUR (2009)

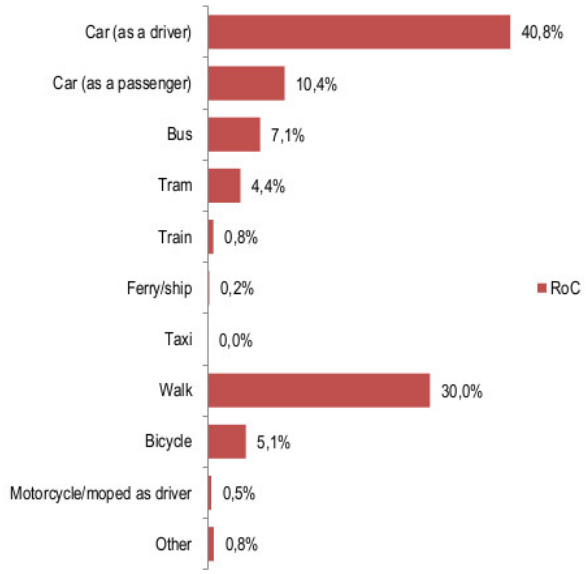
Source: European Cyclist Federation

Within the NTM project, a survey on travel behaviour in the Republic of Croatia was conducted, which indicates the following:

- About 5% of all trips were made by bicycle.
- The rank order of mode share was the same for both NUTS-2 regions, though respondents from Adriatic Croatia made more trips by car and by walking while respondents from Continental Croatia used public transport and bicycle more often for travelling.
- Compared to Continental Croatia, respondents from Adriatic Croatia made almost 40% more car trips, 60% more walking trips, 32% fewer public transport trips, and 65% fewer bicycle trips.
- Cycling was the least popular method of travel for home–work, home–school, and home–other trip purpose pairs. A slightly higher proportion of trips made by bicycle was found for the home–leisure (9%) and home–shopping (8%) trips.
- Cycling was the least popular method of travel for work–home, school–home, and other–home trip purpose pairs. A slightly higher proportion of trips made by bicycle were among the leisure–home (7.4%) and shopping–home (7.3%) trips.

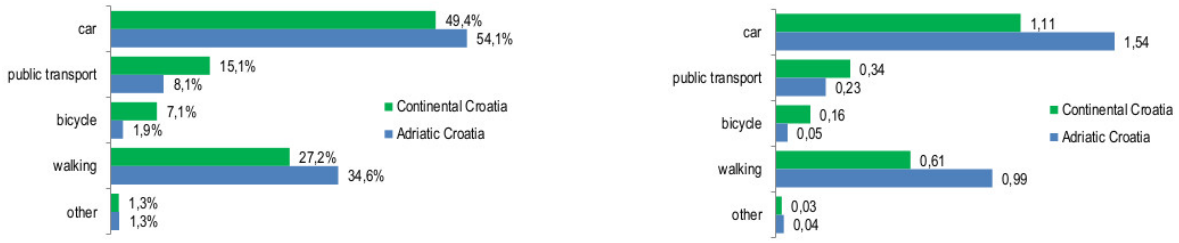
The results are illustrated in the following figures.

Figure 39: Proportion of all trips taken by different methods of transport, at the national level



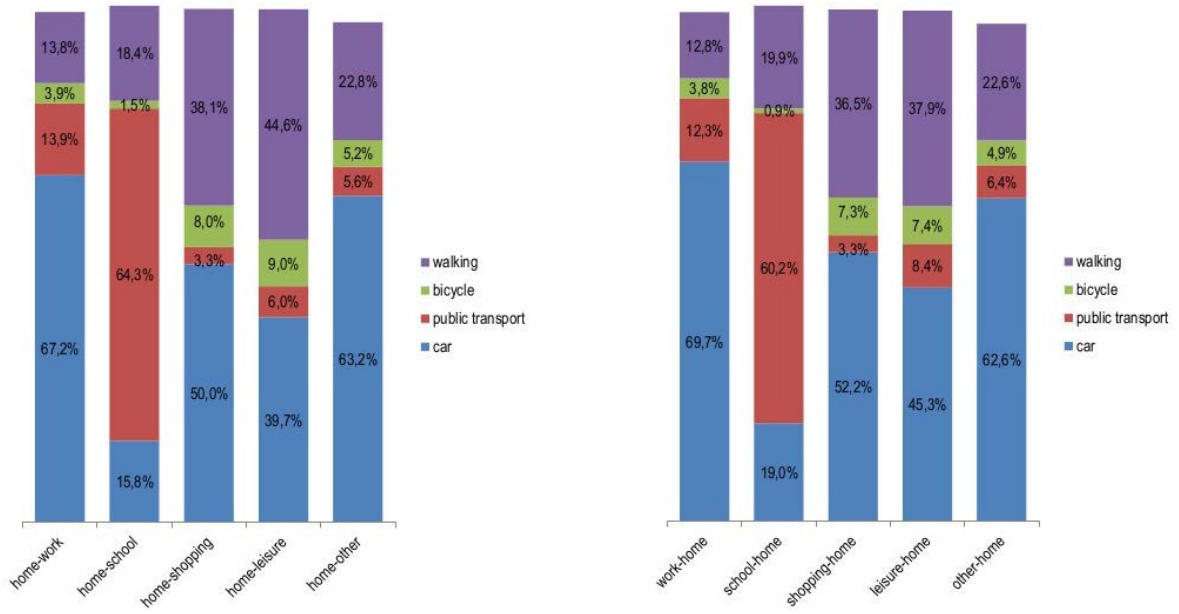
Source: NTM

Figure 40: Proportion of all trip rates and trip rates by different methods of transport at the regional level (vertically listed top down: car, public transport, bicycle, on foot, other, green - continental Croatia, blue - Adriatic Croatia)



Source: NTM

Figure 41: Purpose of traveling according to the form of transportation with the home as the starting point (horizontally indicated from left to right: home-work, home-school, home-trade, home-holiday, home-left, purple - on foot, green - bicycle, red - public transport, blue – cars)



Source: NTM

Cyclists travel on a healthy and environmentally friendly transport mode and have a freedom of choice that no other mode of transport offers. But sometimes there is a limit to its distance or to the effort required. Steep hills and long distances can make the car a necessity even if it is a forced choice. But with electric bikes (pedelecs) that can travel at constant 25 km/h, or even higher for some bikes, regardless or weather, terrain or health, there is more incentive to keep on pedalling.

The development of traditional bicycle transport in some cities of the Adriatic region seems not possible due the unfavourable morphology. According to the Mobility research, in the Adriatic region, only 1.9 % of all trips are done by bikes. The solution for those cities would be e-bikes, whose application requires the adoption of an appropriate regulation.

2.2.6. HYPOTHESIS

The roads outside the agglomerations have a specific role for PT.

Source

National Traffic Model for the Republic of Croatia (NTM)

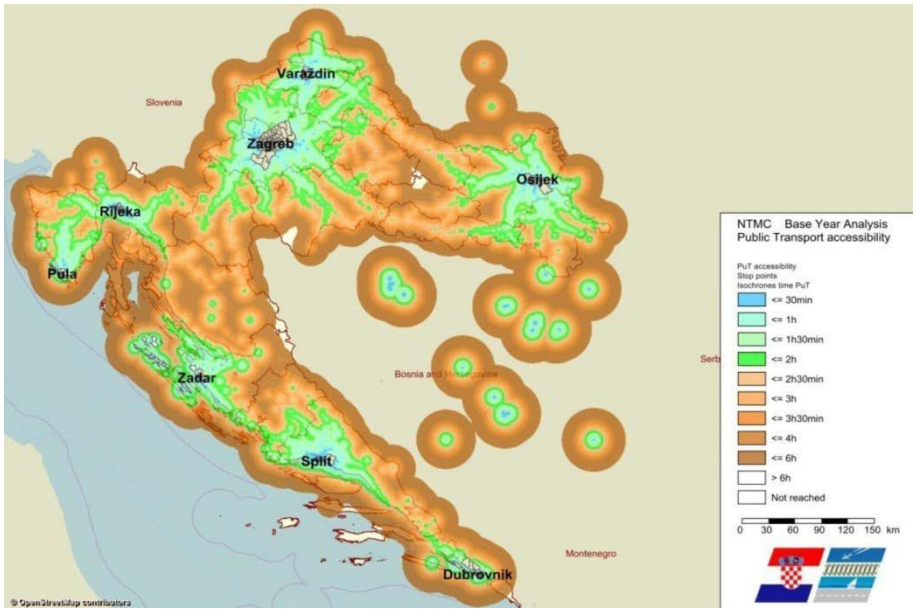
Key findings

- Analysis of the existing bus services shows a lack of availability outside the agglomerations
- Road design for public transport outside the agglomerations is not satisfactory

Note

Public transport should provide the same level of availability to the entire population, however it is not the case in areas outside the cities, as shown in Figure 42. The availability of public transport inside the agglomerations and along the big traffic corridors is sufficient, however areas with low population densities are lagging behind.

Figure 42: Accessibility by public transport (colors indicat the availability of regional centers by public transport in time)



Source NTM

Public transport, in the full sense of the word, takes place in areas of large cities like Zagreb, Rijeka, Osijek, Split and their agglomerations.

In some areas of the Republic of Croatia public transport has almost disappeared, which reflects itself unfavourably on the population density. These are areas whose population moved to large

cities to satisfy their needs for work, education, recreation, etc. On the other hand, big cities are confronted with a growing number of inhabitants and traffic congestions.

The strategic guidelines of the European Union largely encourage the development of public transport system which offers many advantages over private transport, for example: less pollution, greater energy efficiency, greater traffic safety, etc. Investments in optimal public transport services stops emigration from rural and suburban regions, and this creates conditions for long-term sustainable regional planning.

The road network outside the agglomerations provides a solid basis for the development of public transport. The problem with the road network outside the agglomerations is the lack of equipment for the establishment of high-quality public transport which is reflected in the following:

- Insufficient number of bus stops
- Inadequate equipment of bus stops (unmarked positions, don't exist lay-bys, lack of shelters for passengers, missing timetables, etc.)

The following figure shows a typical bus stop outside the agglomeration

Figure 43: A typical bus stop on Croatian roads outside the agglomeration

Source: GoogleMaps

A fine example of a well-equipped bus stop, which includes a bus lay-by, a passenger shelter and a displayed timetable, after the reconstruction of a state road, is shown in Figure 44.

Figure 44: A well-equipped bus stop outside the agglomeration

Source: GoogleMaps

It is obvious that the establishment of good public transport on roads outside agglomerations requires reconstruction and modernization. The need for the development of public transport system has been confirmed by the numerous examples of good practices from the developed European countries. The development of public road transport has a great potential because of its availability and generally an important role in the development of public transport.

2.2.7. HYPOTHESIS

Rolling stock is at the end of the economic life. This applies in particular to Osijek PT system

Source

Gradski prijevoz putnika Osijek (GPP); ZET (Zagreb); Promet (Split); Autotrolej (Rijeka)

Key findings

- In 2014 the rolling stock of GPP Osijek consisted of 64 vehicles, 26 trams and 38 buses. Average age of trams was over 45 years. Average age of buses was 10 years.
- Average age of rolling stock in Promet Split was 12 years in 2015 (in range of 2,6 to 31 year); Rolling stock in Split area was renewed only by one used bus in 2016.
- ZET rolling stock has been renewed by 142 trams and 214 buses in 2008 and 2009, and 23 school buses in 2007; ZET buses have now average of 9.2 years of age.
- In 2015 Autotrolej Rijeka has 172 buses of average age of 11 years.
- There is a low share of buses that use alternative fuels or a combination of alternative fuels and diesel fuels in the fleet structure of public city transporters.

Note

Looking at the average age of rolling stock of four biggest cities and their PT systems in the Republic of Croatia, we can see that most rolling stock is at the end or even beyond its expected life-cycle.

The situation is somewhat satisfactory only in Zagreb. ZET rolling stock has been renewed by 142 trams and 214 buses in 2008 and 2009, and 23 school buses in 2007. Now, ZET buses have average age of 9.2 years.

The situation is a bit worse in Rijeka where local PT company Autotrolej runs a total of 172 buses of an average age of 11 years.

On the other hand, the situation is particularly difficult in Osijek and Split PT which use the oldest rolling stock. In 2014 the rolling stock of GPP Osijek consisted of 64 vehicles, 26 trams and 38 buses. The average age of trams was 52.1 years for 9 trams and 44.4 years for 17 trams. Some trams have been refurbished, but not actually renewed, while most of them have been only repainted. Thirty-eight (38) buses have an average age of more than 10 years, with just 13 buses with an average age of 8 years. Moreover, the Osijek tram infrastructure partly still uses some old technologies and needs improvement in order to decrease the number of faults due to bad infrastructure.

Regarding Split, the average age of the rolling stock of Promet Split was 12.2 years in 2015. Promet Split runs 154 buses aged 2.5 to 31 years. The rolling stock in the Split area received only one addition in 2016, one second-hand bus.

Table 9: Average age of rolling stock

City	Year	Buses	Average age	Trams	Average age
Split	2015	154	12	-	-
Rijeka	2015	172	11	-	-
Osijek	2014	38	10	26	47
Zagreb	2015	426	9.2	277	12

Besides the rolling stick, we have to consider the problem with infrastructure, which is by far in the worst condition in Osijek. Zagreb and Osijek are the only cities operating big PT systems that include trams, but they are almost completely different by the status of their tracks, power stations and signalling. Some of the power rectifier stations in Osijek were built 40-50 years ago and they are already beyond their expected life-cycle and need to be replaced as soon as possible.

2.2.8. HYPOTHESIS

The respective PSCs need to be reviewed in order to fully comply with the legal acquis.

Source

Ministry of the Sea, Transport and Infrastructure (MSTI)

Key findings

- Public Service Contract(s) in compliance with EU Reg. 1370/2007 are a fundamental tool to assure transparency and efficiency in the provision of public transport services
- At this moment, only GPP Osijek PSC is in line with EU Regulation 1370/2007

Note

Pursuant to Article 3 of Regulation EC 1370/2007 of the European Parliament and the Council of public rail and road passenger transport, it is necessary to regulate the mutual rights and obligations to ensure the regular transport of passengers in the transport system of the Republic of Croatia, which is in the general economic interest of the country.Public transport of passengers must be in balance with revenues of business firms engaged in such carriage and paying compensation from the state budget.

A widespread implementation of PSCs is required not only for compliance purposes, but also as a first step towards an improvement in sustainability of Croatian's transport system. Typology and duration of the PSC will have to be determined on a case-by-case analysis, together with the applicability of the in-house model (either based of pure compliance issues or after a thorough assessment of technical and financial requirements). This type of contracts can also be signed with a private company which is registered for providing public transport.

Therefore, the Republic of Croatia should, by 2019, become harmonised with the Regulation 1370/2007 as well as implement this type of contracts throughout the country.

2.2.9. HYPOTHESIS

Where there is a tram network (Zagreb and Osijek) the infrastructure (tracks, power supply, traffic management, communication equipment, etc.) is in bad condition.

Source

ZET – Zagreb tram service; GPP Osijek

Key findings

- Zagreb tram service in the last decade intensively work on modernization of rolling stock, while the quality of tram infrastructure is lagging behind.
- Tram traffic in the City of Osijek is characterized by the age of the infrastructure and rolling stock

Note

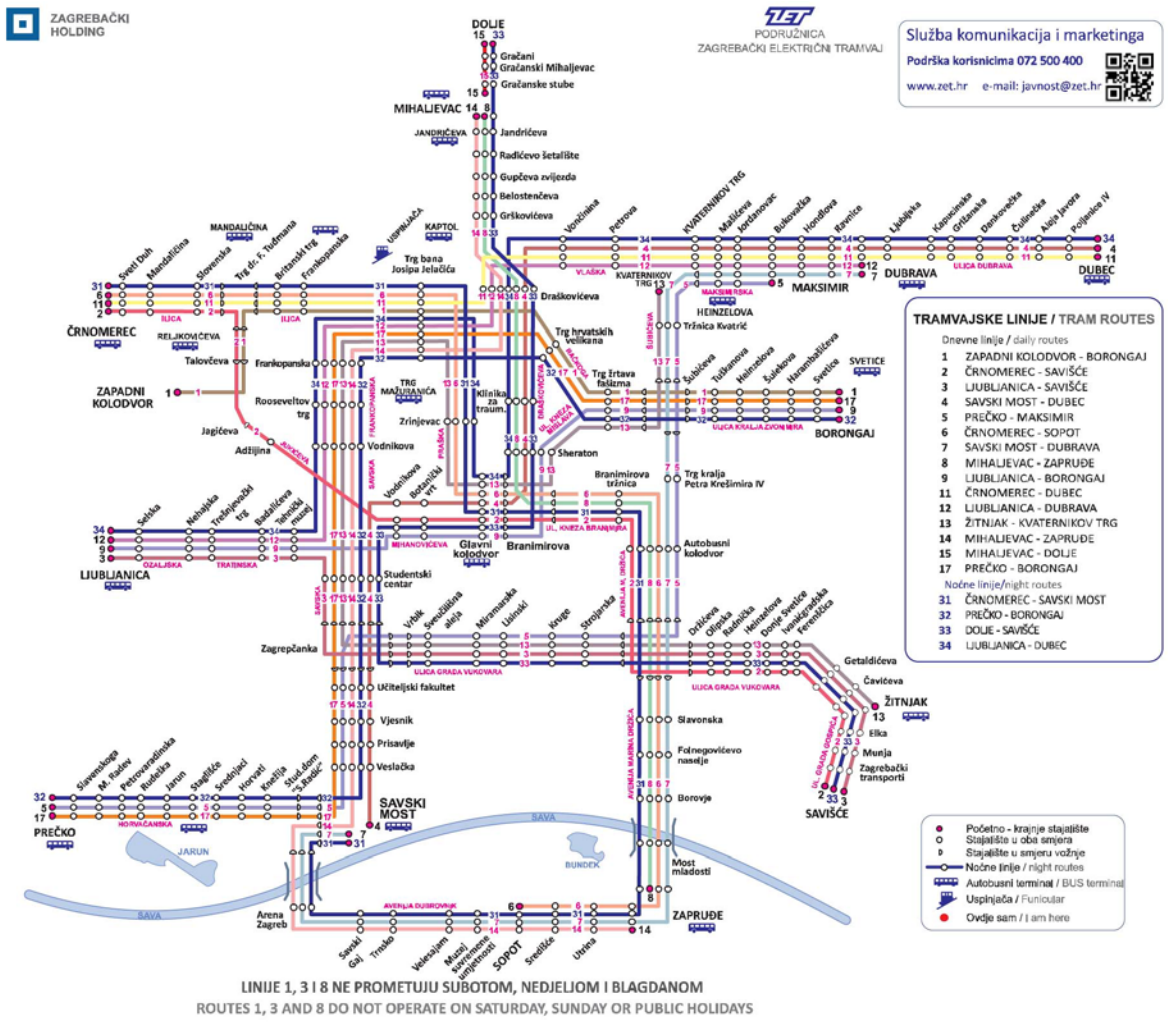
Tram service is the basic type of public transport in Zagreb. Regular tram transport includes 116,3-km operating-long tracks, 193 lead cars and 41 trailers. There are fifteen lines running along 148 km long track and 4 night lines on a 57-km long track. The city has 167 switches and 256 tram stations. The trams in Zagreb transport approximately 204,000,000 passengers a year.

Slightly less than half of the operating length (49%), i.e. 57,5 km of tracks are located in a separate lane, 24.5 km (21%) located on the road with private traffic but separate with the "yellow tracks", 23.1 km (20%) share lanes with private traffic and the remaining 10% is on squares and turntables, where the track is not in a separate lane, but is restricted to public traffic.

The Zagreb tram system have nine types of track structures: tracks on thresholds (0,8%), tracks on gravel background (8,6%), old straight concrete base (0,3%), type ZG 2 (0,2%), ZG 3/1 (7,9%), 3/2 ZG (24,5%), ZG 3/2 PE (6,9%), ZG-3 / k (1,1%) and DEPP (49,6%).

Given the size of tram traffic in Zagreb, some parts of tram tracks have annual load of more than 14 million t/year. When the load is more than 8 million t/year the regime of special design and increased maintenance must be applied, which results that almost 50% of the tram network in Zagreb must submit to this regime, to be circulated within the limits of safety.

Figure 305: Zagreb tram lines



(Source: ZET)

With regard to the amount of tram traffic in Zagreb, on some sections, the annual loading of the railway line is greater than 14 million tonnes. At loads above 8 million tons per year, a regime of special constructions and enhanced maintenance must be applied to keep traffic within the limits of safety, meaning that 50% of the tram network in Zagreb enters that regime.The modernization of the rolling stock has placed higher demands on the tracks, particularly on the turnout system. The distance between the tram tracks in Zagreb is 1 m, the depth of the tracks grooves is too shallow, the higher weight and overall size of new vehicles increased the load on the tracks. All of this results in faster wear of tracks and turnouts, thus there is a need for replacing the rails, an opportunity to use new ones appropriate to the new fleet. The modernization of the rolling stock should take place simultaneously with an increase of electric power and the reconstruction of the catenary line, thus it is necessary to dimension the power network according to the new fleet (currently it is not possible to run the system only with new vehicles, as the existing power is not

sufficient). The permanent availability of electric power system directly depends on the quality of maintenance and structure of the tram fleet. Calculations and measurements with the new low-floor trams (70 NT 2200) in traffic registered a growth of electrical loads and pointed to the possibility of frequent power failure. How outage at any of the parts of the system causes partial and sometimes complete blockage of traffic, it is necessary to further invest in the improvement of the infrastructure facilities and network of the existing electric power system.

In addition, the stations length must be adapted to the size of the new rolling stocks. Only 30% of tram stations in Zagreb are equipped with tram displays displaying the announced time of tram arrival.

Trams are put in two tram depots in Zagreb.

Depot in Trešnjevka consists of 9,213.11m long gauges, 28 of which are used for parking, and 87 switches. Depot accepts 236 trams. Existing depot with its traffic-technical characteristics and the its size is not appropriate for receiving and servicing of new low-floor trams NT 2200. The age structure of Trešnjevka depot is very high, communal infrastructure is outdated and equipment for maintenance of vehicles is inappropriate. One of the major problem in Trešnjevka depot is the inefficiency of the location, the reason is that in the early hours increased number of tram vehicles are opening to traffic at the same time, which results in traffic jams on road network near depots.

The depot in Dubrava has 8,500 m long tracks with 30 gauges and 75 switches. This depot puts in service 3 types of trams and one type of trailer. Storage technology has not completely finished. The main problems are related to the deterioration of existing infrastructure, as well as a number of disadvantages of the existing space and surface, which prevent the effective implementation of all the necessary operations.

The Osijek tram system has 2 tram lines organized at approximately 29 km of tram tracks, of which 24 km are double track lines, and 5 km are single-track lines. The tram has two lines with a total of 81 tram stops. In 2014 the tram system transported approximately 10.9 million passengers.

Figure 316: Osijek tram lines

Source: GPP Osijek

Tram tracks are largely built on a concrete base, approximately 25 km, while around 4 km are laid on gravel background. A recent study of track condition in Osijek tram system show that around 40% of the tracks is in very poor condition and require thorough reconstruction, while 60% of the tracks is estimated to be in good condition.

The tram depot was built 90 years ago (in 1926), and most of the workshops, channels as well as a part of the equipment are from that period, which would mean that they are in a very poor condition. The tram depot in Osijek needs radical reconstruction. Given the tendency of purchasing new rolling stocks, there is also a need for the construction of new facilities such as laundry, lacquer, etc. The existing tram depot is situated within the protected zone C and registered as cultural and historical heritage of the City of Osijek. A number of issues arising from the specifics of cultural heritage protection can be expected.

The existing rectifier station is currently at a very poor technical level, and there is an urgent need for the rehabilitation of the equipment and devices. Rectifier stations were built in 1968 and 1975, and their service life is at the end due to the deterioration of key electrical components. The existing outdated equipment must be replaced by installing inside the plant new, more energy efficient and environmentally friendly equipment.

The maximum capacity of existing rectifier station is 9,000 A. If the tram tracks and catenary line should be extended, more power will be required.

Considering the existing situation and the analysed records of vehicle maintenance as well as the deficiencies on the infrastructure, one may conclude that GPP Osijek could have problems in the future with maintaining the traffic safely and providing a seamless transport service to its passengers.

2.2.10. HYPOTHESIS

Integrated ticketing as a pull factor for the improvement of the Modal Split in favour of PT should be considered.

Source

Croatian Bureau of Statistics (CBS)

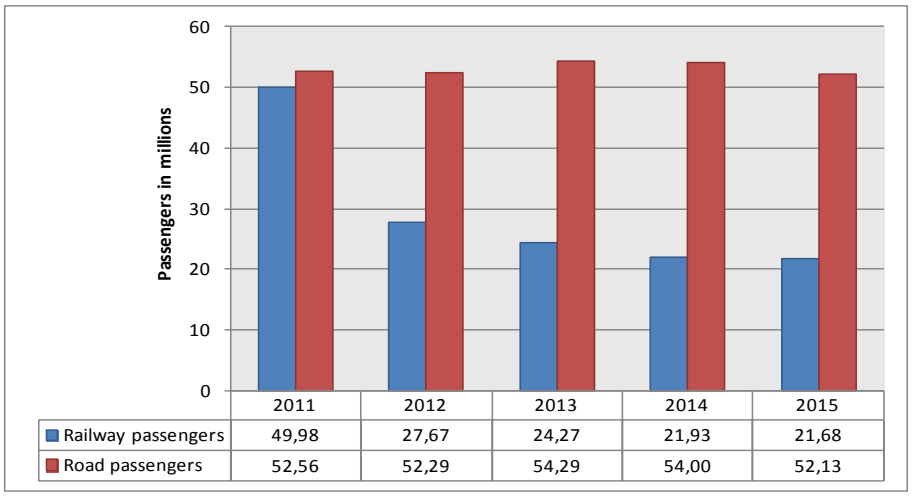
Key findings

- Significant decline of railway passengers in Zagreb agglomeration in 2012 after stopping the integrated ticketing between HŽPP and ZET; the actual number of persons carried are not counted as railway passengers, but as ZET passengers.
- Public transport (PT) in Croatia has seen a decrease in the number of passengers in all modes of transport. An increase in the number of registered personal cars, personal car mileage and the general use of passenger cars has been observed. The predominance of private transport is made evident by the big traffic jams on access roads to urban centres.

Note

For the time being, public transport in the Republic of Croatia is not integrated, as there are no coordinated timetables or single tickets for different modes of transport. Intermodal terminals, which enable transit from one mode of transport to another, do not exist or are extremely rare. On certain lines, bus and rail carriers have "parallel routes". The contribution of rail transport is penalized by the fact that average age of the rolling stock is close to the end of its service life.

Figure 327: Number of passengers in Railway and Road transport (In the period from 2011 to 2015 (blue - passengers in rail transport, red - road passengers, on x - axis the number of passengers in million)



	2011	2012	2013	2014	2015
Railway passengers	49,98	27,67	24,27	21,93	21,68
Road passengers	52,56	52,29	54,29	54,00	52,13

Source: CBS

2.2.11. HYPOTHESIS

In several places the different modes of PT transport are competing instead of complementing another.

Sources

Zagreb rail node study; National Traffic Model for the Republic of Croatia (NTM); Croatian Bureau of Statistics (CBS); ZET (Zagreb); Promet (Split); GPP (Osijek)

Key findings

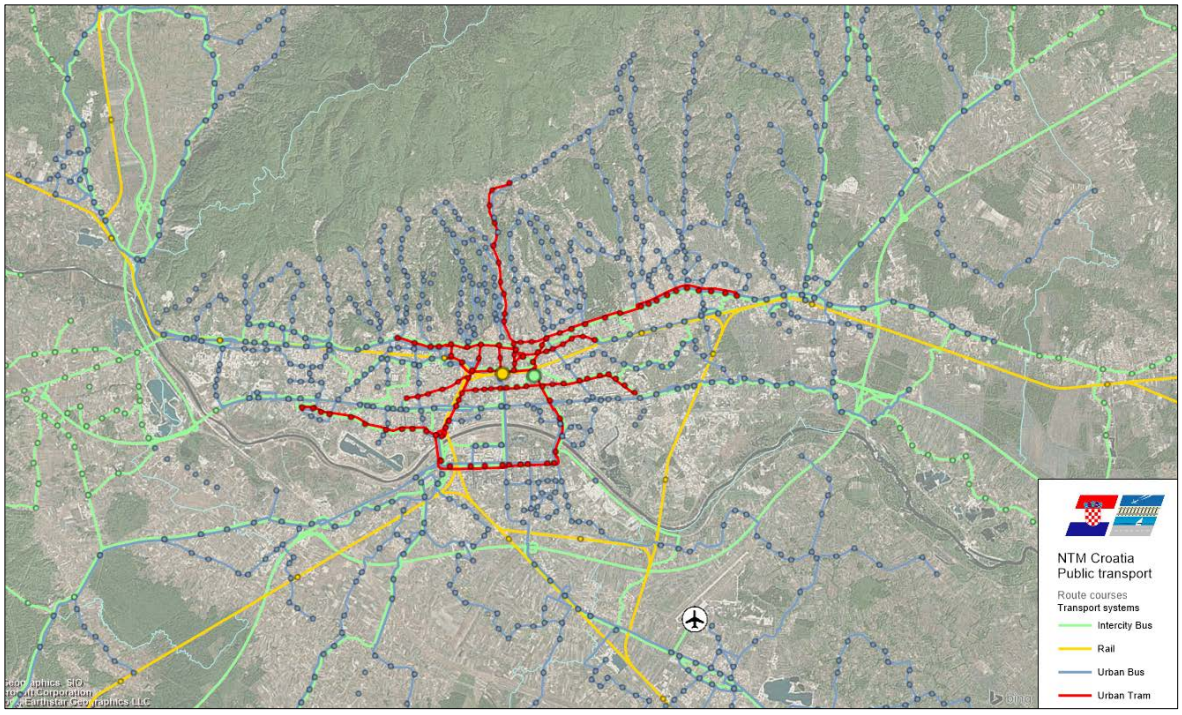
- In the Zagreb node, the rail and the tram are serving the same functionality.
- In Zagreb, buses and trams are integrated and are not competing with each other.
- The rail and bus system between Zagreb and other regional centres is not harmonized, neither operationally nor organizationally.
- "Parallel" routes and overlapping of tram and/or bus lines with railway are observed in other urban areas of the Republic of Croatia.

Note

As part of the Zagreb public transport system, ZET operates tram and bus lines, and their routes and lines are very well integrated, with no overlapping. Urban and suburban railway lines are operated

by HŽPP and are parallel to the lines operated by ZET. Figure 48 shows Zagreb PT lines, where we can observe buses and railway lines serving the same routes.

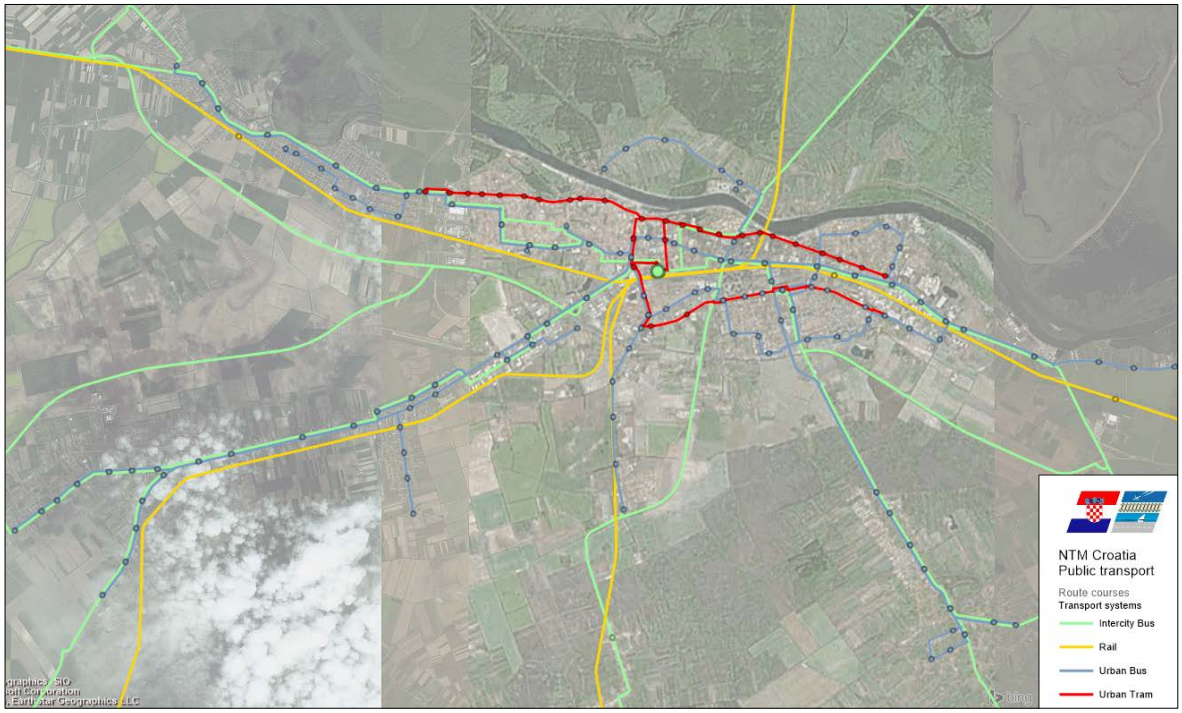
Figure 338: Zagreb Public transport(red – tram lines, blue – bus lines,yellow – railway,green - intercity bus)



Source: NTM

A similar situation is in Osijek, where local public transport company GPP runs trams and buses, while HŽPP operates the trains. Figure 49 shows the PT in Osijek. Again, bus lines are competing with railway.

Figure 49: Osijek Public Transport (red – tram lines, blue – bus lines, yellow – railway, green - intercity bus lines)



Source: NTM

The Table 10 shows the number of passengers carried on certain routes in the Zagreb region in 2014. We have compared the railway, bus and personal car transport. As expected, the personal car transport carries by far more passengers than buses and rail combined. Bus lines are particularly trying to take over railway passengers by offering cheaper ticket prices even though the bus ticket price does not bring any profit. As a result, instead of complementing each other, they are competing, but still lagging much behind the personal car transport.

Table 10: Comparison of number of passengers carried in 2014

Type	Line/direction	in 000
Rail	Zagreb Gk - Zaprešić - Zabok/Đurmanec/Gornja Stubica/Budinščina	141
Bus	Zagreb – Zabok	130
Personal car	Zagreb - Zabok/Zaprešić	10,500
Rail	Zagreb Gk - Dugo Selo - Križevci/Bjelovar	193
Bus	Zagreb - Vrbovec – Bjelovar	265
Personal car	Zagreb - Dugo Selo - Križevci/Bjelovar	4,900
Rail	Zagreb Gk - Dugo Selo - Novoselec/Kutina	170
Bus	Zagreb - Ivanićgrad – Bjelovar	168
Personal car	Zagreb - Dugo Selo – Ivanić Grad – Kutina	4,000
Rail	Zagreb Gk - Velika Gorica - Sisak/Sisak Caprag	573
Bus	Zagreb – Sisak	504
Personal car	Zagreb - Velika Gorica – Sisak	3,800
Rail	Zagreb Gk -Hrvatski Leskovac - Karlovac/Duga Resa	355
Bus	Zagreb - Karlovac	343
Personal car	Zagreb – Karlovac	7,500

Today, the public passenger transport in Zagreb operates through a network of tram, bus and train lines. Although the railways came first to Zagreb (1862), the organized public transport of urban passengers started in late 1880s. Tram in Zagreb runs since1891, but as an electric tram since 1910. Today's tram network consists of 116 km of tracks with 210 stops and 15 daily and 4 night lines, transporting annually more than 200 million passengers. ZET is also the operator of the public bus transport, with 132 daily and four night lines that are connecting the City of Zagreb, Velika Gorica and Zaprešić. Passenger transport is also organized in the municipalities of Bistra, Luka, Stupnik and Klinča Sela. The total length of the bus lines is 1,363 kilometres, with 2,120 stops.

The tram and bus networks are very well integrated, without any parallel lines. They are both operated by ZET. The analysis of the bus and railway network shows several parallel lines.

So far, no cooperation between bus and railway operators has improved the coverage or increased the number of passengers carried. In Zagreb PT there is a joint ticket that allows passengers to travel by ZET and use urban and suburban trains operated by Croatian Railways, though no revision has ever been made to remove or at least cut the "parallel" lines. Until 2011 the City of Zagreb provided subsidies for public transport tickets, including a joint HŽPP and ZET ticket. Such subsidised tickets increased the number of passengers, although there is a statistical "gap" in the number of passengers carried by rail in 2011 and 2012 due to changes in the passenger measurements.Based on the agreement between ZG Holding, ZET and HŽPP, concluded on 1st of

Match 2017 comon freight tickets of ZET + HŽ in the public transport of the City of Zagreb reduced between 35%, which brought prices to the level abolishing subsidies.

2.3. RAIL TRANSPORT

2.3.1. HYPOTHESIS

The potential of growth of freight traffic on the railway line between Zagreb and Rijeka is significant.

Source

National Traffic Model for the Republic of Croatia (NTM); Port of Rijeka statistics; HŽ Infrastruktura

Key findings

- The functionality of the railway line between Zagreb and Rijeka is mainly passenger over the whole line from Zagreb to Rijeka, but a part from commuters between Zagreb and Karlovac, and around Rijeka, IC passenger transport between Zagreb and Rijeka and Split is very limited.
- Due to the ongoing investments on the freight terminals of Port of Rijeka (National main port), the freight growth rates can be expected to be higher than the standard country growth rates.
- A logistic concept for the railway sector largely utilizing the Croatian network will be developed, and the cooperation with the neighbouring countries will be optimized, above all Hungary, BiH, Slovakia, Italy and Serbia which show the strongest freight loading and unloading volumes in relation to national rail cargo operators, in the Republic of Croatia.

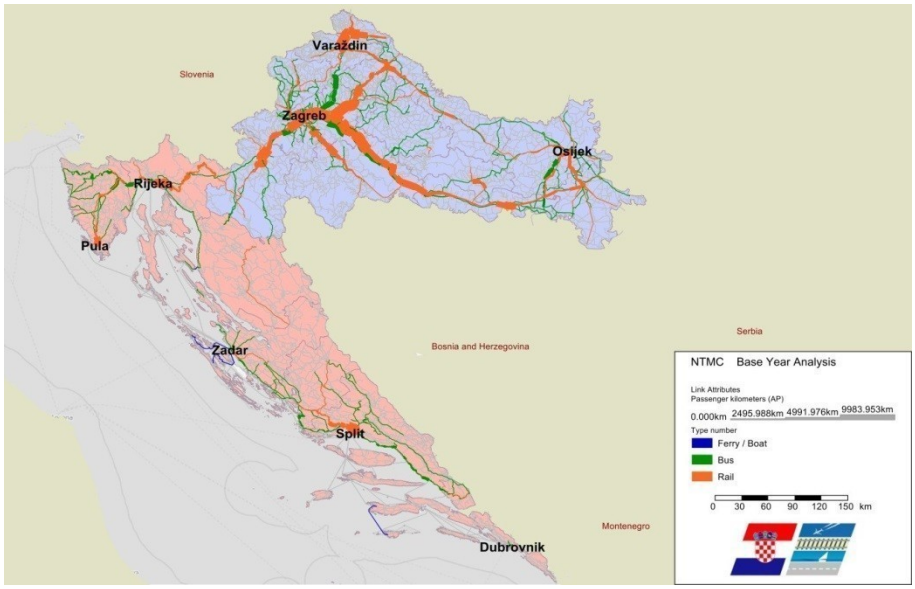
Note

IC passenger transport between Zagreb and Rijeka and Split due to inadequate offer (duration of travel) is very limited,apart from daily commuters between Zagreb and Karlovac, and around Rijeka – figure 50).

The share of railway cargo transport with the source and destination in the Port of Rijeka in the 1990's amounted to about 90%. However, construction of the new motorway diverted much of the cargo to the road transport. Today, the railway participates in delivery/dispatch of goods with

approximately 25% which means that realized freight transport has dropped to a third of the value achieved thirty years ago.

Figure 50: Average passenger transport volume between Zagreb and Rijeka (blue - navy lines, green - bus lines, orange - rail lines)



Source: NTM

According to the available data, taking into account the dry cargo, about 70% of the transport to / from the port of Rijeka takes place by rail transport.

Table 11: Freight operation volumes in Port of Rijeka rail stations

Year	Cargo [NT]	Passenger
2006	10,887,048	221,860
2007	13,212,464	211,988
2008	12,391,591	217,324
2009	11,238,154	203,954
2010	10,183,304	186,376
2011	9,390,380	171,396
2012	8,554,001	169,190
2013	8,687,679	173,062
2014	9,022,776	159,607
2015	10,900,421	153,304

Source: Port of Rijeka development strategy

The Port of Rijeka development strategy is to increase the port present capacity of about 10 million tons of dry cargo to around 20 million tons by the year 2017. Together with planned liquid cargo, port capacity should amount to 45 million tons. Planned major investments in the Port development

by 2030 should further increase its capacity to over 30 million tons of dry cargo, i.e. to a total of over 55 million tons. It can be assumed that the cargo operations in Ports railway stations (Rijeka, Rijeka Brajdica, Bakar) will amount to 12 million net tons by the year 2045. It is necessary to analyze in more detail the possibilities of increasing the share of railway transport in the scheduled freight traffic mentioned in Table 12.

Table 12: Planned cargo volumes in Port of Rijeka

Year	Projected Port Cargo [MNT]	Projected Rail Freight Transport [MNT]
2015	10.9	2.8
2020	20.0	5.1
2025	37.0	8.1
2030	45.0	10.0
2035	49.0	10.9
2040	53.0	11.7
2045	55.0	12.0

Source: Port of Rijeka

Furthermore, the competitiveness of the northern Adriatic ports might be strengthened compared to the Atlantic ports. At the European Union's call for project proposals in its co-financing of TEN-T (Trans European Network - Transport) links, NAPA (North Adriatic Ports Association) has been granted 50% funding for its ITS Adriatic Multi-Port Gateway project. Traditionally used as a transit port for countries of Central and Central-Eastern Europe, Port of Rijeka is the most convenient transit hub for the Republic of Croatia, Hungary, Austria, Czech Republic, Slovakia, the western part of Ukraine, the southern part of Poland and the southern part of Germany.

Table 13: Rail distances from Port of Rijeka

City	Rail distance from Port to City [km]
Munich	574
Prague	844
Vienna	572
Bratislava	686
Budapest	592
Belgrade	669
Zagreb	229
Sarajevo	490

The development and modernization of the Port is not accompanied by concurrent development of railway infrastructure of Rijeka hinterland. Rail line capacity is approximately 6.5 million net tons

per year, mostly because of the poor operation characteristics of line section Rijeka-Lokve. This line section is on Mediterranean corridor and on national RFC6 corridor.

2.3.2. HYPOTHESIS

The potential for using the railway system for inner-agglomeration communication in Zagreb and Rijeka is significant, there is the potential for the better integration of the railway into other cities PT systems (for example: Split, Osijek, Varaždin, etc.)

Source

National Traffic Model for the Republic of Croatia (NTM); HŽI Network Statement 2015; Zagreb railway node study

Key findings

- The operational concept for passenger traffic on the railway network in Zagreb is mainly focusing on delivering the passengers at the Zagreb Main Station
- The location and the connectivity of railway stations and stops in the Zagreb wider agglomeration is not convenient for PT commuters
- There is no timetable or ticket integration between rail and other PT systems
- The congestion on the road network during the daily peak time is significant, which is a push factor for the use of Public Transport

Note

Zagreb railway node is an intersection of RH1 and RH2 corridors (formerly the Pan-European Corridor X and Vb). Under current conditions, it stretches from Savski Marof station in the west up to Dugo Selo station in the east, and Hrvatski Leskovac station towards Rijeka and Zagreb Klara station towards Velika Gorica. All the lines in the node area are electrified, protected by a relay interlocking and signal - security device except Zagreb Main Station where an electronic signal - safety device is installed (train traffic is flowing block space interval, except between Zagreb GK and Zagreb ZK where traffic takes place at the railway distance). Average speeds on all lines are 60 to 140 km/h. There are 14 rail stations and 11 stops in the node area. The freight transport through the node takes place on the Zagreb West Station - Zagreb Klara - Zagreb Ranch station - Sesvete, i.e. it does not run through the Zagreb Main Station (Zagreb GK) in the center of the not but greatly influences the organization of passenger traffic (urban, suburban , Longitudinal) on other parts of the node.

Urban and suburban traffic represent an important component in Zagreb and the surroundings. Four lines for inner-agglomeration (IA) rail passenger transport in Zagreb are organized on following rail network sections: Zagreb GK - Sesvetski Kraljevec (15.4 km of M102 Zagreb Gk - Dugo Selo rail line), Zagreb GK - Podsused (11.3 km of M101 DG - S. Marof - Zagreb Gk rail line), Zagreb GK-Odra (10.4 km of M502 Zagreb GK - Sisak - Novska rail line), and Zagreb GK-Mavračići (19.9 km of M202 Zagreb GK-Rijeka rail line). The operational concept for passenger is mainly focusing on delivering the passengers from suburban areas to the station Zagreb.

IA rail passenger network in Zagreb is characterized by uneven station arrangement with relatively large interstation distances. This disparity is particularly pronounced on IA rail lines to south and south/west suburban areas of Odra and Horvati (table 14).

Table 14: Station/stops distances, average travelling time between stations/stops

Station	Distance [m]	Average travelling time [min]
Line Zagreb GK - Sesvetski Kraljevec (M102 Zagreb Gk - Dugo Selo)		
Zagreb GK	-	-
Maksimir	3,680	5
Trnava	2,055	4
Čulinec	1,131	2
Sesvete	3,715	4
Sesvetski Kraljevec	4,831	6
Line Zagreb GK - Podsused (M101 DG - S. Marof - Zagreb Gk)		
Zagreb GK	-	-
Zagreb ZK	2,094	4
Kustošija	2,115	2
Vrapče	2,385	3
Gajnice	1,846	3
Podsused	2,868	4
Line Zagreb GK-Odra (M502 Zagreb Gk - Sisak - Novska)		
Zagreb GK	-	-
Klara	7,224	11
Odra	3,134	4
Line Zagreb GK-Mavračići (M202 Zagreb GK-Rijeka)		
Zagreb GK	-	-
Remetinec	5,927	9
Hrvatski Leskovac	4,819	5
Horvati	6,736	6
Mavračići	2,462	3

At present, rail public transport in Zagreb is not integrated with public bus and tramway system. Central parts of east to west line Sesvetski Kraljevec-Zagreb GK-Podsused could compete with existing well developed tram and bus network because of their parallel routes, but most of the train

stations (apart from Zagreb GK and Zagreb ZK) are located more than 0.5 km from the tram and bus terminals. This repels the PT users from possible rail transport use, even though the train travelling time on this part of node is much shorter in comparison to other urban transport systems.

Rail lines of various forms of public transport are not harmonized and since 1st of March 2017 a contract has been concluded between HŽPP and ZET and the following prices are in force: general monthly ticket - 400 kn, elementary school pupils - 200 kn, students High school, student, pensioner and social category cards - 200 kuna, with the mention that the City of Zagreb does not participate in subsidizing the same. The withdrawal of Zagreb City and national subsidies to certain population groups for the purchase of tickets in 2011 resulted in drastic fall in the number of passengers using rail public transport system (from almost 54 million in 2009 to almost 2 million passengers in 2015, see table 15).

Table 15: Passenger transport volume on GPP Zagreb City, 2005-2015

Year	Sold tickets ZET-HŽ	Number of passengers (thousands)	PKM (millions)
2005.	492,162	21,655	325
2006.	650,081	28,604	429
2007.	1 009743	44,428	666
2008.	1,192,040	52,450	787
2009.	1,225,185	53,908	809
2010.	1,136,635	50,008	750
2011.*	669,322	29,450	442
2012.	106,173	4,672	70
2013.	70,299	3,093	35
2014.	55,802	2,455	28
2015.	48,098	2,116	23

Today PT passengers tend to choose only one PT operator or personal automotive transport. This general reduction in demand for rail PT and increase in car transport in combination with reduction of the cost of parking and the expansion of parking zones in the city wider centre increases the negative impact of urban transport on the environment, overall traffic situation and deteriorates the living conditions.

Apart from Zagreb, there is also a large potential for better integration of the railway system into existing PT systems of Split, Osijek, Rijeka and Varaždin and potentially other cities..

The Split suburban railway network was renewed in 2006. It consists of one line 17.8 km long serving altogether seven train stations, running from Split-Harbour to Kaštel Stari. An average train ride lasts for around 25 minutes. The line passes through two tunnels under the very centre of city,

near existing regional (intercity) and local bus terminals, but there is no integration with this existing bus public transport because there are no train stops in this area.

City of Rijeka has well developed rail network currently not used for PT. PT in the City of Rijeka is organized by 19 bus lines which cover the entire metropolitan area. There is a potential for incorporation of rail PT system on the existing rail route from Matulji to Škrljevo. The existing railway line in Rijeka is very well placed within the city area in terms of establishing public railway transport in the area of Rijeka agglomeration and is presenting valuable but today insufficiently used spatial and infrastructural resources.

In these and other cases a detailed assessment of operational options is recommended (functional region master plan).

2.3.3. HYPOTHESIS

The overall condition of national rail operators rolling stock is not adequate to modern transport needs including both Passenger and Cargo rolling stock.

Source

National Traffic Model for the Republic of Croatia (NTM); HŽ Cargo and HŽPP programme for modernization of transport capacities

Key findings

- Investments in railway infrastructure are not accompanied by modernization of rolling stock.
- Operational characteristics of old rolling stock have negative impact on infrastructure in terms offaster track superstructure degradation and also inadequate and inadequate maintenance of the track affects the bottom of tow and towed vehicles. .
- Prior to rolling stock modernization it is necessary to create a study that will point out deficiencies in the existing fleet ss well as the technical requirements that the new fleet needs to meet.

Note

Average age of HŽPP and HŽ Cargo rolling stock is more than 30 years. The passenger fleet of HŽPP consist of multiple unit trains, and diesel and electric locomotives for hauling conventional closed passenger coaches. The freight fleet consists mostly of covered or open wagons, some suitable for combined traffic operations, and diesel and electric locomotives. The passenger fleet is

mostly based on outdated and inefficient communication, information and access technologies. Many locomotives need replacement, with an estimated 70% reaching the end of their working lives within the next decade.

The characteristics of the old rolling stock are such that they cannot meet the requirements of modern rail freight and passenger traffic. Main problems are lack of compatibility between fleet and rail infrastructure, and accessibility for people with reduced mobility. Modernization of fleet and integration of rail system in PT within the Zagreb urban region is a rare example of successful revitalization of rail passenger transport in the country.

To increase the competitiveness of rail passenger and freight transport in comparison with other transport modes it is necessary to modernize the rolling stock in coordination to the foreseen improvements on the infrastructure. The first step of this process should be to perform a comprehensive analysis of the current organizational, operational and maintenance setup of the railway operator in relation to the existing and future transport requirements, operational and maintenance plan. Once the real needs are identified, further studies should define the specific technical requirements for the rolling stock.

2.3.4. HYPOTHESIS

Unsatisfactory maintenance level of infrastructure which causes limitations in operation together with low security standards on rural stations is preventing passengers from the use of the railway system.

Source

Maintenance data, available financial resources, maintenance management, National program of HŽ Infrastructure 2016-2020

Key findings

- The key elements of the railway network are not properly maintained due to lack of funding
- Due to the war in the 90ies, some parts of the railway lines were destroyed and/or have not been properly maintained
- Safety and signalling equipment is outdated and needs to be renewed
- Most of the telecommunication equipment is at the end of its economic and useful lifetime
- Modern security and access standards are not met on most rural stations

Note

Due to deterioration and overall technical state of open track superstructure regarding operational safety requirements, normal or increased maintenance procedures can be implemented only on 45.6% of total track length. On remaining 54.4%, it is necessary to carry out investment projects or more extensive maintenance procedures. Current tracks condition enables achieving maximum travelling speed equal to designed speed value on 18% of the network. Because of the safety reasons, train speed of 160 km/h is allowed only on 7.14% of open tracks, and train speed of 100 km/h is allowed on 12.2%. 12.4 % of the tracks have speed limits under 60 km/h. The above mentioned speed limits are conditioned by the state of the infrastructure.

Overall length of overhead contact line (catenary) on electrified lines is 1827 km. During the war in the 90s 633 km of catenary was damaged. Today there are still 62 km of catenary out of order and waiting for repair. Two electric traction systems are in use on Croatian rail network: AC 25kV / 50Hz and DC 3kV (only on 3 km railway line from Šapjane to state border). Insufficient investments caused deterioration of the technical state of the electric traction system and particular facilities are now in critical condition. Prescribed renewal of the system every 8 to 10 years has not been carried out due to lack of funds in the past 35 years. For all these reasons, it is necessary to thoroughly revitalize the entire system to maintain the functionality and traffic safety.

Most of the tracks in stations on main (corridor) rail lines for international traffic are equipped with out-of-date relay interlocking equipment. Small portion of tracks is not secured at all because the equipment damaged during the war was never renewed. Zagreb main station (Zagreb GK) is equipped with electronic signalling safety device. Only part of the tracks in stations for regional and local traffic is equipped with relay interlocking equipment. Open track segments on these lines do not have any safety and signalling equipment. Existing equipment is 25 to 40 years old and therefore technologically obsolete so it can’t meet the demands of technical standards for trans-european rail system interoperability.

Most of the telecommunication equipment is older than the declared operational lifetime and technologically obsolete. Cables are 25 to 70 years old. Lines are over 70 years old. Analog transmission and railway telecommunication devices are 18 to 40 years old, and the age of automatic telephone exchanges is up to 60 years. Radio dispatcher devices are up to 35 years old. Due to its obsolescence, deterioration and incompleteness, telecommunication system on the Croatian rail network will not be able to meet and follow the demands of modern railway traffic.

The condition of tracks and turnouts in stations is poor. In most stations, there is not enough free space to construct island platforms. Reconstruction of tracks in station zones and construction of suitable access routes for passengers which will consider the legal requirements regarding access of people with limited mobility are necessary.

Figure 51: Examples of the security problems at the stations in rural areas Blata, Benkovac, Unešić and Đurmanec (no surveillance systems, lights, unsecure access paths)

2.3.5. HYPOTHESIS

International rail passenger traffic is mainly related to the corridor RH1 (Slovenia and Serbia).

Source

National Traffic Model for the Republic of Croatia (NTM); Croatian Bureau of Statistics; HŽI; HŽPP

Key findings

- The functionality on corridor RH1 is passenger on the whole corridor, mainly because of rail PT in the Zagreb node area, and IC between Zagreb and Slovenia and Zagreb and central Slavonia
- Apart from connections between Serbia and Slovenia, the potential of regular international passenger transport is limited.
- International passenger railway traffic on Croatian part of corridor RH1 and RH2 is of lesser importance than freight traffic.

Note

Passenger transport is dominant on corridor RH1, mainly because of PT service in the Zagreb node and IC between Zagreb and central Slavonia. The functionality on corridor RH3 is freight, and on RH2 predominantly passenger but of local/regional nature because of the lack of adequate supply.

Most of international passenger railway traffic from Croatia towards Slovenia (Germany) is taking place on small section of corridor RH1. Number of international passengers on this corridor counts more than 160,000 passengers per year, which is still very low. International transport on corridor RH2 from Croatia to Hungary is much lower (around 50,000 passengers per year). It can therefore be concluded that the international passenger railway traffic on corridors RH1, RH2 and RH3 is not a priority for railway business development. There are about 700 passenger and about 110 freight trains on daily voyages in the Republic of Croatia

Table 16: Percentage of freight and passenger train movements by corridors and lines

Corridor/Line	% of train km per corridor/line	
	Freight	Passenger
RH1 (X)	21	79
DG - Savski Marof - Zagreb GK	12	88
Zagreb GK - Dugo Selo	10	90
Dugo Selo - Novska	24	76
Novska - Vinkovci - Tovarnik - DG	26	74
RH2 (Vb)	40	60
DG - Koprivnica - Dugo Selo	33	63
Zagreb GK - Karlovac - Rijeka	42	58
Rijeka - Šapjane - DG	40	60
RH3 (Vc)	20	80
DG - Beli Manastir - Osijek	16	84
Osijek - Strizivojna Vrpolje	6	94
S. Vrpolje - S. Šamac - DG	38	62
DG - Metković - Ploče	99	1

Figure 52: Corridors of the basic and comprehensive railway network in the republic of Croatia in accordance with EU Regulations 1315/2013, Delegated EU Regulation 2017/849

Source: EU 1315/2013, Delegated EU Regulation 2017/8492

2.3.6. HYPOTHESIS

Increasing the interoperability of the Croatian railway network with the railway network of the neighbouring countries (in particular Slovenia and Hungary) has a significant potential for improving the Modal Split in favour of the rail system.

Source

DG MOVE homepage, chapter 3. of National program of railway Infrastructure for the period 2016-2020

Key findings

- Level of interoperability on Croatian corridor railway network is low.
- Ensuring interoperability on lines other than the corridor lines could allow increasing the interoperability of the entire Croatian rail network.

Note

In terms of railway infrastructure interoperability characteristics, over 80% of tracks on Croatian rail network are designed for axle loads of 20 tonnes per axle or larger (up to 22.5 tonnes per axle). Structure gauge GC is provided on 54.6% of the network. 2.7 % of the network has the structure gauge limitation of GA. Further studies should determine gradual (phased) preparation of technical documentation and construction works needed to achieve required levels of interoperability on corridor lines. It should also consider upgrading other connecting non-corridor lines. The current state of railway infrastructure subsystems and projects whose implementation is in progress as well as the financial resources needed for the development of technical documentation, procurement of equipment and construction works should be analysed.

To enable required interoperability on rail lines on the European corridors in the framework of the European Rail Traffic Management System (ERTMS), the introduction of a European Train Control System (ETCS), as well as digital radio communication rail system Global System for Mobile Communications - Railway (GSM-R) is needed. Dependent on the operational concept it might be feasible to install ETCS and GSM-R on other lines of the Croatian network (comprehensive and non-TEN-T). ETCS Level 1 involves continuous supervision of train movement while a non-continuous communication between train and trackside (normally by means of Euro-balises). Lineside signals are necessary and train detection is performed by the trackside equipment out of the scope of ERTMS. ETCS Level 2 involves continuous supervision of train movement with continuous communication, which is provided by GSM-R, between both the train and trackside.

Lineside signals are optional in this case, and train detection is performed by the trackside equipment out of the scope of ERTMS. Further studies must define specific needs and technical parameters (ETCS Level 1 or 2) in each case.

2.3.7. HYPOTHESIS

A safety problem at the level crossings between rail and road.

Source

Black spot analysis, statistical data, official data from MUP from Deaths in the Republic of Croatia, http://www.hzinfra.hr/vjub-opcenito; Chapter 3.7.4. of the National program of HŽ Infrastructure 2016-2020

Key findings

- Railway Infrastructure in Croatia consists of 2,605 km and there are 1,520 level crossing, of which 70 are pedestrian crossings. 63% of all level crossings are secured only by a road traffic sign ("St Andrew's cross" and the sign "Stop") and a visibility triangle.
- 60% of all accidents on level crossings occur on those secured only by a road traffic sign.

Note

On 2,605 km of railway tracks in Croatia there are, in total around 1,520 level crossings between rail, road and pedestrian traffic flows. Distribution of level crossings regarding the type of protection is given in table 17.

Table 17: Types of level crossings

Significance of line	Total	Rail-road crossings protected with		Pedestrian crossings protected with	
		road signs	devices	road signs	devices
International	592	219	327	36	10
Regional	440	276	149	15	-
Local	468	387	71	9	1
Tracks out of station	13	6	7	-	-
Total		888	554	60	11
Total number of rail-road crossings		1.442			
Total number of pedestrian crossings			71		
Total number of level crossings	1.513				

Note: data without line L217 Sisak Caprag - Karlovac

On 63% of all crossings there are no automatic or mechanical security devices (ramps). They are secured only by a road traffic sign ("St Andrew's cross" and the "Stop" sign) and a sight triangle. Such crossings represent critical "black" spots on railway network because on these locations most rail accidents, often with human casualties and deaths, occur (table 18).

Table 18: Number of level crossings accidents

Year	2010	2011	2012	2013	2014
Rail-road crossings protected with devices	11	13	17	11	11
Rail-road crossings protected with road signs	25	20	20	17	22
Pedestrian crossings	0	0	0	0	0
Total	36	33	37	28	33

On average, 60% of all accidents on level crossings occur on crosings secured only by a road traffic sign. Fatal accidents mostly occur at crossings with small traffic volumes of both transport modes, on the county, local and unclassified roads in or near the settlements when car drivers do not respect the regulations. Some of the accidents are related to the low visibility. This problem is present on many crossings located on local and unclassified (field and forest) roads and very frequent pedestrian and road crossings situated on unclassified roads in cities.

2.3.8. HYPOTHESIS

There is a problem with the environmental impact of railway operations along the corridor Zagreb to Rijeka.

Source

Noise exposure of population, NATURA 2000 protection status and other

Key findings

- The old rolling stock is deteriorating the infrastructure and therefore the noise levels during operations are high, however the noise level is also influenced by the structural design of the tracks, which are done with a large number of curves, ups and downs.
- The drainage system along the corridor is insufficient and/or out of service.

Note

The overall quality of the railway infrastructure along the RH2 rail corridor from Zagreb to Rijeka is quite low since the maintenance was reduced over many years due to lack of funding of the railway network. Additionally, average age of HŽPP and HŽ Cargo rolling stock is more than 30 years, which means that the rolling stock is deteriorating the somewhat upgraded infrastructure even faster than expected. The main consequence of the poor contact quality between rolling stock wheels and rails is that the rail traffic noise levels, especially in urban areas, are higher than prescribed.

Drainage system along the rail corridor from Zagreb to Rijeka functions as an open system with open ditches, without a purifier, which means that in the case of an accident harmful substances can directly go to the water protected area. Drainage system on many track sections was not renewed and it is out of service.

A set of measures consisting of infrastructure (closed drainage system) renewal, rolling stock purchase, noise barriers construction, etc. should be implemented to solve the problems.

2.3.9. HYPOTHESIS

There is a lack of logistic coordination (knowhow) on the railway system.

Source

HŽ Infra, HŽPP, HŽ Cargo

Key findings

- Some renewed sections of network are heavily under utilized considering the available capacity.
- There is a lack of business coordination in the railway sector
- There is a need of better coordination between infrastructure manager and railway carriers

Note

The freight modal split between rail and road is in favour of road transport, even on corridors where a developed railway alternative is existing and the railway freight market has been opened. For instance, modal split concerning the cargo going from/to Port of Rijeka is very high in comparison to other similar ports in the surroundings.

The source of problem is that rail track maintenance and renewal projects and operations are not well coordinated with current and/or planned freight and passenger transport. To improve the efficiency and effectiveness of the railway system moving towards a more sustainable setup, changes in the organisation and higher degree of coordination between HZ Infrastructure Ltd, HZ Cargo Ltd., and HŽPP Ltd. are required (improvements in the production chain such as modalities for operating services, maintenance, offering added value services in a more user oriented approach etc.).

Adequate structures and organisation for maintenance, renewal, planning and construction activities must be put in place to provide an efficient and effective/sustainable rail service. The concept must derive from an appropriate and specific joint analysis of the HZ Infrastructure Ltd, HZ Cargo Ltd. and HŽPP Ltd., considering technical, financial and users' requirements, the indications from Directive 2008/57/EC on the interoperability of the rail system respecting EU Directives and Regulations, as well as legal and subordinate acts.

2.3.10. HYPOTHESIS

The financial sustainability is not provided to the railway system.

Source

HŽ Infra, HŽ PP, HŽ Cargo

Key findings

- Current operations of all three mayor companies in Croatian railway system are not sustainable without government support
- Railway sector PSCs are in compliance with EU Regulative 1370/2007
- Financial sustainability is a key factor for development of railway system in the Republic of Croatia

The European Commission closed the restructuring program of the HŽ Putnički prijevoz d.o.o. and HŽ Cargo d.o.o.***Note***

The railway system of the Republic of Croatia is formed by three large companies: HŽ Infrastruktura d.o.o. (HŽI), HŽ Passenger Transport d.o.o. (HŽPP) and HŽ Cargo d.o.o (HŽC) and other railway carriers registered in the Republic of Croatia. HŽI provides services to the railway network according to the demand of the other two companies (HŽPP and HŽC) and other users who depend on the demand of passengers and carriers.The number of train kilometres achieved on HŽI's rail network has declined from 24.1 million in 2012 to 20.3 million kilometres in 2014 – in 2015, the number of train kilometres has stabilised at 20.4 million. Revenues from government funding of HŽI in FY 2015 reached HRK 956m. HRK 516m were intended for railroad infrastructure and traffic regulation while HRK 172.1m were derived from excise duties (20 lipa per litre of fuel sold).

Table 19: HŽI summary P&L ststement 2012-2015

HRK (thousands)	2012	2013	2014	2015
Sales revenues	227.635	259.527	214.276	208.091
Income from the Budget of the Republic of Croatia for the railroad infrastructure	855.000	515.809	952.490	956.000
Funds from the state budget for the railroad infrastructure and traffic regulation	855.000	515.809	516.000	516.000
Funds from the state budget derived from excise duties (20 lipa per litre of fuel sold)	-	-	436.490	440.000
Other operating revenues	71.550	123.199	173.345	172.110
Total operating revenues	1.154.185	898.536	1.340.111	1.336.201
Material expenses	210.424	340.866	379.233	377.487
Employee expenses	893.390	784.375	682.509	671.740
Other operating expenses	218.595	537.163	314.898	205.024
Total operating expenses w/o D&A	1.322.409	1.662.404	1.376.640	1.254.251
EBITDA	168.224	763.868	36.529	81.950
Depreciation and amortisation	71.939	58.134	50.027	49.859
EBIT	240.163	822.002	86.556	32.091
Financial revenue	21.053	4.571	132.749	4.634
Financial expense	12.833	20.587	55.496	25.801
Net financial result	8.220	16.016	77.253	21.167
Profit /(loss) before tax	231.943	838.018	9.303	10.924
Corporate profit tax	-	-	-	-
Profit (loss) after tax	231.943	838.018	9.303	10.924
EBITDA margin, %	14,6 %	85,0 %	2,7 %	6,1 %
EBIT margin, %	20,8 %	91,5 %	6,5 %	2,4 %
Net income margin, %	20,1 %	93,3 %	0,7 %	0,8 %
Number of employees, end of period	6.436	5.438	5.097	5.029

Source: Annual Financial Statements, after the audit

As seen from the table above current operations of HŽI are not sustainable without government support. In order to achieve financial sustainability HŽI should consider the following key strategic options and activities:

- implementation of restructuring and/or cost optimization programme,
- significant reliance on EU funding of infrastructure projects (e.g. Connecting Europe Facility – CEF),
- sign new railway infrastructure management contract with Government of the Republic of Croatia,
- implementation of revised track access charges system in line with EU legislation, etc.

HŽ Putnički prijevoz d.o.o. is leading passenger Railway Company in Croatia. Its primary activity is the public transport of passengers in domestic and international rail transport. Revenues from

government funding in FY 2015 were HRK 537,3m. In order to ensure that operations by HŽPP can be maintained, HŽPP has a Public Service Obligation („PSO") contract with the Government of the Republic of Croatia. In 2014, HŽ PP derived 52% of total operating revenues from transfers from the budget (per PSO contract) i.e. a total of HRK 498,3 million. In 2016, HŽ PP signed a year long PSO contract, and is currently preparing a multi-annual Public Service Contract.

Table 20: HŽPP summary financials 2012-2015

HRK (millions)	2012	2013	2014	2015
Operating revenue	783,7	847,3	990,5	908,6
Operating expense	1.004,5	1.052,2	967,9	882,3
Operating profit/(loss)	220,8	204,8	22,6	26,3
Net profit after tax/(loss)	127,9	362,2	3,0	2,5
Total assets	1.971,4	1.759,3	1.715,4	2.195,3
Total shareholder's equity	152,7	209,2	28,4	30,6

Source: Audited financial statements in 2013, 2014 and 2015.

Improved financial performance should be one of the key goals of HŽPP in the near future. Liberalisation of the passenger train market planned not before 2019 will impact HŽPP's future operations. It may be the case that this liberalisation might potentially be further delayed. Once when the liberalization will be implemented it could be reasonably expected that other passenger train operators will substitute and/or complement existing HŽPP services at least on potentially profitable routes or routes subject to PSO contracts.

HŽ Cargo is state owned company that provides rail freight transport services via domestic and international rail transport and combined transport. In addition, company AGIT owned by HŽ Cargo provides cargo reload on railway stations and other places. The full effects of market liberalisation of the Croatian railway cargo market is not yet fully clear however, is currently resulting in only a very slow acquisition of market share by these new cargo operators in the context of a still declining cargo market – however, by late 2015, there are signs that this has stabilised, while in the year 2016 there was a 14% increase in freight transport activity..

HŽ Cargo was the subject of privatization efforts in 2014 – however, negotiations with potential investor broke down. In 2015, Government of the Republic of Croatia as the sole owner of HŽ Cargo recapitalized company and issued state guarantee if respect of the loan HŽ Cargo received from the World Bank. Currently, the topic of HŽ Cargo restructuring programme has been closed by European Comission.

Table 21: HŽ Cargo summary financials 2012-2015

HRK (millions)	2012	2013	2014	2015	2016
Operating revenue	1.017,9	891,7	850,1	852,6	519,0
Operating expense	1.246,9	1.061,2	930,9	828,4	595,0
Operating profit/(loss)	229,0	169,5	80,8	24,2	14
Net profit after tax/(loss)	248,5	243,7	170,5	12,5	(121)
Total assets	2.057,1	1.826,6	1.696,5	1.528,0	1.438,9
Total shareholder's equity	172,7	64,3	221,1	912,0	791,0

Source: Audited financial statements in 2013, 2014 and 2015.

In the medium term and potentially sooner in case of the absence of strategic measures, the survival of HŽ Cargo could be questionable and hence poses a risk to the whole Croatian railway system.

2.4. ROAD TRANSPORT

2.4.1. HYPOTHESIS

The basic road network in the Republic of Croatia has been established.

Source

Croatian Bureau of Statistics; Croatian Motorways Ltd; Rijeka-Zagreb motorway PLC; Croatian Motorways Maintenance and Tolling Ltd; BINA-ISTRA Ltd; Motorway Zagreb – Macelj Ltd; Croatian Roads Ltd; HUKA

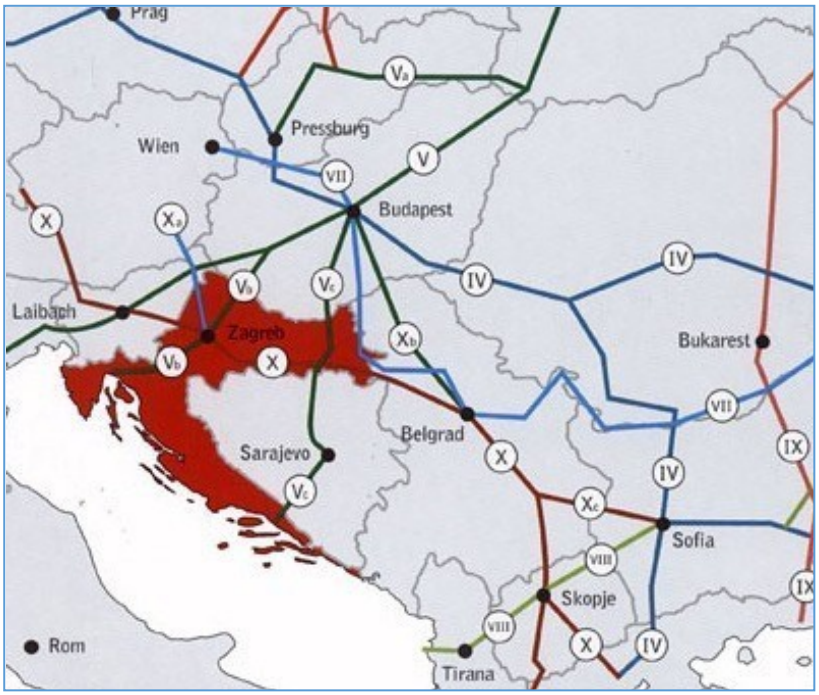
Key findings

- TEN-T corridors in the Republic of Croatia are Vb (TEN-T Mediterranean Corridor), Vc (TEN-T comprehensive network), X (TEN-T core network) and Xa (TEN-T comprehensive network)
- The road network in the Republic of Croatia consists of 1,419.50 km of motorways, 7.097,70 km of state roads, 9,498,50 km of county roads and 8,937,30 km of local roads as defined by the decision of the Government of the Republic of Croatia on the Classification of Public Roads (OG 96/2016).
- A motorway network of 1,313.83 km has been built and is opened to traffic, which is more than 90% of the total categorized motorway network in the Republic of Croatia.
- Further development of the road network should be based on the functional region (FR) concept.
- The projections of the midterm demand for the existing motorways including planned developments show that currently no significant developments are justified. Exemptions are local bypasses of identified bottlenecks, and projects which have secured financing

Note

Pan-European transport corridors Vb, Vc, X and Xa which are crossing the Croatian territory and are a part of the TEN-T network as follows: Vb (TEN-T Mediterranean corridor), Vc (TEN-T comprehensive network), X (TEN-T core network) and Xa (TEN-T comprehensive network).

Figure 53: Map of International road corridors



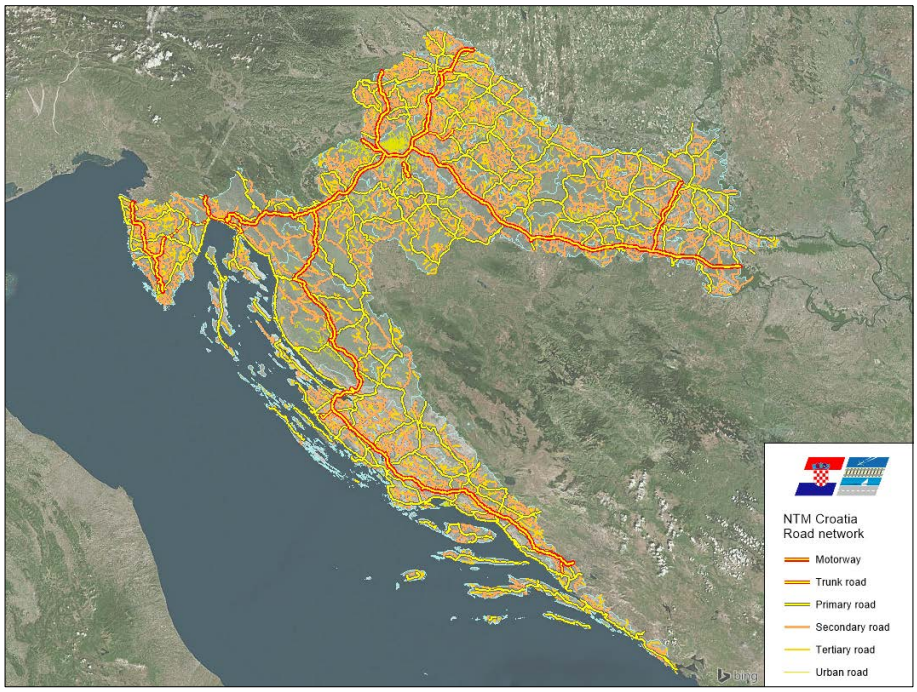
Source: Transport Development Strategy Annex 1

Croatian road infrastructure on above listed corridors is composed by following motorway network:

- A2 motorway which is a part of TEN-T comprehensive network – Pan European corridor Xa,
- A4, A1 (Zagreb- Bosiljevo 2) and A6 (Bosiljevo 2-Rijeka) which are part of TEN-T Mediterranean Corridor – Pan European corridor Vb,
- A5 and A10 which are part of TEN-T comprehensive network – Pan European corridor Vc,
- A3 motorway which is part of TEN-T core network - Pan European corridor X.

The Adriatic-Ionian Road Transport Corridor, a part of TEN-T core network, goes through the territory of the Republic of Croatia. The Corridor connects 7 countries (Italy, Slovenia, Croatia, Bosnia and Herzegovina, Montenegro, Albania and Greece) between Trieste and Kalamata. Along the Adriatic coast, the Corridor connects the main seaports (Triest, Koper, Rijeka, Zadar, Šibenik, Split, Ploče, Dubrovnik, Bar, Durresi, Igoumenitsa, Patras, Kalamata), and Pan European corridors (V, Vb, Vc, and VIII). Adriatic – Ionian corridor on Croatian territory is mostly built. Projections of medium-term traffic demand show that the functional region of South Dalmatia is covered by the Dubrovnik Airport and Pelješac Bridge projects along with access roads from both sides as part of the project..

Figure 54: Croatian Road Network



Source: NTM of the Republic of Croatia

Road network in the Republic of Croatia is 26,953,00 km long and comprises 1,419.50 km of motorways, 7.097,70 km of state roads, 9, 498,50 km of county roads and 8, 937,30 km of local roads.

If we look at the integration of the Republic of Croatian road network in the international traffic, one may conclude that the basic road network in the Republic of Croatia has been established (Table 22 and Figure 54). It can be said that, in terms of international road connections, Croatia is very close to high European standards.

Table 22: Croatian Motorway Network

Company	Total network 2015	Total network 2016	Total network plan for 2017
HAC	925,80	925,80	925,80
ARZ *	187,03	187,03	187,03
BINA-ISTRA	141,00	141,00	141,00
AZM	60,00	60,00	60,00
TOTAL	1.313,83	1.313,83	1.313,83

Source: HUKA, National Reports on Motorways 2016

The level of development of the roads and motorways achieved in the last decade imposes a new approach to the development policy in this field. Republic of Croatia accelerated the road

development policy over the last decade, and the development has to be slowed down in the next period to maximize the process of rationalization in the construction and development of the road network.

Further development of the road network requires defining priorities among feasible road sections according to transport demand. Further development of the road network should be oriented towards the achievement of a high standard of regular road maintenance, ensuring that the core road network matches the present transport standards, as well as the completion of the necessary planned motorway and fast road network. Further development of the road network in the Republic of Croatia should be based on the functional region (FR) concept.

2.4.2. HYPOTHESIS

During the touristic off-season only the transport system of the agglomerations in general and of Zagreb in particular reaches the capacity limits.

Source

National Traffic Model for the Republic of Croatia (NTM)

Key findings

- On the road side and off-season, apart from the main agglomerations only the roads from Zagreb towards Sisak, from Zagreb towards Bjelovar and from Varazdin towards Koprivnica (State road D2, Podravska magistrala) show significant capacity utilization.

Note

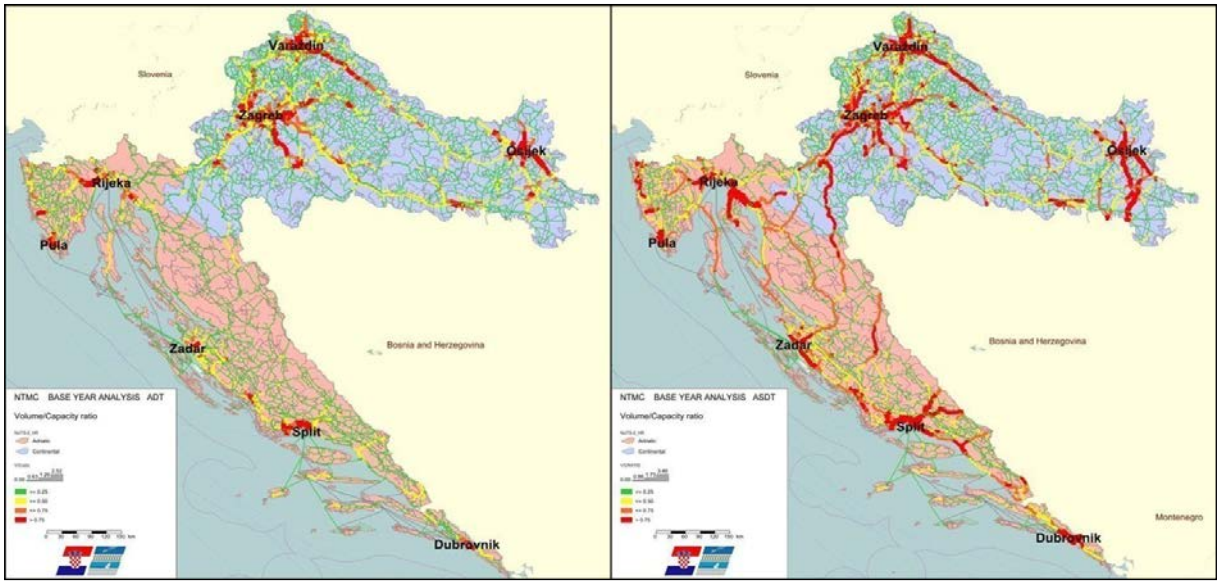
To understand the internal impacts and to identify bottlenecks in the network as well as potential shortcomings, it is necessary to relate the actual flows to the provided capacities. Volume/capacity ratio (V/C) is calculated as total traffic volume (in PCUs) divided by daily capacity of the links in the entire network. The figure 55 shows the volume/capacity ratio for the off-season conditions and the conditions in the summer season. Volume/capacity ratio levels above 75% (shown in red) are critical, potentially bearing the risk of congestion and traffic breakdowns at peak hours.

High volume/capacity ratios off-season, can be observed mainly around the main agglomerations, and more in the Continental Croatia. Off-season high volume/capacity ratios can be observed mainly around the main agglomerations, and more in the Continental Croatia. Roads from Zagreb towards Sisak (motorway alternative to the existing primary road towards Sisak is partially

existing), from Zagreb towards Bjelovar, and from Varaždin towards Koprivnica (State road D2,Podravska magistrala) shows a significant capacity utilization.

In the summer season, high volume/capacity conditions occur also on the motorway network towards the Adriatic coast as well as in and around the Adriatic cities.

Figure 55: Road Traffic – Volume/Capacity Ratio for Annual Average (ADT) and for seasonal traffic (ASDT)(blue color markst he continental region and pink the Adriatic region)



Source: NTM

2.4.3. HYPOTHESIS

The quality of the roads is on a relatively high standard.

Source

Croatian Bureau of Statistics; Croatian Roads Ltd; National Traffic Model for the Republic of Croatia (NTM)

Key findings

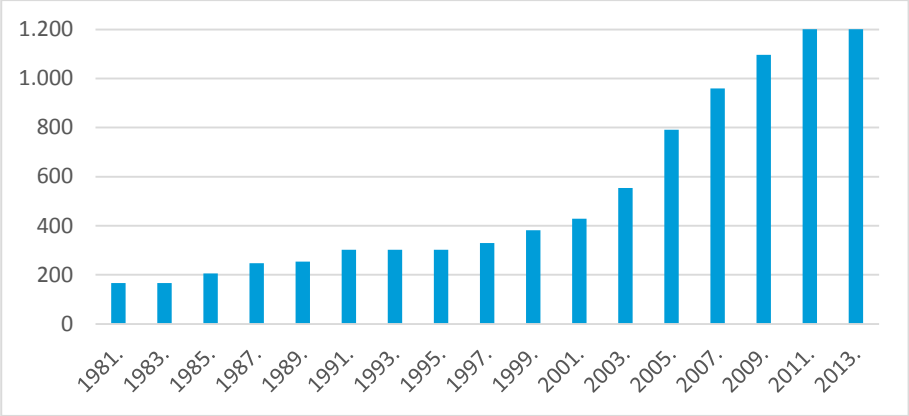
- The Republic of Croatia has 1,313.83 km of motorways, mostly constructed in the last 20 years.
- The quality of pavement on state roads, constructed in the last 35 years, is in a satisfactory to very good condition.
- Traffic indicators on motorways show a high level of service, the ratio between volumes and provided capacities of the motorway network are not critical, volume/capacity ratios for the daily average are under 75%.

Note

Public roads in the Republic of Croatia are classified according to various criteria and features. By reference to their social and economic importance, roads are classified as motorways, state roads, county roads and local roads. According to the type of traffic, roads are classified as roads for motor vehicles only (motorways and high-speed roads) and as mixed-traffic roads. According to the traffic volume (AADT), the class and road category (motorway, 1-5 classes or road categories) are defined.

Over the last 20 years the Republic of Croatia has experienced a "road-construction boom". One can conclude from the chart in Figure 56 that the greater part of the motorway network was built between 2000 and 2013, which represents a new road network with a good pavement quality and a high standard of transport operation.

Figure 56: Length of the motorways network in the Republic of Croatia, 1981-2013

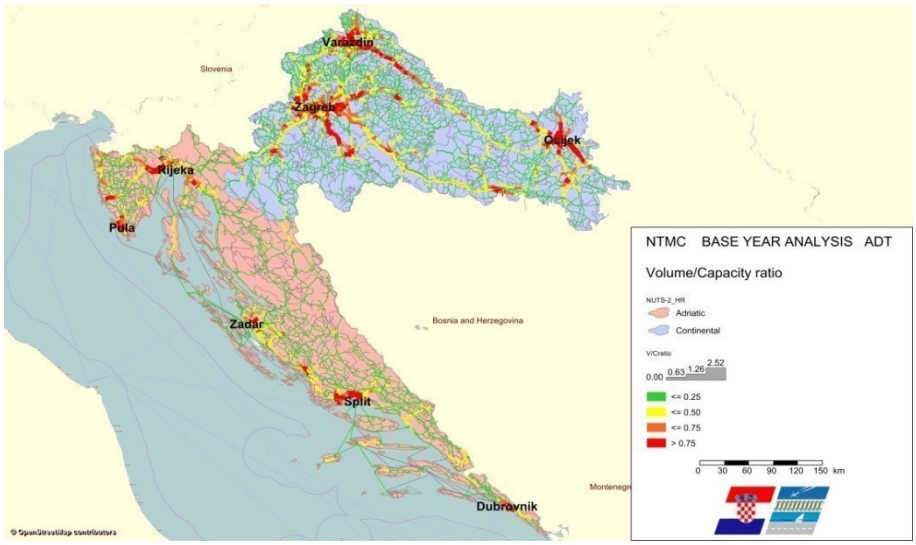


Source: CBS

The analysis of the actual demand expressed in volumes or number of vehicles per time interval is in relation to the capacity of road links and junctions. The ratio of volumes and provided capacities shows the exploitation levels or where the situation is already critical. Normally, daily average volume/capacity ratios above 75% are considered as critical and to be avoided, as within the peak hour the volumes can easily exceed 100% and can lead to unstable traffic flows, resulting in traffic breakdowns and congestions, and consequently in time lost for the users.

The following figure again shows the ADT and indicates clearly the critical areas with a v/c ratio above 75% (marked in red), found in and around the urban areas, whereas, for example, the north-eastern motorway link with high flows is not critical, as apparently sufficient capacity is provided here.

Figure 57: Volume / capacity ratio on the Croatian Road network for ADT (blue color markst he continental region ant the pink the Adriatic region)

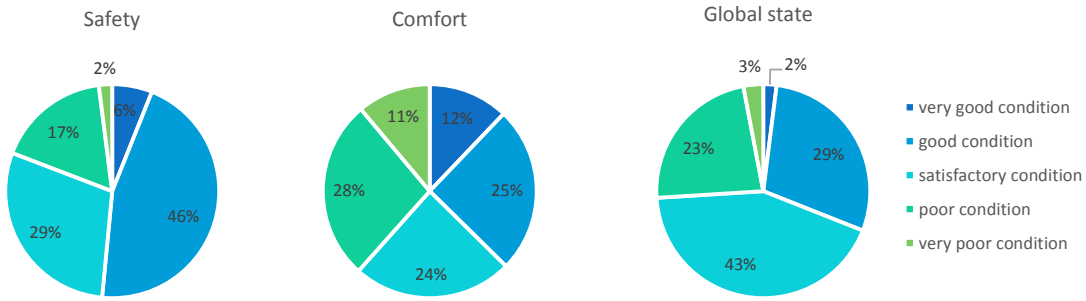


Source: NTM

The analysis of critical volume/capacity ratios is definitely an important input for the development of strategies and measures for the development of the future transport system. The links marked in red, links with high v/c values, represent links requiring the implementation of measures by either extending the capacity or reducing the road network demand by means of demand management, alternative transport modes and similar.

According to data about the quality of state-road pavement from 2012, more than 50% of the network is in a satisfactory to a very good condition.

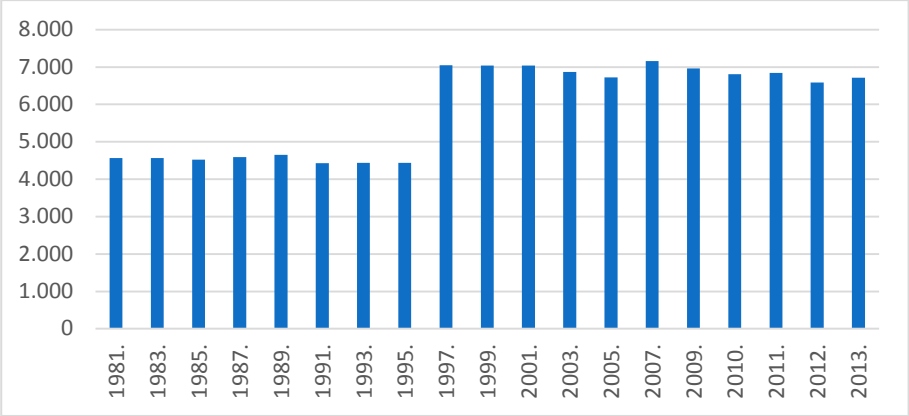
Figure 58: State-road pavement condition, 2012



Source: The Public Road Network Construction and Maintenance Programme for the Period 2013–2016, (OG no. 1/2014)

The state-road network was developing evenly, with a sharp rise in 1997, as presented in the chart in Figure 59 below.

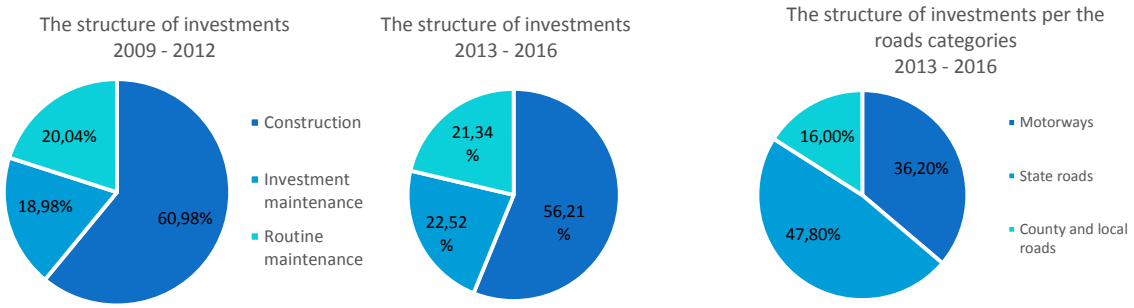
Figure 59: Length of State roads network in the Republic of Croatia from 1981 to 2013



Source: CBS

The State Road Network Construction and Maintenance Programme for the Period 2017–2020 was adopted by the Government and presents the plan of investments in the road infrastructure. An analysis of the structure of the investments for the planning periods 2013–2016 and 2017-2020 shows a decrease of investments in the construction and an increase of investments in periodic improvements (periodic maintenance and reconstruction) and regular maintenance. Looking at the structure of the investments by road category, more than two-thirds of the investments are planned for state roads, county roads and local roads.

Figure 340: Review of investment in road infrastructure



Source: The State Road Network Construction and Maintenance Programme for the Period 2017–2020 (OG 47/2017)

2.4.4. HYPOTHESIS

The standards of the Croatian motorways are high compared to international standards; however, on older parts of the network, especially environmental protection measures and drainage are not up to date.

Source

National Traffic Model for the Republic of Croatia (NTM); National Inventory Report 2013 – Greenhouse gas inventory for the years 1990-2011, 5th National Communication of the Republic of Croatia under the UNFCCC

Key findings

- The existing traffic management and road safety equipment of the Republic of Croatian motorways and some high-speed roads puts Croatia on the top in the region as a country with high developed ITS.
- Motorways constructed in the 1970es and 1980es requires implementation of new environmental protection standards.

Note

The construction of motorways in Croatia over the last decade has induced the implementation of intelligent transport systems (ITS). In terms of the impact of traffic management systems and tunnel incident management, Croatian motorways are characterized as safe and modern roads. The introduction of a unique ITS for transport safety, mobility and environmental protection on the Trans-European Road Network is regulated by the following documents of the European Parliament and Council:

- Directive 2008/96 on the safety of road infrastructure,
- Directive 2004/54 on the minimum of technical conditions of safety in tunnels,
- Directive 2010/40 on Intelligent Transport Systems,
- Action Plan on the implementation of the ITS Directive adopted by the European Commission (EC 2011/289).

Motorways in Croatia constructed in the last decade have been built in line with high environmental protection standards (as part of ecological network of the European Union Natura 2000). Special attention was paid to the protection of wildlife by building passages for animals, the so-called “green bridges”, the position of which was determined by observing the natural movement of animals. Newer motorways are under controlled and closed drainage system, with built-in purifier,

grease traps and lagoons for storm water. In addition, noise barriers were erected in settled areas to provide noise protection. They are also under a technical management system that is able to monitor the traffic and weather conditions on every segment of road and its entire infrastructure.

While newer motorways meet environmental protection standards, there are old parts of motorways constructed in 1970es and 1980es which have since then only been maintained, and requires the implementation of new environmental protection standards.

The first section of the motorway A1 between Zagreb and Karlovac, was opened to traffic in the 1970es. On this section, except for regular maintenance, it was invested in the installation of ITS equipment and construction of noise protection walls, but did not perform any interventions to improve environmental protection. This relates primarily to the drainage, which functions as an open system with open drainage ditches, without a purifier, which means that in the case of an accident harmful substances can directly go to the water protected area. Since the section Zagreb - Karlovac has a high traffic volume there is a need for construction of additional lanes, the project should provide the construction of a closed drainage system.

A similar situation is on the A3 motorway section Zagreb - Lipovac that was built in the 1980es. An ITS system was also installed, as well as noise barriers in settlement areas, but there were no investments in the construction of the so-called “green bridges” for wild animals. The drainage system is also an open system with open drainage ditches, without a purifier or lagoons.

2.4.5. HYPOTHESIS

Generally speaking, the technical standard solutions for the road parameters (road categories) are in line with the internationally used standards. However, the development of additional road categories (for example 2x2 lane roads with separation of directions and large roundabouts etc.) might lead to economically and technically more suitable solutions.

Source

Guidelines for designing intersections with spiral flow for the circular carriageway on State Roads (July 2016); Rulebook on essential road safety requirements for public roads outside urban areas and their elements regarding road safety (OG no. 110/01)

Key finding

- The introduction of a new road category (2x2 lanes with separation of directions and roundabouts instead of interchanges) in case of roads with a strong functionality for local

traffic (development axis for Spatial Planning) is a more appropriate suitable solution than constructing motorway standards

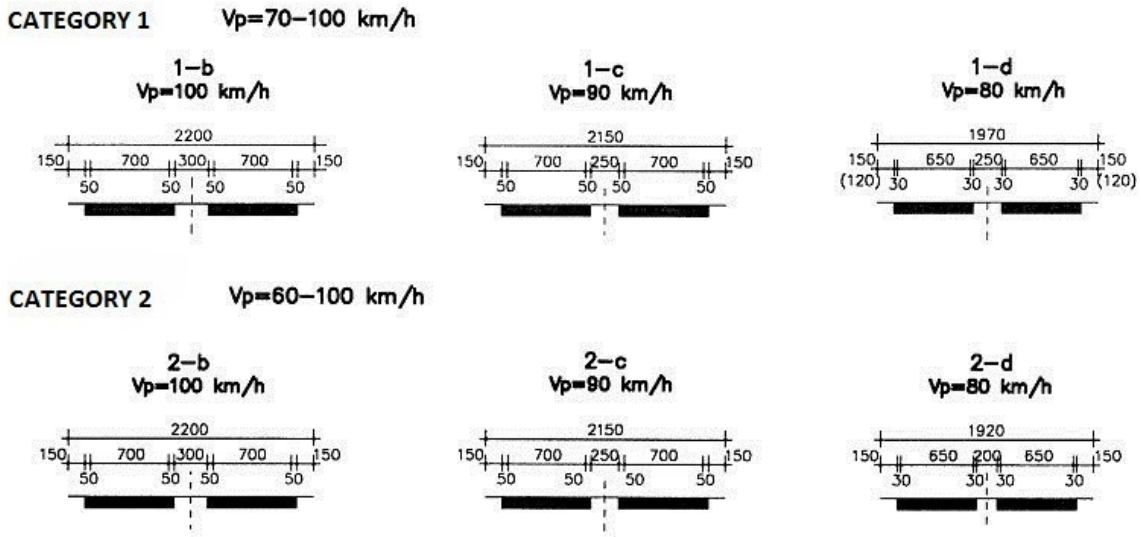
- Croatian regulations allow the use of economically and technically more suitable solutions

Note

The development of the road network as well as of certain categories of roads should be based on the function of each segment of the road network. This particularly applies to the city bypasses with mostly local traffic, which enables the use of technical solutions such as roads with two separate carriageways, with 2 lanes per direction separated with a central reserve without an emergency lane.

The Croatian regulations have defined roads of 1st or 2nd category, with 2 traffic lanes per direction separated by central reserve without an emergency lane. Such a cross-section corresponds to the project speeds ranging from 80 to 100 km/h. An overview of the elements of the cross-sections in accordance with the Croatian regulations is shown in the following figure.

Figure 61: Overview of cross-section dimensions



Source: Rulebook on essential road safety requirements for public roads outside urban areas and their elements regarding road safety (OG no. 110/01)

The basis for design, traffic analysis and safety analysis for the design of the roundabouts with spiral flow on circular carriageway on State roads are determined by the guidelines. The guidelines allow the application of the following types of roundabouts, as shown in Figure 522, depending on whether the intersection is located within or outside an urban area.

Figure 62: Overview of a turbo roundabout outside and within urban

Source: Guidelines for the design of roundabouts with the spiral flow the circular carriageway on State roads, 2014

The regulations of the Republic of Croatia allow the development of new road categories, which could lead to a potential use of solutions that are technically and economically feasible, which has to be proven from the spatial, traffic and construction aspects.

2.4.6. HYPOTHESIS

The tolling system is a key factor for the traffic jams during the touristic season.

Source

National Traffic Model for the Republic of Croatia (NTM)

Key findings

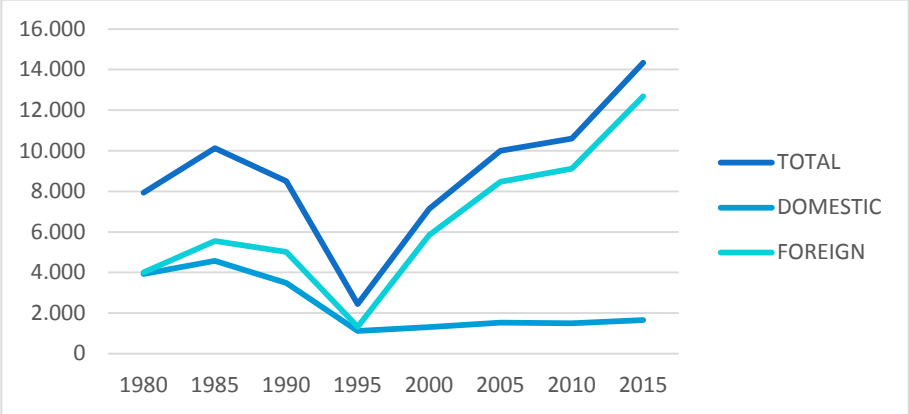
- The main limitations of the touristic traffic in the Republic of Croatia are at the national borders, the tolling stations and in the touristic areas mainly along the coast line.
- The tolling system leads to a significant shift of traffic from the motorways to the national road system in particular in the direction Zagreb – Sisak, Karlovac – Sinj and Zagreb – Maribor
- The current tolling system is a limiting factor to the construction of additional interchanges and the utilization of motorways for local traffic

Note

Infrastructural, operational and/or organisational bottlenecks at borders often result in high travel times and low average speeds reducing the attractiveness of international journeys. The elimination of bottlenecks at borders is a special challenge for the Republic of Croatia as an EU member and the expected adhesion to the Schengen treaty, which on the one side will imply the suppression of currently relevant border crossings with EU countries, but on the other hand, will bring a higher relevance of border crossings with Serbia, Bosnia and Herzegovina and Montenegro.

Looking at the total number of tourist arrivals, the Republic of Croatia has an increasing number of foreign tourists from year to year, while the number of domestic tourists stagnates.

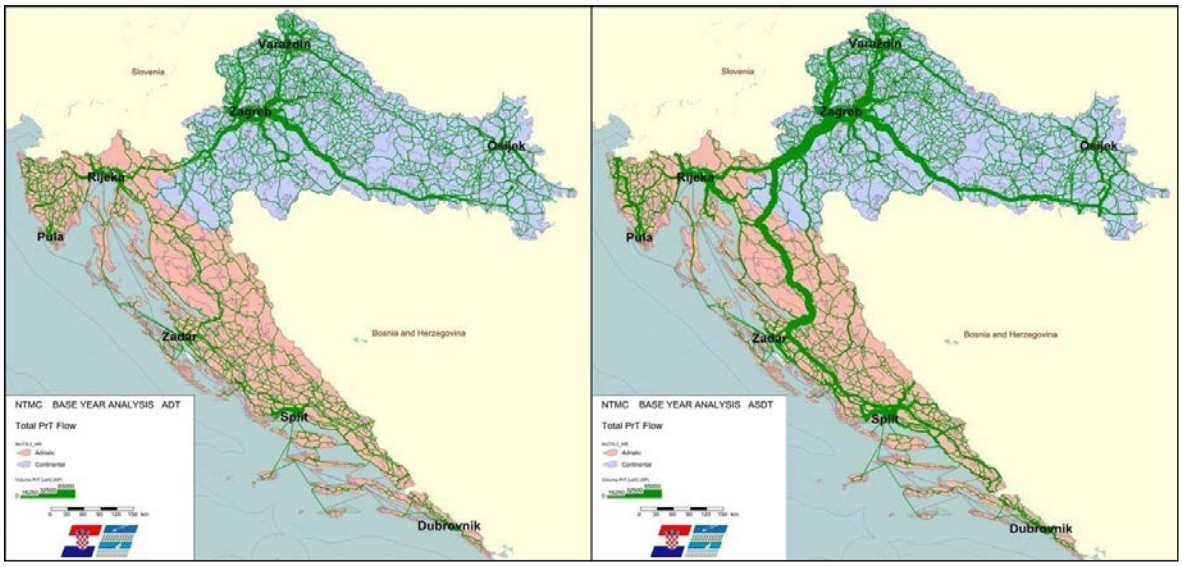
Figure 63: Tourist arrivals



Source: Tourism in figures 2015

As part of the National Traffic Model for the Republic of Croatia two separate models were developed, one for the average daily traffic (ADT) that covers off-season period and the other for the average daily seasonal traffic (ASDT). Comparing the models, it can be concluded that the overall demand on country level in season is 20% higher than the demand off-season. Traffic demand in season, results with 2 times higher traffic demand on the main touristic routes, especially on the motorways that leads to the Adriatic coast and on the primary roads in the Adriatic Region.

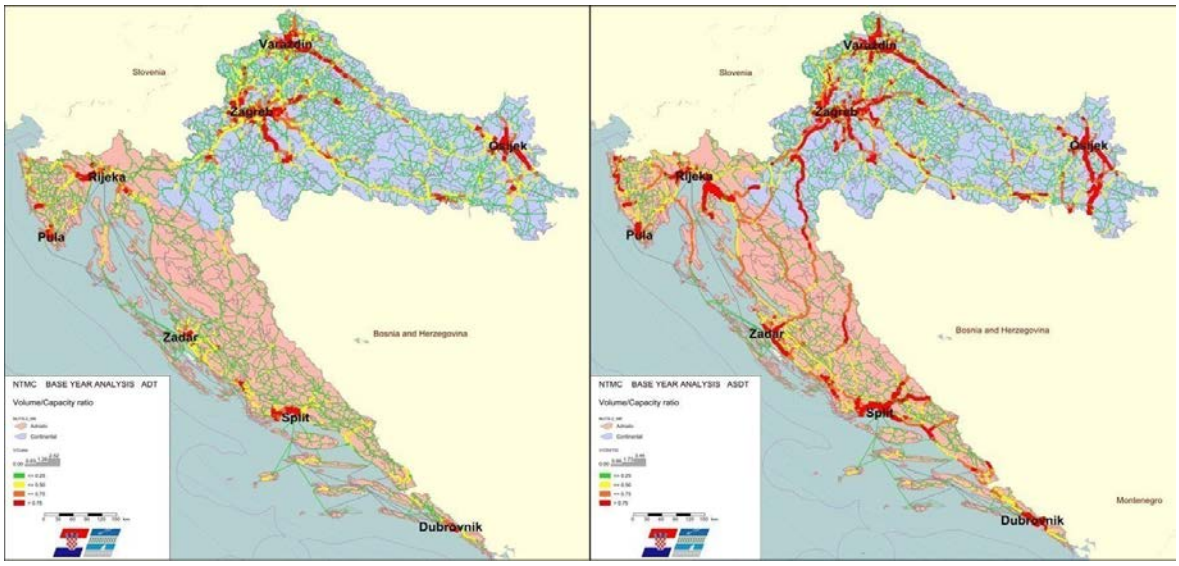
Figure 64: Road traffic – Annual Average Daily Flow for whole Year (ADT) and for seasonal traffic (ASDT)(blue color markst he continental region, pink the Adriatic region, ant the green color the volume of daily traffic on certain roads)



Source: NTM

It is possible to relatively quickly and comfortably arrive to outer areas of tourist towns owing to motorway infrastructure and, in part, state roads, which are maintained as much as possible, i.e. at a sustainable level. Problems arise after switching to local and unclassified roads, which are in technical terms poorly equipped, the signalisation and notification system is insufficient, the roads are damaged, traffic is inadequately organized and in cities on the coast, which are mostly tourism-oriented, there is a chronic lack of parking spaces. These are all elements which must be improved to increase the level of service.

Figure 65: Volume/Capacity ratio – For off-season and season traffic (blue color markst he continental region, pink the Adriatic region)



Source: NTM

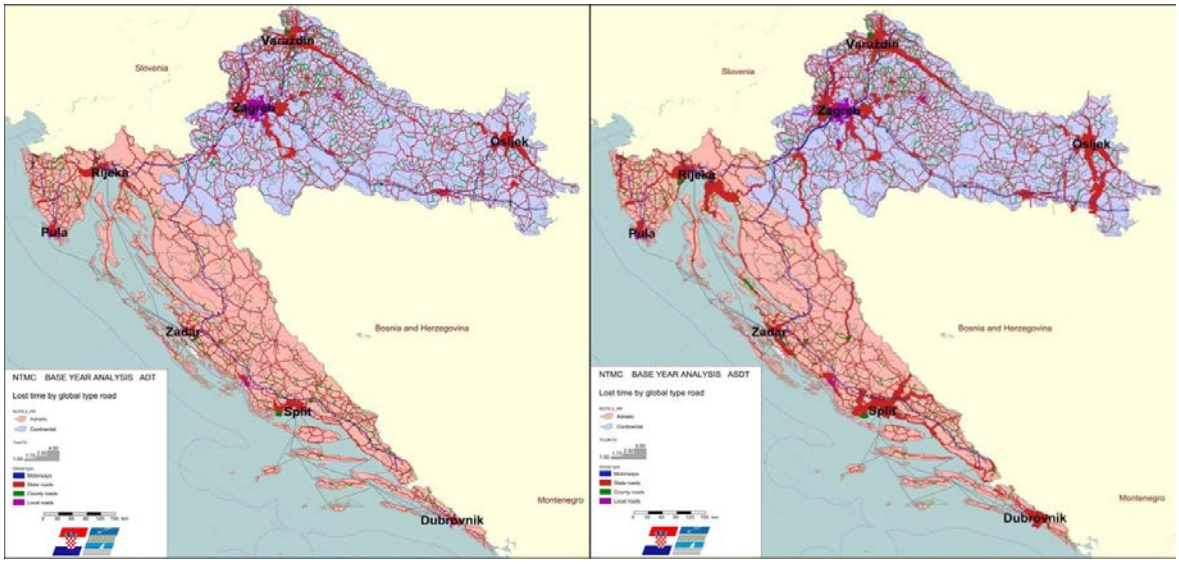
The general levels of adequacy and effectiveness of the road network in both off season and on season periods are shown by the following Volume/Capacity ratio maps (as part of the key outcomes of the NTM of the Republic of Croatia). The V/C ratio is calculated as total traffic volume (in PCUs) divided by daily capacity of the links in the entire network.

Lost time maps provide a clear understanding of the level of performance of the national road network and identify sections with lower levels of services.

Lost time analysis is based on the direct comparison between the actual travel time along road links (on the basis of the assignment results of the NTM baseline scenario for the Republic of Croatia) and the travel time under free flow conditions.

In the following set of maps the links width represents the lost time and the colour of the link depicts the link type according to the official classification of the road network.

Figure 66: Lost time (actual travel time/target time) – For off-season and season traffic (blue color markst he continental region, pink the Adriatic region)



Source: NTM

The closed stop and go toll system on motorways is the main cause of traffic jams on the entry and exit points during the tourist season when ADT at least doubles. The tolling system in the Republic of Croatia is operated by four concessionaires, and the main problem is that there is no unique ETC or SMART card for all concessionaires. The Republic of Croatia has not established EETS - EUROPEAN ELECTRONIC TOLL SERVICE. The objective of the EETS is to achieve interoperability of electronic tolling systems used throughout the Community, resulting in conclusion of a single contract between the users and the EETS provider and the use of a single electronic tolling device in the future.

Local traffic generally does not use the existing motorway infrastructure. This is because of relatively high daily toll charges and the existence of state roads running parallel to the motorway (e. g. Motorway Zagreb – Macelj), which are not in the closed toll system, and the inefficient stop-and-go toll system that goes through the toll booths. The result of all this is a considerable road traffic on D30 in direction Sisak, D1 in direction to Karlovac, and on the international traffic routes: D206, which is the main connection towards Slovenia, D3 and D209 towards Hungary (passing through Varaždin and Čakovec).

On the other hand, a closed toll system in the agglomeration areas has a positive effect on the saturation of the motorway. A large number of local traffic that blocks traffic in transit can be observed on the motorways running through areas of large agglomerations that are not under the closed toll system. A closed toll system requires the construction of toll booths on the motorway interchanges, which results in higher costs of building facilities, interchanges occupying a larger area and larger distances between interchanges.

2.4.7. HYPOTHESIS

The different tolling systems in the Republic of Croatia are not well harmonized.

Source

HUKA; Croatian Motorways Ltd; Rijeka-Zagreb motorway PLC; Croatian Motorways Maintenance and Tolling Ltd; BINA-ISTRA Ltd; Motorway Zagreb – Macelj Ltd

Key findings

- Croatian motorways are mainly on closed toll system, which are conducted by Croatian motorways Ltd (HAC) and three concessionaires: Motorways Rijeka Zagreb (ARZ), BINA-ISTRA and Motorway Zagreb – Macelj Ltd
- Possibilities for toll pay in the Republic of Croatia are: cash (in kunas or euros), credit and debit card, ETC, SMART card, INA card, where the means of payment between the concessionaire are not harmonized

- In Republic of Croatia EETS - EUROPEAN ELECTRONIC TOLL SERVICE has not been established

Note

Motorway network in Republic of Croatia is managed by Croatian motorways Ltd (HAC) and three concessionaires Motorways Rijeka Zagreb (ARZ), BINA-ISTRA and Motorway Zagreb – Macelj Ltd. see Table 23.

Table 23: List of concessionaires on Croatian motorways

Company	Motorways
HRVATSKE AUTOCESTE d.o.o.	A1 A3 A4 A5 A10 A11
AUTOCESTA RIJEKA-ZAGREB d.d.	A6 A7
BINA-ISTRA d.d.	A8 A9
AUTOCESTA ZAGREB -MACELJ d.o.o.	A2

Croatian motorways are primarily under the closed toll collection system, with several entrances and exit points. The open toll collection system is less used (e.g. on Bregana-Zagreb Motorway on the Krk Bridge, on Rupa – Rijeka and at the St. Ilija Tunnel).

On all motorways, toll can be paid in cash (in kunar or euros), by credit and debit cards, by INA card, by SMART cards. An electronic toll collection (ETC) system is available on all motorways except the Zagreb-Macelj Motorway (A2).

The toll collection systems of HAC, ARZ and BINA-ISTRA networks are Stop and go system with integrated electronic toll collection (ETC).

In 2016 HAC plans to upgrade the exit lanes by setting up automatic vehicle pre-classification and adding more automated exit lanes without presence of toll collectors.

Future motorway Rijeka - Zagreb projects are focused on the need to increase the flow through toll stations by introducing faster toll lanes without stopping (currently there are two of the kind) as well as on introducing new products based on electronic tags and ANPR modules.

On toll stations controlled by the company Autocesta Rijeka - Zagreb d.d. toll can be paid in cash (in kunas or euros), debit cards, credit cards, smart cards, monthly and annual charts and contactless ENC devices. The subscription account for the ENC device can be charged at one of the sales offices of Lučko, Grobnik, Krk and Rupa.

Additionally, the subscription account can be upgraded by credit card on the internet portal https://www.arz.hr/ as well as by ARZ SMS e-bills purchased at the sale points of the distributor.

At HAC toll stations the toll can be paid either in cash (in kunar or euros), by credit cards and through subscription (prepaid account). The ETC prepaid account can be replenished 24 hours a day at the following toll station: Bregana, Ivanja Reka, Sveta Helena, Varaždin, Osjek, Đakovo, Sl.Brod-West, Okučani, Županja, Lipovac, Žuta LOkva, Gospić, Zadar-East, Šibenik, Dugopolje, Šestanovac and Ravča. In addition, the ETC device replenishment can be operated by credit cards via a web portal "https://prodaja.hac.hr/", via a mobile device linked to credit card and prepaid account, at 15 retail outlets and also via SMS vouchers.

At BINA-ISTRA-e toll collection point, toll can be paid by all credit and debit cards, and also by INA card and the ETC device. Furthermore, the users who already own an ETC device can register devices already bought at HAC and ARZ for the BINA-ISTRA-e toll collection system and become BINA-ISTRA-e subscribers (for frequent users), or to register their cards for ETC devices (for non-frequent users).

At motorway Zagreb-Macelj toll collection points, the toll can be paid by all credit and debit cards, and also by INA card and prepaid toll payments via SMART card. The ARZ plans introducing toll payment using ETC devices in the following years.

The European Commission Decision 2009/750/EC of 8 October 2009 defines the European electronic toll service (EETS) and the elements required for implementation of Directive 2004/52/EC (the interoperability directive). The objective of the EETS Decision is to achieve interoperability of electronic tolling systems used throughout the Community, resulting in the conclusion of a single contract between the users and the EETS provider and the use of a single electronic tolling device in the future.

Decision 2009/750/EC provides that all Member States that have already introduced or intend to introduce an ETS on their territories must maintain a national electronic register containing information about roads covered by EETS, as well as the toll collection entities responsible for a certain area and about EETS providers (if any) having a toll collection contract with tolling entities and in particular on EETS providers registered in Member States.

2.4.8. HYPOTHESIS

The unsustainability of the financial self-sustainability of the road system in the Republic of Croatia (Croatian roads and Croatian motorways).

Source

HAC (Croatian Motorways) annual report and financial statements 2015; HC (Croatian Roads) annual report and financial statements 2016

Key findings

- HAC expenses substantially exceed annual revenues. Revenues are generated from tolling activities and imposed fuel tax according to Public Roads Act (OG 84/11, 22/13, 54/13, 148/13, 92/14).
- In order to cover debt repayments, HAC takes on new debt each year.
- The level of debt is unsustainable with net debt to EBITDA ratio of 25x.
- HAC debt is included in the calculation of the public debt of the Republic of Croatia.
- Large majority of cash inflows to HC comes from fuel tax toll which are used for funding CAPEX needs and covering operating expenses.
- Current operating model relies on additional funding. Income streams are not sufficient for debt repayments which are covered by taking on new debt.

Note

Due to a specific nature of the Company's operations, HAC displays separate presentation of its income statement which is divided between HAC and Public good as per Roads Act (due to the fact that the owner of the motorways is the Republic of Croatia while HAC is the operator).

The Company generates majority of revenues from tolling activities (HAC) and excise duties i.e. fuel tax (Public good). Fuel tax charged on sold oil derivatives is used for construction, financing and other public roadways management activities. The fuel tax represents an asset of Republic of Croatia (Public capital) and is separately presented in the legal entity (HAC) which operates public roadways. This fuel tax (excise duty) represents a state support HAC receives for motorways construction and management.

HAC side of the income statement generated approximately 1.5 bn HRK in total revenues (large majority relates to tolling activities) with the equal amount of expenses. Namely, HAC income

statement is never negative, surplus of revenues over operating expenses covers depreciation of the motorways.

Public good side of the income statement generated approximately 0.76 bn HRK in revenues with 0.5 bn HRK relating to fuel tax and the rest mostly relating to financial income. Public good generated approximately 1.5 bn HRK of expenses (0.85 bn HRK relating to interest payments). Cash outflows exceeded inflows by approximately 0.7 bn HRK.

In 2014, excise duty was reduced from 0.6 HRK per litre of fuel to 0.2 HRK per litre resulting in approximately 1 bn HRK less in cash inflows. This negatively impacted the ability of the Company to service principal repayments. Hence, principal repayments are made from additional borrowings or refinancing of existing obligations. In 2015, the Company borrowed 2.9 bn HRK from banks and repaid 3.2 bn HRK of principal. Without additional debt and with current model in place, HAC would experience severe financial and liquidity pressure. In 2016, more than 3.9 bn HRK of principal becomes due. In 2017 and 2018, bn HRK 4.7 and 4.6 bn HRK becomes due, respectively.

As at 31. December2015, total financial liabilities of HAC amounted to 23.3 bn HRK with EBITDA of 0.9 bn HRK, resulting in net debt to EBITDA ratio of 25x. The ratio indicates that leverage level is not sustainable. Accelerated construction of highways, disproportion between internal vs. external funding i.e. bank financing and inadequate maturity of external funding causes high levels of debt and future financing issues. Therefore, it is essential to find a viable and independent financing in the future.

Hrvatske Autoceste d.o.o. revenue streams are mostly generated from excise duties. The Company presents financial statements similar to HAC i.e. according to IFRS and Roads Act. Income statement and Balance sheet are divided between HC and Public Good.

HC operates national roads. Contrary to HAC, HC does not receive income from tolling activities. Cash inflows mostly relate to excise duties i.e. fuel tax fee (attributable to Public good). HC receives 0.8 HRK per litre of fuel which corresponded to 1.76 bn HRK in revenues in 2015. Total cash inflows amounted to 1.86 bn HRK while cash outflows for CAPEX and operating expenses were 2.45 bn. Given the dispersion in inflows and outflows, the existing business model needs to be changed by turning around the sustainable financing of construction and maintenance of state roads in the future.

2.4.9. HYPOTHESIS

The road safety in the Republic of Croatia is lagging behind the majority of European countries.

Source

Ministry of Interior; HUKA; Croatian Roads; Croatian Bureau of Statistics; European Road Safety Observatory; National Traffic Model for the Republic of Croatia (NTM)

Key findings

- The Republic of Croatia has adopted National Road Safety Programme of the Republic of Croatia 2011-2020, (OG no. 59/11) which is compatible with the European Action Plan
- Over the last ten years, the number of persons killed and injured in accidents on Croatian roads has been declining
- Croatian highways are safe and modern, the safety level can be linked to implementation of the ITS technologies
- The annual report on accidents in Europe for 2016 shows that the number of of traffic deaths in the Republic of Croatia is higher than the EU average

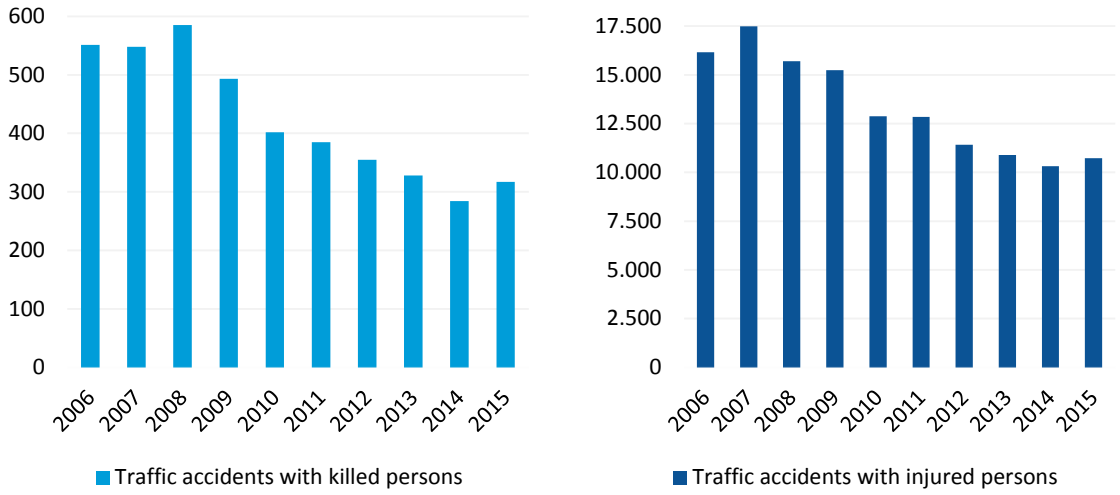
Note

The national Road Safety Programme of the Republic of Croatia 2011-2020, (OG no. 59/11) is the basic document that defines important road safety elements. The document summarizes the up to date effects of the national program implementation. It defines inputs for the implementation of safety elements, access and monitoring activities related to the incorporation of European and global trends in the national program.

The European Road Safety Action Programme 2011-2020, adopted by the European Commission, is the framework for national strategies of EU member states, consequently also for the strategy of the Republic of Croatia.

According to the data from the last 10 years, Republic of Croatia has a declining number of persons killed and injured in traffic accidents, which is a good indicator of the success of the National Programme for Road Safety 2011-2020.

Figure 67: Traffic accidents with killed and injured in the period 2006-2015



Source: Ministry of Interior

The motorway safety indicator is represented through the number of dead and injured in traffic accidents. According to the data from the last 7 years the number of traffic accidents on Croatian motorways is in decline, as presented in Table 24.

Table 24: Traffic accidents on Croatian motorways 2008-2015

Number of Traffic accidents	2008	2009	2010	2011	2012	2013	2014	2015
With fatalities	48	43	39	28	29	31	21	18
With injured	420	420	391	367	346	308	293	307
With material damage	2,072	2,287	2,245	1,971	1,839	1,823	1,863	1,961
TOTAL number of traffic accidents	2,540	2,755	2,691	2,366	2,214	2,162	2,177	2,286
TOTAL number of fatalities	72	58	46	31	45	39	25	19

Source: HUKA

These indicators confirm the objectives defined in the National Road Safety Programme, which acknowledges the importance of behavioural change of the traffic participants, and highlights the importance of the road infrastructure improvement.

Table 25: Repaired dangerous locations („black points“) on state roads from 2001 to 2016

Year of reparation	Number of repaired dangerous locations	Invested funds in HRK (excluding VAT)
2001	4	1,061,758.20
2002	15	10,078,581.93
2003	36	21,384,384.14
2004	51	13,120,100.14

Year of reparation	Number of repaired dangerous locations	Invested funds in HRK (excluding VAT)
2005	26	23,617,914.32
2006	13	6,882,110.75
2007	12	5,436,579.73
2008	19	19,345,363.75
2009	15	29,141,864.48
2010	8	11,584,734.09
2011	18	15,620,212.03
2012	9	17,499,501.81
2013	23	49,162,884.08
2014	21	36,054,822.14
2015	8	4,686,000.00
2016	4	5,600,000.00
Total (2001.-2016.)	**282**	**270,276,811.59**

Source: Hrvatske ceste d.o.o., Sector for Maintenance and Traffic, Department of Traffic, Zagreb, 2017

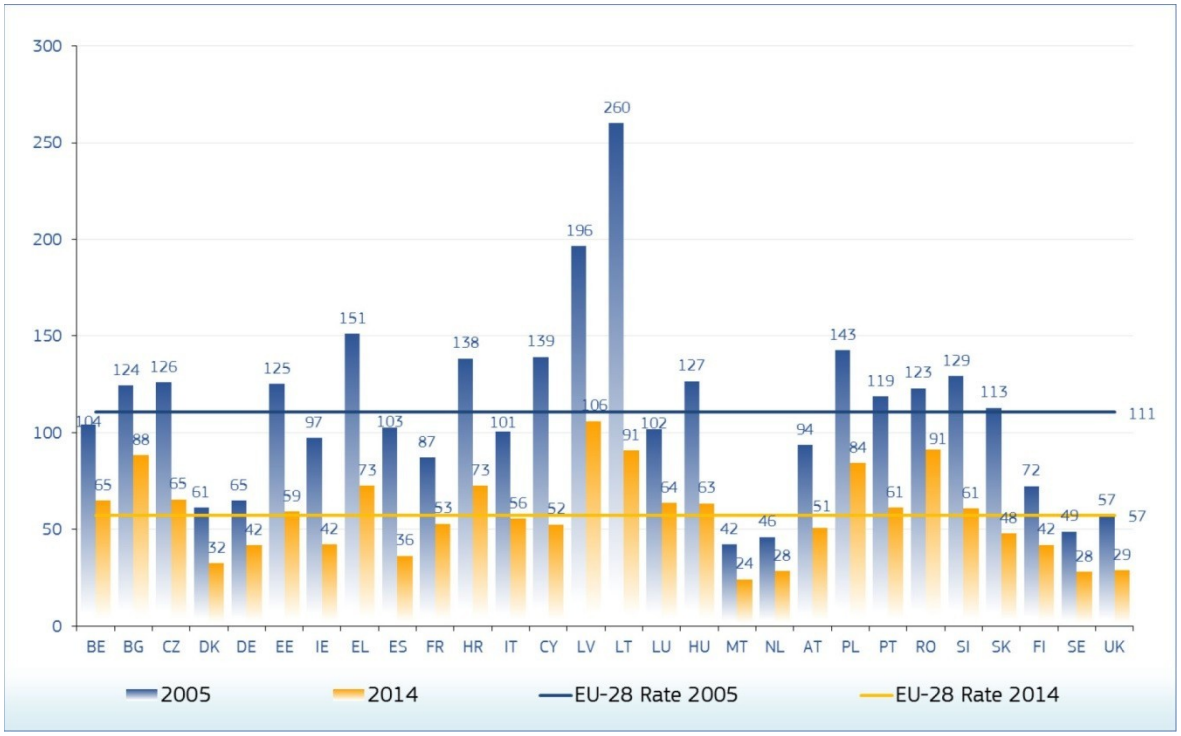
andandananansdAnd TrafficOne of the important goals of the infrastructure improvement is the detection and remediation of hazardous sitess. Table 25 shows the remediated hazardous siteson state roads in the period 2001 – 2016.. In the forthcoming period, remediation of 27 hazardous sites that have been identified and recorded on state roads by 2017 is planned. Based on the new Methodology for Identification of Hazardous Sites, and in the forthcoming period, the implementation of the activities of identifying and remediation of possible dangerous places is planned. The construction of motorways in Croatia has also induced implementation of intelligent transport systems (ITS). As a result of the traffic management systems and incident management in tunnels, Croatian motorways are characterized as safe and modern roads.

However, on state and local roads, additional resources need to be invested to keep the information systems at a higher level. The technical organization of traffic flow enables operational service of the road, 24/7, to monitor the status of traffic and weather conditions, to control the state of road surface, to control the performance and readiness of installed equipment, to detect and identify possible atypical event and be able to react, in real-time, automatically (and/or) on staff command.

From the safety aspect, it is extremely important to predict and detect timely any atypical situations as well as respond timely to events, using the available built-in technology, as well as to organize optimally the supporting technical services. The results are the reduction in traffic accidents, cuts to maintenance costs, lower travel costs and a reduced negative impact on the environment.

Looking at the data about the number of fatalities on the roads in Europe, decrease in the number of fatally injured in 2014 compared to 2005 becomes evident. The number of fatalities in the Republic of Croatia is above the European average. In 2014 Republic of Croatia had 73 fatalities per million inhabitants which is also higher than in the neighbouring countries, such as Slovenia (61 per million inhabitants) or Hungary (63 per million inhabitants).

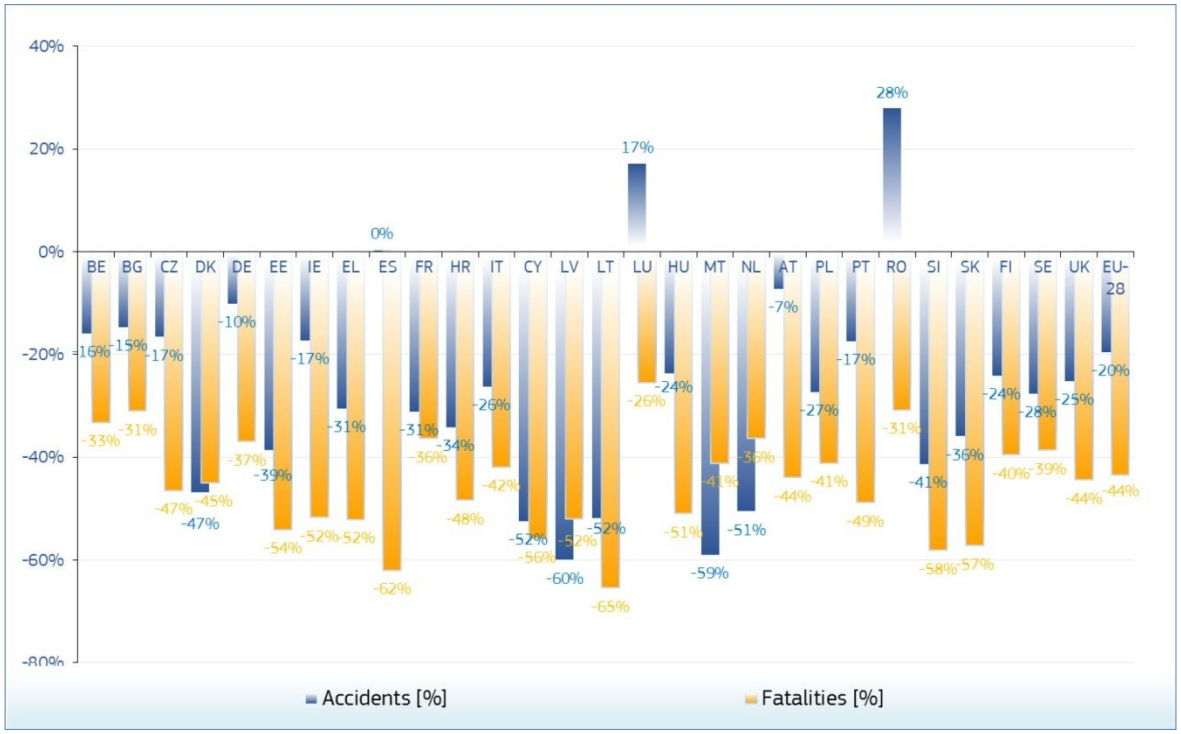
Figure 68: Fatalities per million inhabitants in the EU, 2014 compared to 2005



Source: European Road Safety Observatory, Annual Accident Report 2016

The following diagram shows the percentage change in the number of fatalities and injury accidents by country

Figure 69: Percentage change in number of fatalities and injury accidents by country, 2014 compared to 2005 (blue - percentage of injured, orange - percentage of deaths)



Source: European Road Safety Observatory, Annual Accident Report 2016 of European Observatory for Road Safety

2.4.10. HYPOTHESIS

Bypass of Zagreb is 'blocked' by local traffic although the main functionality is to insure the transmissibility of Zagreb node for transit.

Source

National Traffic Model for the Republic of Croatia (NTM)

Key finding

- There is a strong traffic demand for local traffic in the corridor of the Zagreb bypass.
- The current free toll system, and construction of additional interchanges are the main factors for utilization of Zagreb's motorways for local traffic

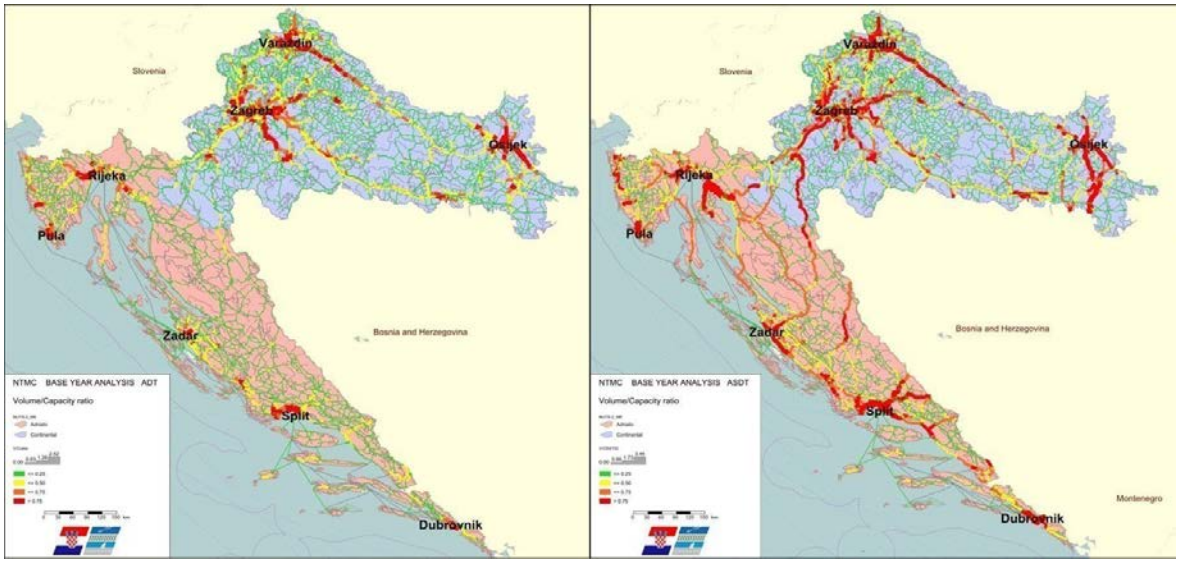
Note

The Zagreb bypass is part of A3 motorway which represents a major east–west transportation corridor in Republic of Croatia and a significant section of the Pan-European Corridor X, serving as a transit route between the European Union states and the Eastern European countries. Zagreb as the most important and largest traffic intersection in Croatia is the origin and destination point of most

road traffic flow. A3 motorway is under a closed toll system, except the section of the Zagreb bypass which is approximately 27 km long, with 6 junctions, and an average junction distance of 4 km.

Absence of closed tolling system and higher density of intersections on the Zagreb bypass, is a major cause of constant traffic saturation on Zagreb bypass. By comparing the images of the on-season and off-season V/C ratio, the conclusion is the Zagreb Bypass is overcrowded during the whole year. It means that, in the area of Zagreb, the local traffic blocks a free-flow for transit traffic on the motorway. Since the traffic demand for the local traffic in the existing corridor of the bypass exists, options such as putting the Zagreb bypass under the toll system as well as constructing parallel roads or expansions of existing bypass should be assessed, to try to redirect local traffic on the motorway that would be thus free for transit traffic.

Figure 350: Volume/Capacity ratio – For off-season and season traffic (blue color makrs continental region and pink Adriatic region)



Source: NTM

2.5. AIR TRANSPORT

2.5.1. HYPOTHESIS

The Adriatic airports and in particular the Croatian southern Adriatic airports have a key function in accessibility for the touristic sector.

Source

National Traffic Model for the Republic of Croatia (NTM)

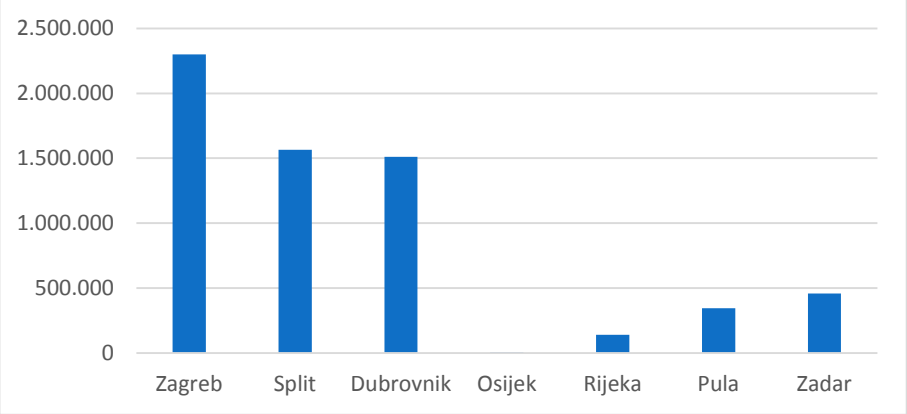
Key findings

- Air transport sector in the Republic of Croatia is directly linked to tourism, as it can be seen from the demand charts in the traffic model.
- Demand in all Croatian airports significantly increases from May to September in all Croatian airports.
- Rijeka and Pula airports have marginal traffic volumes during the off season.

Note

Each year airports in the Republic of Croatia are recording an increasing number of passengers. Official information from Croatian airports for the year 2013 displaying the annual number of airport passengers is presented in the following figure. Almost 85 % of the entire airport passenger traffic takes place at the three largest airports: Zagreb (36%), Split (25%) and Dubrovnik (24%).

Figure 71: Annual passengers in Croatian airports. 2013 (Zagreb Airport, Split Airport, Dubrovnik Airport, Osijek Airport, Rijeka Airport, Pula Airport and Zadar Airport.)



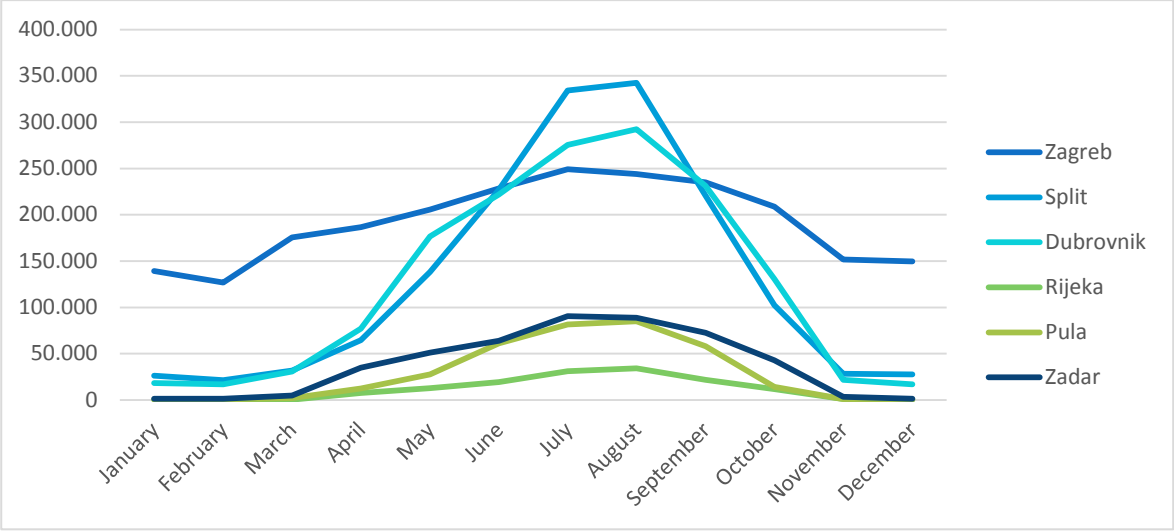
Source: Central Bureau of Statistics

Analysing the monthly distribution of the number of passengers, a conclusion is that the air transport sector in the Republic of Croatia is directly linked with the tourism. According to the chart

(Figure 72), the demand significantly increases from May to September. This is particularly true for the Split and Dubrovnik airports, where passenger traffic is 20 times higher in the summer months, July and August, then in February. Passenger volumes at the Franjo Tuđman Airport in Zagreb in July are almost double the February traffic. The Rijeka and Pula airports have marginal traffic volumes during the off-season, with the volume increasing in August to almost 35,000 and 85,000 monthly passengers, respectively. The high seasonality in all the airports suggests that a touristic concept of widening the season is essential.

A significant increase in the number of passengers in the summer months extends the time until the departure.

Figure 72: Monthly passengers in Croatian airports. 2013 (Zagreb Airport, Split Airport, Dubrovnik Airport, Rijeka Airport, Pula Airport and Zadar Airport.)



Source: Central Bureau of Statistics

2.5.2. HYPOTHESIS

Dubrovnik airport has a key function for the international and nation passenger accessibility of the Southern Dalmatian Region

Source

Dubrovnik Airport Master Plan; Transport Development Strategy of the Republic of Croatia (TDS); Coastal Liner Service Agency (CLSA); Dubrovnik Airport; Croatian Bureau of Statistics (CBS)

Key findings

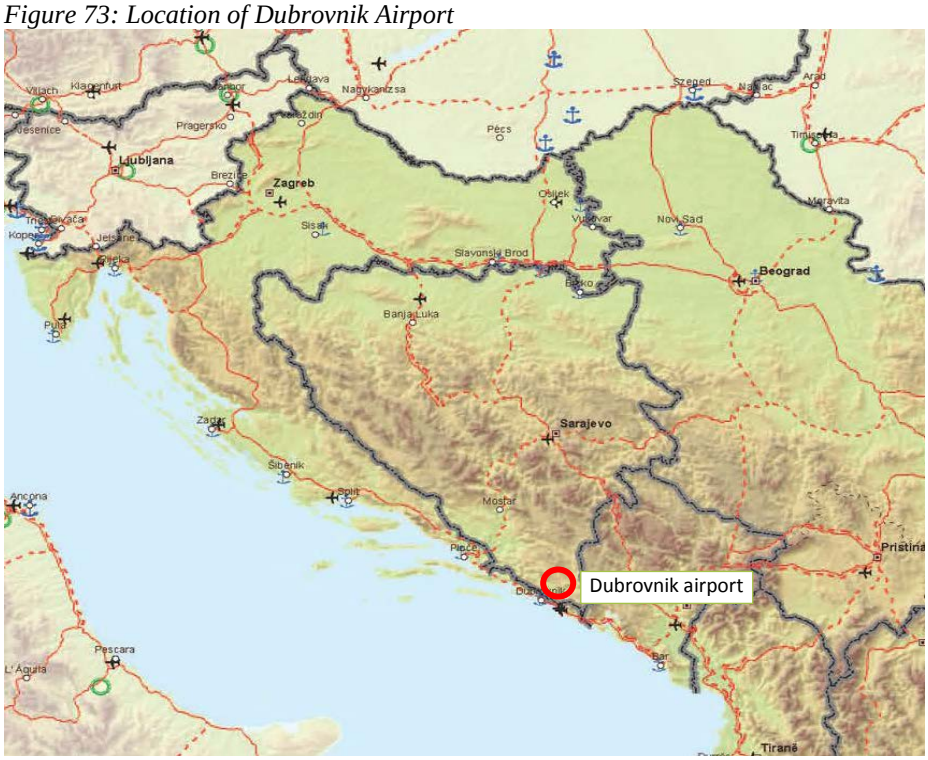
- Parts of the Dubrovnik county do not have a direct continental connection to the rest of Republic of Croatia.

- Dubrovnik Airport has a key role in ensuring accessibility of the Dubrovačko-neretvanska County tourists.
- Dubrovnik Airport in its current state cannot accommodate the anticipated increase in traffic because its capacity is already on the verge of utilization. The constant overload of various sub-systems at the airport would over time lead to the disruption of its functionality.
- The cost of a car travel from Dubrovnik to Zagreb is about the same as a plane ticket, but the travel time by plane is significantly lower (more than 6 hours by car, less than an hour by plane).
- The daily distribution of passengers at the Dubrovnik Airport during off-season (February) shows that people are mostly using the airport on Saturdays and Mondays.

Note

The Dubrovnik Airport is located in the Dubrovačko-neretvanska County in Croatia, which is geopolitically and territorially isolated from the rest of Republc of Croatia and the European Union because of the border with Bosnia and Herzegovina (non-EU). The Dubrovnik Airport plays an important role in the large distances accessibility of the Dubrovačko-neretvanska County, while the question of road accessibility of the Dubrovačko-neretvanska County is compromised by the need for crossing the border with Bosnia and Herzegovina twice on a short distance. This issue will be even more important when the Republic of Croatia joins the Schengen area, thus implying a higher level of border control. Rail transport does not exist, and maritime transport links the City of Dubrovnik only with surrounding islands (Šipan, Lopud, Koločep, Mljet, Korčula and Lastovo). Only the air transport ensures the free movement of people and goods every day without crossing national borders of non-EU members. The price of traveling the distance between Dubrovnik and Zagreb by plane is about the same as for the car travel, but traveling by car lasts longer, i.e. more than 6 hours, while a plane flight takes less than an hour.

Figure 73: Location of Dubrovnik Airport

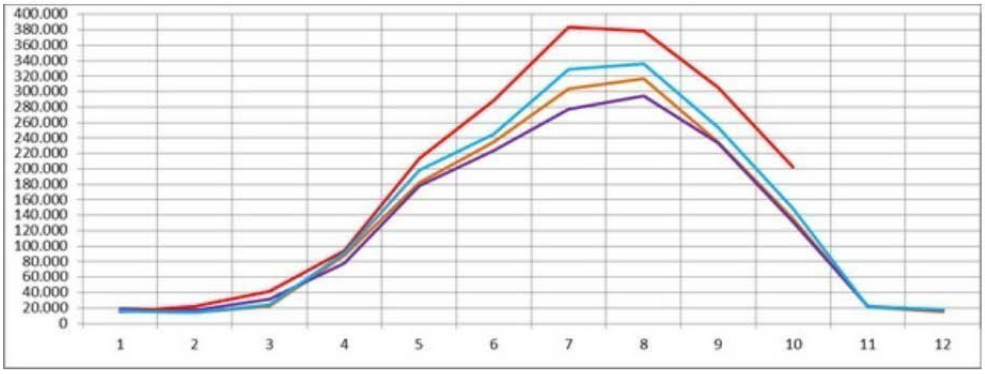


Source: TDS

The region's economy is based mainly on tourism, as the City of Dubrovnik is one of the most prominent tourist destinations in the Mediterranean. For this reason, Dubrovnik Airport has a key role in ensuring accessibility to the county tourists. Passenger traffic through the international airport is increasing from year to year. In 2015 the airport had 1,693,934 passengers. In the first ten months of 2016 the Dubrovnik airport had 1,946,810 passengers, the number of passengers in October 2016 was 202,703, which is an increase by 36% compared with October 2015. This is the largest ever reported increase in the number of passengers in a single month, as well as the ever-largest number of passengers in October ever since the opening of the Dubrovnik Airport.

Figure 74: Monthly passenger flow on Dubrovnik airport

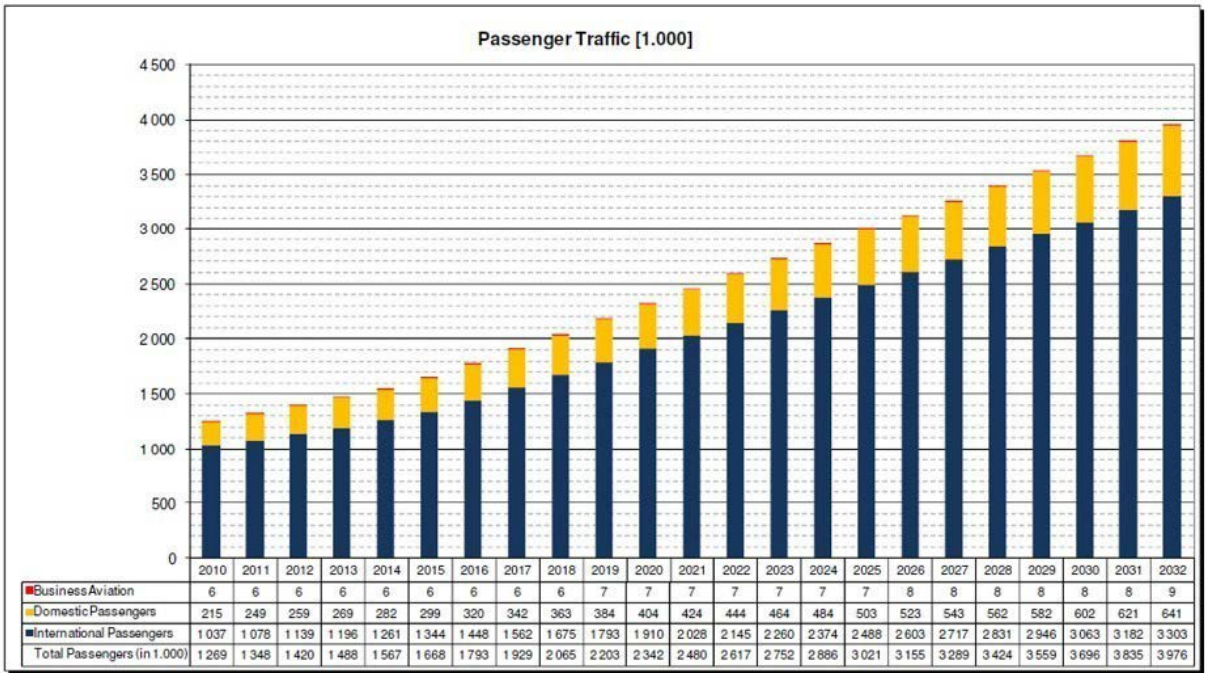
Year	1	2	3	4	5	6	7	8	9	10	11	12	TOTAL
2013	18879	17154	31181	77910	177763	223809	277080	239983	233276	131853	22102	17639	**1522629**
2014	15950	14423	21963	87774	181898	234887	303993	317184	234395	135257	21385	15362	**1584471**
2015	15743	13737	24142	90646	198168	245063	328400	335585	254454	148615	20964	18417	**1693934**
2016	15666	22615	41664	94632	213321	288809	383032	378473	305895	202703			**1946810**



Source: Dubrovnik Airport

At the moment, the project "Development of the Dubrovnik airport" is being implemented, with the anticipated implementation period from 1 January 2014 to 11 April 2019. The project is co-financed by the European Union, i.e. the European Regional Development Fund "Investment in future!". The Airport reconstruction and development project will ensure the increase of the competitiveness of Dubrovnik Airport in relation to other airports, a higher level of service, higher employment rates, and improvements in both, inbound and outbound tourism. One of the Airport primary goals is to increase the number of passengers to approximately 3.98 million per year in the planning period until the year 2032.

Figure 75: Passenger traffic prognosis for DBV (basic scenario) 2010. – 2032 (red - business flights, yellow - domestic travelers, blue - international travelers; the x-axis shows years, and y-axis number of passengers in thousands)



	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032
Business Aviation	6	6	6	6	6	6	6	6	6	7	7	7	7	7	7	7	8	8	8	8	8	8	9
Domestic Passengers	215	249	259	269	282	299	320	342	363	384	404	424	444	464	484	503	523	543	562	582	602	621	641
International Passengers	1 037	1 078	1 139	1 196	1 261	1 344	1 448	1 562	1 675	1 793	1 910	2 028	2 145	2 260	2 374	2 488	2 603	2 717	2 831	2 946	3 063	3 182	3 303
Total Passengers (in 1.000)	1 269	1 348	1 420	1 488	1 567	1 668	1 793	1 929	2 065	2 203	2 342	2 480	2 617	2 752	2 886	3 021	3 155	3 289	3 424	3 559	3 696	3 835	3 976

Source: Master plan Dubrovnik Airport

2.5.3. HYPOTHESIS

Airport "Franjo Tudjman" plays a key role for Central-Croatian functional region accessibility towards the main European centres.

Source

National Traffic Model for the Republic of Croatia (NTM); Croatian Bureau of Statistics (CBS); Monografie "Airport Zagreb " 50 years (lead editor Zvonke Šeb, Zagreb 2012.)

Key findings

- Airport Franjo Tudjman in Zagreb is the main exit / entry point from / to Republic of Croatia and operates as a hub for domestic and international traffic.
- Motorways and state roads are also playing a key role in accessibility towards the main European centres due to the geographic location of Republic of Croatia.

Note

In the year 2015 the International Airport Franjo Tudjman had 2,587,798 passengers within 39,854 flights. Compared with the year 2014, there was a growth in the number of passengers by 6.45%.

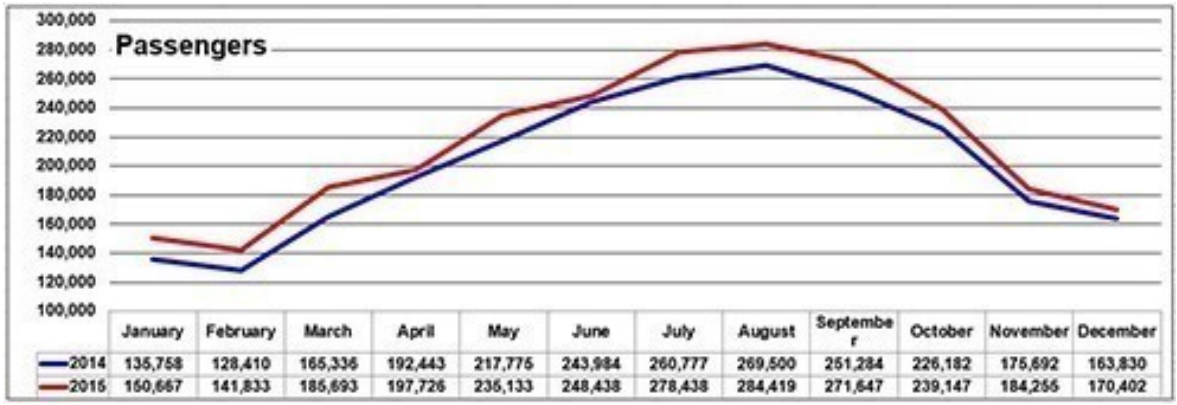
According to these indicators Zagreb Airport is leading in the number of passengers in Republic of Croatia, because in year 2015 it had nearly 600,000 passengers over the Split Airport which second airport in Croatia by the volume of passengers.

Figure 76: Number of aircraft movement in year 2014 and 2015

	January	February	March	April	May	June	July	August	September	October	November	December
2014	2,684	2,496	3,030	3,110	3,512	3,430	3,560	3,542	3,632	3,506	2,974	2,872
2015	2,936	2,676	3,232	3,556	3,724	3,686	3,708	3,672	3,572	3,394	3,018	2,780

Source: Franjo Tuđman Airport

Figure 77: Number of passengers in year 2014 and 2015



	January	February	March	April	May	June	July	August	September	October	November	December
2014	135,758	128,410	165,336	192,443	217,775	243,984	260,777	269,500	251,284	226,182	175,692	163,830
2015	150,667	141,833	185,693	197,726	235,133	248,438	278,438	284,419	271,647	239,147	184,255	170,402

Source: Franjo Tuđman Airport

There are 17 Airline companies that operate on scheduled routes in passenger traffic at the airport Franjo Tudjman during the year:

1. Air France flies to: Paris (CDG)
2. Austrian Airlines flies to: Vienna (VIE)
3. Lufthansa flies to: Frankfurt (FRA), München (MUC)
4. Germanwings flies to: Köln (CGN), Stuttgart (STR), Berlin (TXL)
5. Aeroflot flies to: Moscow (SVO)
6. Turkish Airlines flies to: Istanbul (IST)
7. British Airways flies to: London (LHR)

8. Croatia Airlines flies to: London (LHR), München (MUC), Frankfurt (FRA), Paris (CDG), Brussels (BRU), Amsterdam (AMS), Copenhagen (CPH), Vienna (VIE), Rome (FCO), Zurich (ZRH), Bucharest (BUH), Helsinki (HEL), Oslo (OSL), Stockholm (ARN), Skopje (SKP), Sarajevo (SJJ), Split (SPU), Dubrovnik (DBV), Pula (PUY), Zadar (ZAD), Osijek (OSI)
9. Royal Dutch Airlines flies to: Amsterdam (AMS)
10. Brussels Airlines flies to: Brussels (BRU)
11. Air Serbia flies to: Belgrade (BEG)
12. Norwegian flies to: Copenhagen (CPH)
13. Eurolot flies to: Warsaw (WAW)
14. Czech Airlines flies to: Prague (PRG)
15. Quatar Airways to: Doha (DOH)
16. Air Transat to Toronto (YYZ)
17. Emirates to Dubai (DXB)

Figure 1: Connection between airport Franjo Tudjman and other European centers

Source: Monografie "Airport Zagreb " 50 years (lead editor Zvonke Šeb, Zagreb 2012.)

Airport Franjo Tudjman does not provide accessibility only for the capital City of Zagreb, but also for other cities in the Central-Croatian functional region. Those cities are: Velika Gorica (≈3 km) Varaždin (≈87 km), Čakovec (≈106 km), Koprivnica (≈98 km), Bjelovar (≈88 km), Virovitica (≈ 153 km), Daruvar (≈129 km), Zabok (≈51 km), Zaprešič (≈33 km), Kutina (≈83 km), Sisak (≈46 km) and Karlovac (≈59 km). Connection between those cities and Airport Franjo Tudjman are through many motorways (A1, A2, A3, A4, A11) and state roads which starts / ends in Zagreb. The long distance (international traffic) road traffic system of Croatia is well linked to surrounding countries. It has a dense network of motorways and state roads with a high level of service:

- Motorway A3 (E70): Belgrade - Zagreb – Ljubljana – Munich, connecting Slovenia and Serbia,
- Motorway A2 (E59): Zagreb – Maribor – Vienna, connecting Slovenia,
- Motorway A4 (E65): Zagreb – Budapest, connecting Hungary,
- Motorway A5: State border – Beli Manastir – Osijek – Svilaj, connecting Hungary and Bosnia and Herzegovina,
- Motorway A7 (E61): Križišće – Rijeka – Rupa, connecting Slovenia,
- Primary road D2: Dubrava Križovljanska border crossing to Slovenia to Ilok border crossing to Serbia,
- Primary road D5: connecting Hungary and West Bosnia and Herzegovina,
- Primary road D7: Dubošević – Beli Manastir – Osijek – Đakovo – Slavonski Šamac, connecting Hungary and Bosnia and Herzegovina.

The motorway A1 connects Central Croatia with Bosnia and Herzegovina at the southern border, near the border to Montenegro. At the same time, Central Croatia is linked to Slovenia in the West by the motorway A6 (E65).

Currently Airport Franjo Tudjman is managed by concessionaire who founded a new company, Zagreb International Airport Jsc.. Jsc., previously operated by the airport, is still active and now provides technical and technical assistance to the concessionaire in Implementation of the Concession Contract for Construction and Management of Zagreb Airport between the Republic of Croatia and International Airport Zagreb d.d. with a view to further develop the infrastructure and all segments of traffic not subject to the concession contract. The completion of a new passenger terminal is opened in March 2017.

2.5.4. HYPOTHESIS

The accessibility of airports in Republic of Croatia is a problem especially during the touristic season. The integration of the airports into the regional transport system is not adequate

Source

Croatian Bureau of Statistics (CBS); National Traffic Model for the Republic of Croatia (NTM); Airport Franjo Tudjman, Dubrovnik Airport; Zadar Airport; Rijeka Airport; Split Airport; Pula Airport

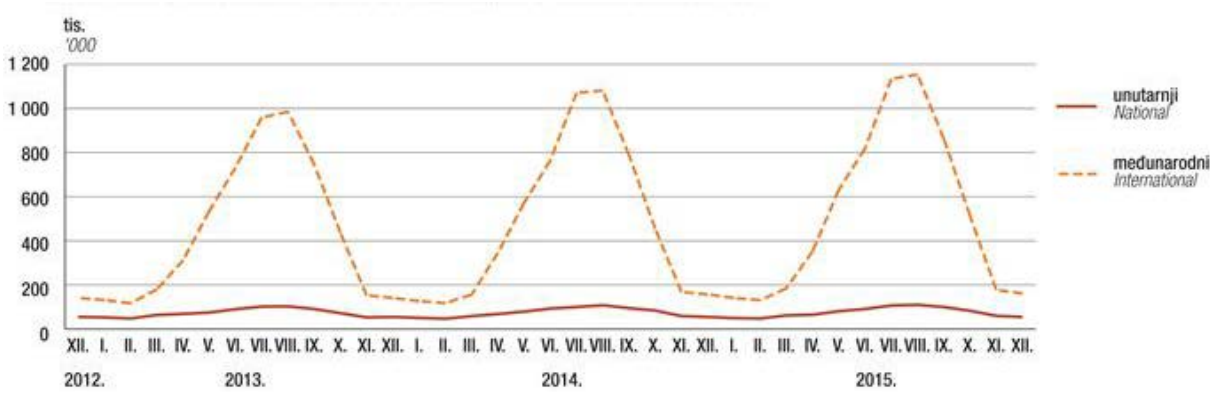
Key findings

- Monthly distribution of passengers in Croatian airports is very seasonal.
- Passenger modal split and average occupation to/from the Zagreb Franjo Tudjman Airport show that 36% of people use the car with the occupancy of 1.5 people, 33% use the bus with the occupancy of 25 people and 31% use the taxi with the occupancy of 1.2 people.
- Available modes of transport to access the airports do not provide adequate service during and off-season periods because of the capacity level of the urban road network.
- Certain measures should be implemented in order to provide adequate transport services to the airports, either by extending capacity or by reducing demand on the road network through demand management, introducing alternative transport modes and similar.

Note

According to the data obtained from the Croatian Bureau of Statistics (CBS), the monthly distribution of passengers in all Croatian shows that the volume of passengers starts increasing in March, peak volumes are in July and August, the volume decreases in September and the lowest volume is in February. This is especially correlated with passengers on international flights because air transport sector is in direct connection with summer tourism season in Republic of Croatia. The monthly distribution of passengers on national flights at all Croatian Airports is not so seasonal.

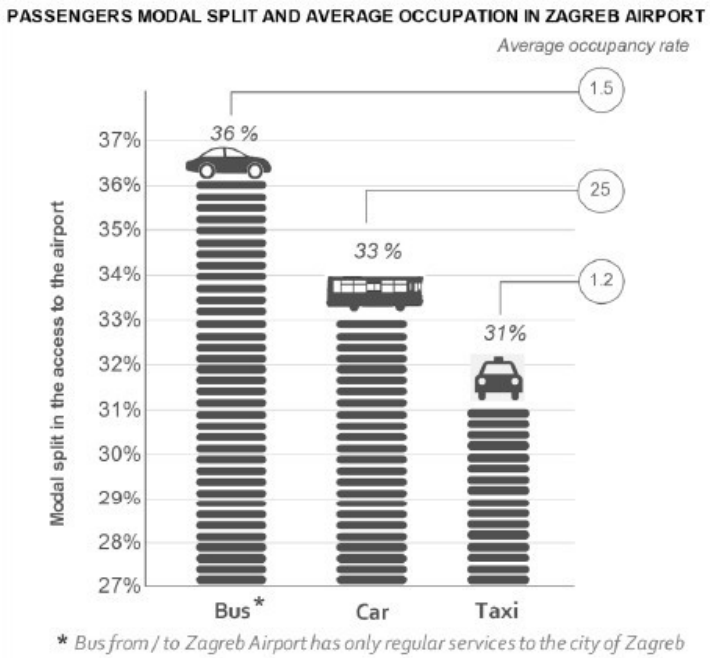
Figure 2: Passengers in Croatian airports, by types of transport, December 2012 – December 2015



Source: Croatian Bureau of Statistics - CBS

There is no airport in Croatia with a railway/tram connection. Passengers are transported by car, public bus or taxi. The information about the modal split in the access to the airports is not available; therefore, the estimations are based on the actual data from similar airports (Madrid Airport, Barcelona Airport, Alicante Airport and Kuwait International Airport).

Figure 80: Estimated modal split in the access to the Zagreb Airport



Source: NTM

Table 1: Estimated modal split in the access to airports according to the transport supply (left to the right: bus, car, taxi)

Airport	Bus	Car	Taxi
Zagreb	33%	36%	31%
Split	25%	37%	38%
Dubrovnik	35%	33%	32%
Osijek	-	50%	50%
Rijeka	33%	32%	35%
Pula	28%	40%	32%
Zadar	35%	33%	32%

Source: NTM

At the Franjo Tudjman Airport, a scheduled bus shuttle, "Pleso prijevoz", is operating between the airport and the Central Bus Station in Zagreb. The shuttle service operates in scheduled intervals of 30 minutes from 4:30 (7:00) up to 20:00 (20:30) hours each day. However, it is also arranged in a way that it follows the arrival of all scheduled landings at the airport. It takes approximately 30 minutes to reach the Central Bus Station in Zagreb. The taxi service is provided by “VG TAXI Association”.

The Split Airport is located at the very exit from the town of Kaštela, towards Trogir. It is at a 20-km distance from Split. A direct bus line transfer of passengers to/from Split is organised in cooperation with "Pleso prijevoz". Buses from the Split depart 20 minutes after the landing of an airplane. Public transport is provided by bus lines close to the Split Airport: No. 37 (Split – Trogir; Trogir – Split) and No. 38 (Split Airport – Kaštel Stari – Split; Split – Kaštel Stari – Split Airport). Taxi service is available during the Split Airport operating hours.

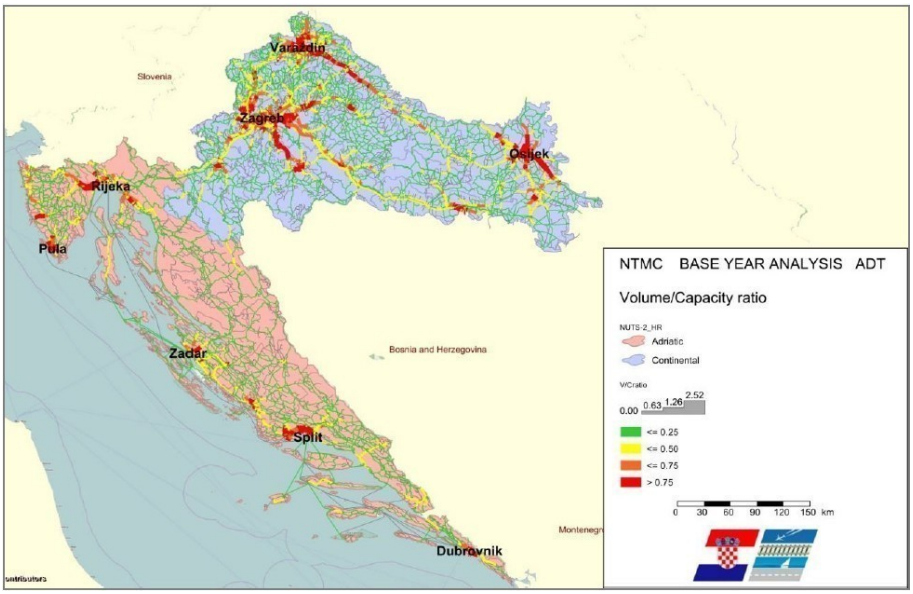
The Dubrovnik Airport is located about 20 km south of the old town of Dubrovnik. The transfer to the City of Dubrovnik is provided by bus or taxi. "Atlas" travel agency organizes passenger transfer by bus upon arrival of every regular flight.

Zadar Airport is located about 7 km south of the town Zadar. Transfer to the City of Zadar is provided by bus or taxi. Buses depart from the Zadar Old Town Bus Terminal to the airport 3-6 times a day and from the Zadar Airport they depart from the front gate of the international arrival terminal 3-7 times a day. Transportation to the city is arranged by firm "Liburnija Ltd.". Taxi is present every day during the regular opening hours of Zadar Airport between 6:00 and 22:00 hours and on call outside the regular time.

The general levels of adequacy and effectiveness of the road network in Republic of Croatia in both season and ff-season periods are shown by the following Volume/Capacity ratio map. The

following figure shows the ADT (Average Daily Traffic) situation, where it can be clearly seen that the critical areas with a v/c ratio above 75%, indicated in red, can be found in and around the urban areas. Volume/capacity ratios for the daily average traffic above 75% are considered as critical and to be avoided because, within peak hours, the volumes can easily exceed 100% and can lead to unstable traffic flows, resulting in traffic breakdowns and congestions, and consequently in time lost for the users. Main Croatian airports (Zagreb, Split, Dubrovnik, Zadar, Pula, Rijeka) and their access roads are located around those urban areas.

Figure 81: Volume / Capacity ADT for ration base year (blue - continental region, pink - Adriatic region)



Source: NTM

2.5.5 HYPOTHESIS

Safety standards on many Croatian airports are not in line with the respective EU requirements.

Source

Croatian Civil Aviation Agency (CCAA); Ministry of Sea, Transport and Infrastructure (MSTI)

Key findings

- The European Aviation Safety Agency (EASA) was pleased to welcome the Republic of Croatia as its 32nd Member State.

- International airports in the Republic of Croatia are certified based on applicable and applicable ICAO, EU and national regulations and are duly inspected by the Croatian Civil Aviation Agency.

Note

By joining the European Union on 1 July 2013, Republic of Croatia has also become a full Member of EASA. The Agency had worked closely with the Republic of Croatia for more than six years to fully prepare the State's transition to the EASA regulatory system, including the conclusion of Bilateral Working Arrangements and Technical Assistance and Support Programmes such as the EASA Instrument for Pre-Accession Assistance (IPA).

On 14 February 2014, Commission Regulation (EU) No 139/2014 laying down requirements and administrative procedures related to aerodromes pursuant to Regulation (EC) No 216/2008 of the European Parliament and of the Council was published in the Official Journal of the European Union. Regulation (EC) No 216/2008 aims at establishing and maintaining a high uniform level of civil aviation safety in Europe. The implementation of the Regulation (EC) No 216/2008 requires the establishment of detailed Implementing Rules, in particular concerning the safety regulation of aerodromes, in order to maintain a high uniform level of civil aviation safety in the Union while pursuing the objective of an overall improvement in aerodrome safety.

This Regulation lays down detailed rules on the conditions for issuing, maintaining, amending, limiting, suspending or revoking: certificates for aerodromes and certificates for organisations responsible for the operation of aerodromes.

Airports in the Republic of Croatia fall within the scope of EASA and this Regulation refers to them if they meet the following requirements: open to public use, serve commercial air transport operations, have a published instrument approach or departure procedure and have a paved runway of 800 metres or above or exclusively serve helicopters.

Certificates issued by the Croatian Civil Aviation Agency prior to 31 December 2014 on the basis of national legislation shall remain valid until they are issued in accordance with Commission Regulation (EU) No 139/2014 or, at the latest, 31 December 2017. Aerodromes whose certification procedure was initiated before 31 December 2014, but have not been issued with a certificate by this date, shall only be issued a certificate when they comply with this Regulation. The Regulation will enter into force on the twentieth day of its publication in the Official Journal of the European Union. It is binding in its entirety and directly applicable in all Member States. At the moment

safety standards on all Croatian airports are being coordinated with the respective EU (EASA) requirements.

2.5.6. HYPOTHESIS

Some of the Croatian airports are not prepared for the Schengen requirements.

Source

Transport Development Strategy of the Republic of Croatia (TDS); European Commission http://ec.europa.eu/dgs/home-affairs

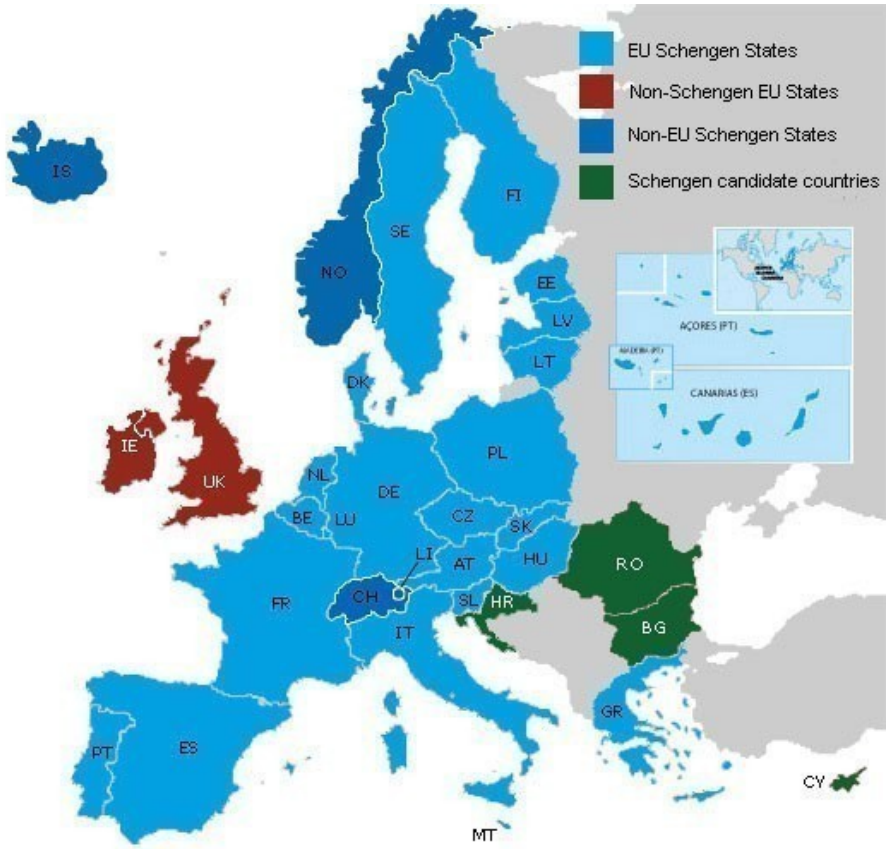
Key findings

- Republic of Croatia is an EU member state which is not part of the Schengen Area but it is in the process of joining it.
- Croatian airports are not prepared for the Schengen requirements.
- Croatian international airports should meet the Schengen requirements.
- At the Dubrovnik Airport and at the "Franjo Tudjman" Airport in Zagreb requirements related to Schengen will be completed after the completion of current projects.
- Implications of the Schengen requirements could isolate Dubrovnik area because of limitations in the road connections.

Note

By applying the Schengen requirements to Croatian borders, the borders will become new frontier for the most part of the European Union.

Figure 82: Schengen Area as of 1/7/2013 (Light blue - EU states in the Schengen area, dark blue - non-EU states not in the Schengen area, red - EU states not in the Schengen area, green - candidate countries for the Schengen area)



Source: European Comission

Schengen requirements must be incorporated into all future Master Plans for international Airports in the Republic of Croatia (such as the Master Plan of Dubrovnik Airport). Changes in the border control will facilitate the movement of Schengen passengers, but it will be also difficult to design terminals. At the Dubrovnik Airport in and at the "Franjo Tudjman" Airport in Zagreb Schengen requirements will be completed after the completion of current projects. The Dubrovnik area could become even more isolated because of limitations in the road connections with the rest of the country. If this happens, air traffic could grow (passenger and freight) because it will be used as a substitute for road transport. This scenario must be taken into account in the further planning related to Dubrovnik because the implications in terms of the quality of service and the national strategy could be drastic.

2.6. MARITIME TRANSPORT

2.6.1. HYPOTHESIS

The use and better integration of maritime passenger transport in the framework of the local PT system has a big potential for the improvement of the Modal Split in favour of PT.

Source

Costal Liner Service Agency (CLSA); National Traffic Model for the Republic of Croatia (NTM)

Key findings

- Costal Liner Service Agency (CLSA) provides general framework for regulation of maritime public passenger service in Republic of Croatia.
- The connection between maritime public transport and local public transport should be more effective so that passengers can easily plan their travel.
- Accessibility of islands should be better.
- There are privileged users of maritime passenger transport.

Note

The Croatian Government has established Costal Liner Service Agency (CLSA) in 2006, on the basis of Liner Shipping and Seasonal Costal Maritime Transport Act (National Gazzete 33/06, 38/09, 87/09, 18/11, 80/13, 56/16), for purpose of regulating of regular maritime public passenger transport. The Costal Liner Service Agency provides general framework for regulation of public passenger service in Republic of Croatia. It also defines general terms of public service, types of public maritime coastal transport, mandatory requirements and procedures necessary for providing services in regular public maritime transport. In coastal line passenger transport, shipping companies perform the transport based on a concession contract or a contract on provision of public services with the Agency for Coastal Maritime Liner Services, which also pays the subsidy for transport from the state budget allocations and monitors the performance under the mentioned contracts.

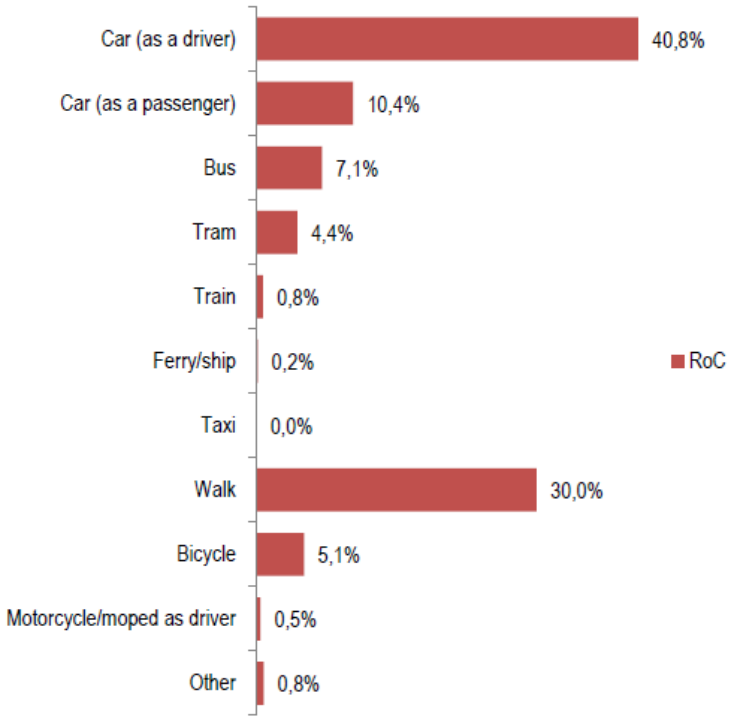
There is a need for better integration of maritime passenger transport in the local framework of public transportation. It means that the Port Authority's, Costal Liner Service Agency (CLSA) and public transport companies should work together and set the standards for providing functional public transport services. The connection between maritime public transport and local public

transport should be more effective so that passengers can easily plan their travel. Also, there should be a possibility of park & ride service.

In order to improve maritime passenger transport some facts from NTM should be taken into account:

- The proportion of all trips taken by different methods of transport. The single most popular mode of transport was by car with about 51% of all trips being made by car (40.8% as a driver and 10.4% as a passenger); walking was the second most popular method of travelling with the proportion of 30% of all trips. The bus was the most often used public transport vehicle with a share of 7.1%, while about 12% of all trips were made by public transport (bus, tram, train, and ferry). About 5% of all trips were made by bicycle.

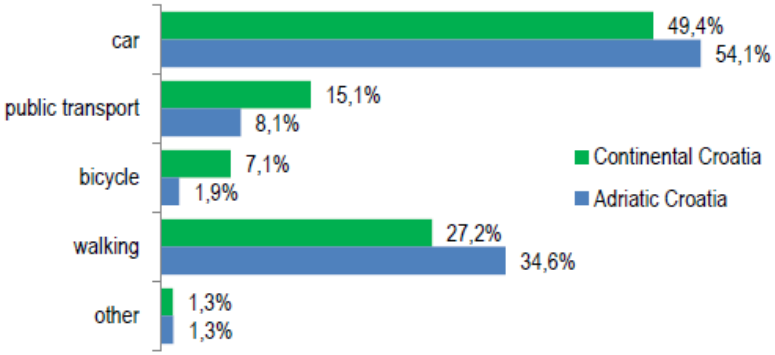
Figure 83: Proportion of all trips taken by different methods of transport, at the national Level



Source: NTM

- The proportion of all trips taken by different methods of transport at the regional (NUTS-2) level and reveals a significant difference between Continental and Adriatic Croatia in mode share. The ranking order of the mode shares was the same for both regions, though respondents from Adriatic Croatia made more trips by car and by walking while respondents from Continental Croatia used public transport and bicycle more often.

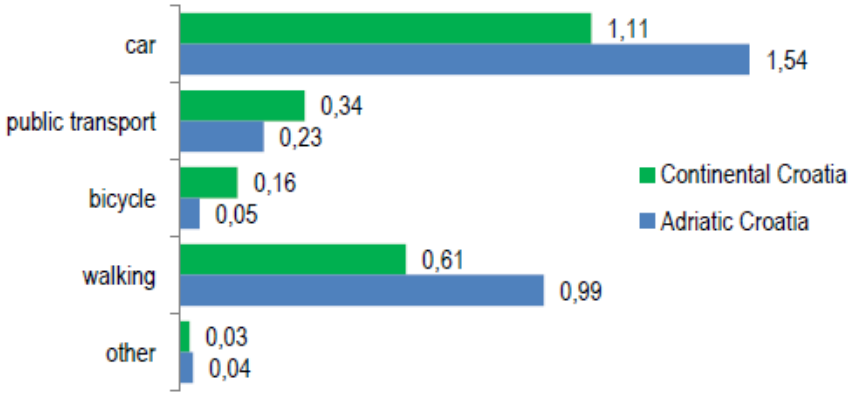
Figure 84: Proportion of all trips taken by different methods of transport, at the regional (NUTS-2) level (vertically listed from top to bottom: car, public transport, bicycle, on foot, other, green - continental Croatia, blue - Adriatic Croatia)



Source: NTM

- The breakdown of trip rates by transport mode for each region depicts more precise differences of travel patterns between Continental and Adriatic Croatia. Compared to the continental part of Republic of Croatia, respondents from Adriatic Croatia made almost 40% more car trips, 60% more walking trips, 32% fewer public transport trips, and 65% fewer bicycle trips than respondents from the Adriatic part of Croatia.

Figure 85: Trip rates by different methods of transport, at the regional (NUTS-2) level (vertically listed from top to bottom: car, public transport, bicycle, on foot, other, green - continental Croatia, blue - Adriatic Croatia)



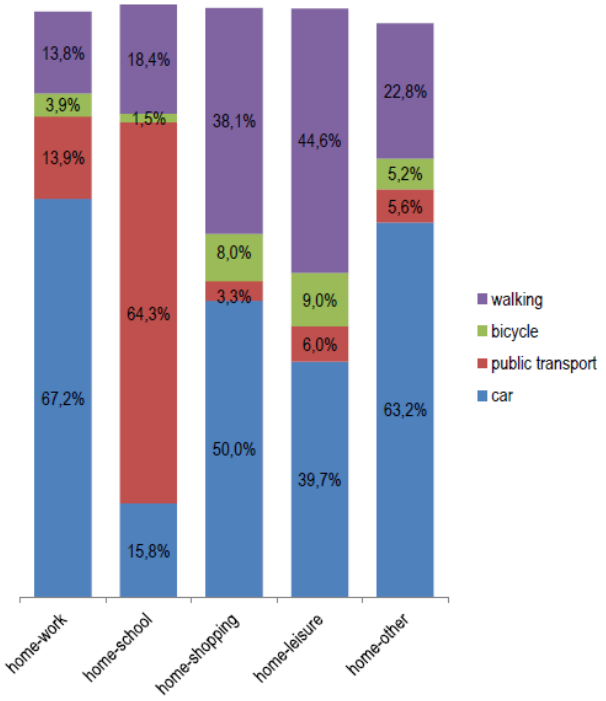
Source: NTM

- Among five trip purpose pairs with home as the origin of a trip, a trip by car (as a driver or as a passenger) was the first transport method of choice for home–work (67.2%), home–shopping (50%), and home–other (63.2%). Public transport was the most frequent method of travel for a home–school trip purpose pair, with a share of 64.3%, while walking was the

most frequent mode of transport for the home-leisure trip purpose pair, with a share of 44.6%.

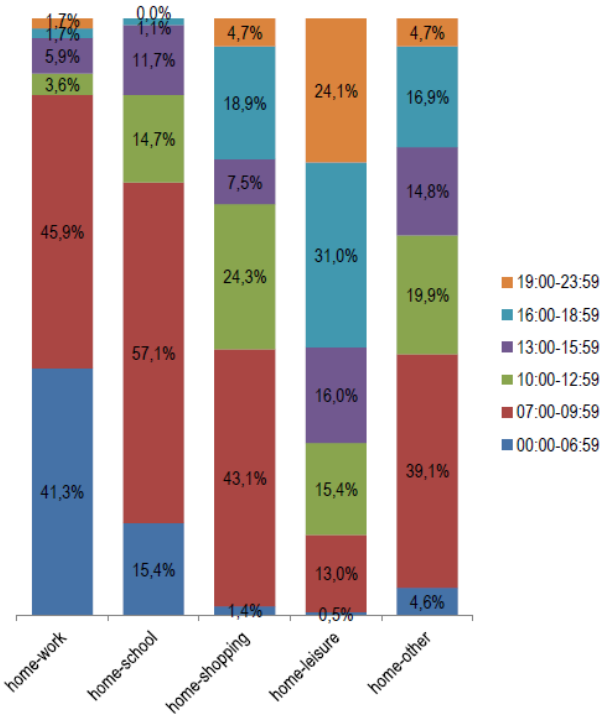
- Public transport had a significant share only for the home–school trip purpose pair, while it accounted for less than 15% in the other four pairs and had the lowest share (3.3%) in the home–shopping trip purpose pair.

Figure 86: Trip purpose pairs with home as the origin of a trip by mode of transportation (Horizontally listed from left to right: home-work, home-school, home-trade, home-away, home-away, purple - on foot, green - bicycle, red - public transport, blue - car)



Source: NTM

Figure 87: Start time for trips by purpose pairs with home as the origin of a trip (horizontally listed from left to right: home-business, home-school, home-shopping, home-vacation, home-other)



Source: NTM

The connection between the mainland and islands should be better. For example, ferry and fast boat connections from the City of Šibenik to the islands of Zlarin, Kaprije and Žirje are once or twice a day, and vice versa, depending on whether seasonal or non-seasonal timetable applies. Accessibility of remote islands should be better as well. For example, the season connections between the town of Vis (on the island of Vis which has around 3700 inhabitants and is around 33 nautical miles far from the Port of Split on the mainland) and the City of Split by ferry or fast boat are four times a day and vice versa (ferry 3x and fast boat 1x). Off-season connections by ferry or fast boat operate three times a day and vice versa (ferry 2x and fast boat 1x).

A good thing is that Costal Liner Service Agency provides ID cards for privileged transport prices. Users enjoying the privileged transport price right in accordance with the provisions of the Rulebook on the conditions and manner of becoming eligible for privileged prices in the coastal line passenger transport ("Pravilnik o uvjetima i načinu ostvarivanja prava na povlašteni prijevoz na linijama u javnom pomorskom prijevozu"; OG No. 41/17) are as follows:

- Croatian and foreign nationals residing in the islands or Pelješac peninsula and nationals of the Member States of the European Economic Area and members of their families irrespective of their nationality who have been declared as temporary residents and who

reside for at least 183 days (a yearr) on the islands or peninsula Pelješac (Hereinafter referred to as "the island"),

- children from the age of 3 to the age of 12 years,
- vehicles owned by physical persons referred to in item 1 of this paragraph and the vehicles of the leasing company with residence on the island which are registered in the competent administrative body in the Republic of Croatia,
- vehicles owned by the islanders or legal entities, or registered company vehicles, family farms (OPG), free professions and car lessees with their residence on islands, with the car registered at the competent administrative body in the Republic of Croatia,
- public service workers (police, armed forces, fire brigades, port captains) whose permanent work is on the island and their official vehicles are used on the island,
- public health service workers and their official vehicles when performing regular and urgent transportation of patients from the island to the mainland and vice versa,
- other persons who receive this right under special regulations.

2.6.2. HYPOTHESIS

Short sea shipping along the coast line or across the Adriatic Sea has a potential to reduce the congestion on the road system.

Source

Maritime Development and Integrated Maritime Policy Strategy of the Republic of Croatia for the Period from 2014 to 2020 (MDIMPS); National Traffic Model for the Republic of Croatia (NTM)

Key findings

- The public transport service in coastal line passenger transport is characterized as unprofitability in business activities.
- Coastal line passenger transport is performed by ships of Croatian nationality, after 31 December 2016 market of line passenger transport will be available to shipping companies from all EU member States.
- Road freight transport is the dominant mode of freight transport.
- Competition of short sea shipping with parallel road corridors with a high level of service is difficult.
- In order to succeed short sea shipping must be reliable, faster and cheaper than road transport.
- There is a potential for short sea shipping during the summer months when local and state roads are overcrowded.
- There is a potential for short sea shipping between Italy and Croatia.

Note

According to Maritime Development and Integrated Maritime Policy Strategy of the Republic of Croatia for the Period from 2014 to 2020 (MDIMPSRC) public transport in the coastal line passenger transport is considered to be the key factor in the maritime transport segment, given that it ensures permanent and regular connection of islands with the mainland and of one island with another, without which there would be no sustainable development of inhabited islands in internal waters and territorial sea of the Republic of Croatia. This sector provides regular and regulated line shipping between the Croatian islands (73 island ports) and the mainland coast (22 mainland ports).

According to Maritime Development and Integrated Maritime Policy Strategy of the Republic of Croatia for the Period from 2014 to 2020 (MDIMPSRC), coastal line passenger transport is characterized as an unprofitable business activity and therefore subsidized by budget funds in a way

that the financial support is given when a shipping company cannot cover the actual costs from the income earned on a specific line. In recent years, the annual budget funds allocated to subsidise this activity were approximately the following: HRK 436 million in 2008, HRK 382.7 million in 2011, HRK 375 million in 2012, and in 2013 these funds were expected to amount to HRK 325.5 million.

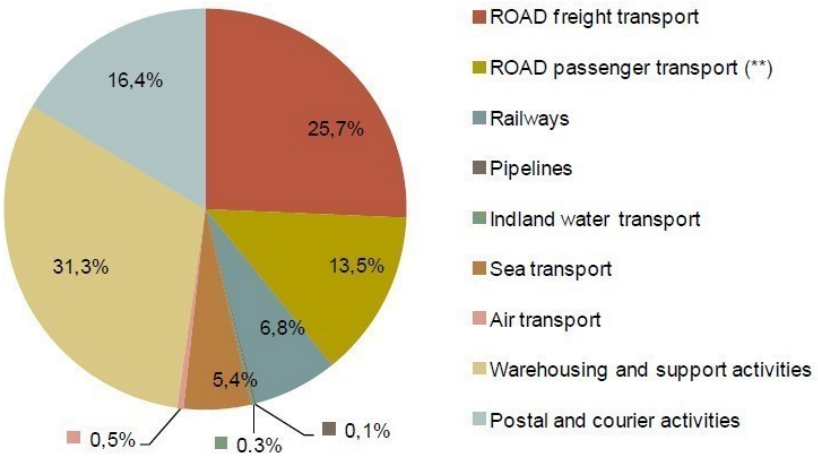
In coastal line passenger transport, shipping companies perform the transport based on a concession contract or a contract on provision of public services with the Agency for Coastal Maritime Liner Services, which also pays the subsidy for transport from the state budget allocations and monitors the performance under the mentioned contracts.

Until the expiry of the transitional period (31 December 2016), with respect to concession contracts or contracts on the provision of public services concluded according to the Regulation on the Freedom to Provide Services in Maritime Transport within Member States, transport service in coastal line passenger transport is performed by ships under the Croatian flag. After that period, the market of line passenger transport will be available under same conditions to shipping companies from all EU member states.

The unfavourable age structure of the fleet participating in the line passenger transport, the high share of the fuel price in the total costs of transport as well as significant seasonal oscillations are the most significant challenges shipping companies are encountering in the regular maritime transport service.

In Croatia freight is mostly transferred by road, as it can be seen by the percentage of Employment by Mode of Transport in Croatia (EUROSTAT 2011).

Figure 88: Employment in the Transport Sector in Croatia by mode of transport in 2011

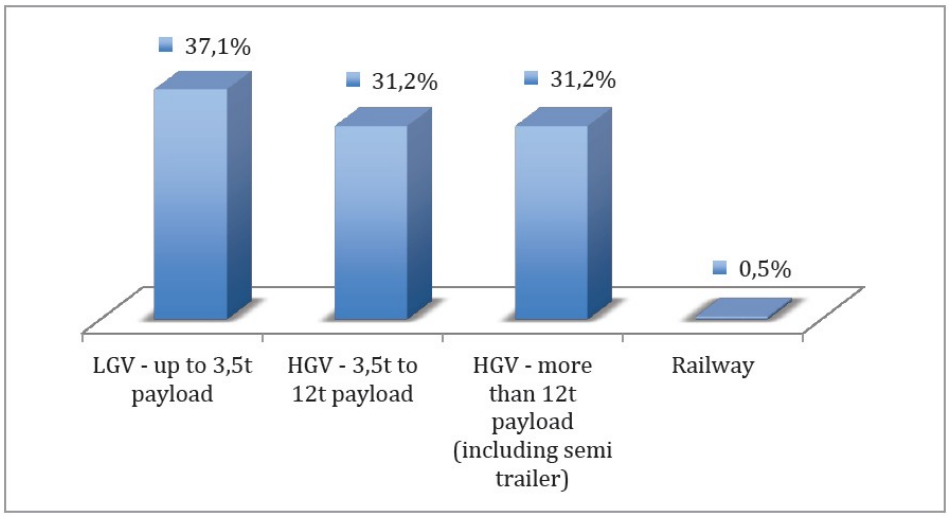


(**) Including all urban and suburban land transport modes.

Source: EUROSTAT

According to NTM the dominant choice of vehicle for freight transport is light goods vehicle (LGV) - up to 3.5t payload.

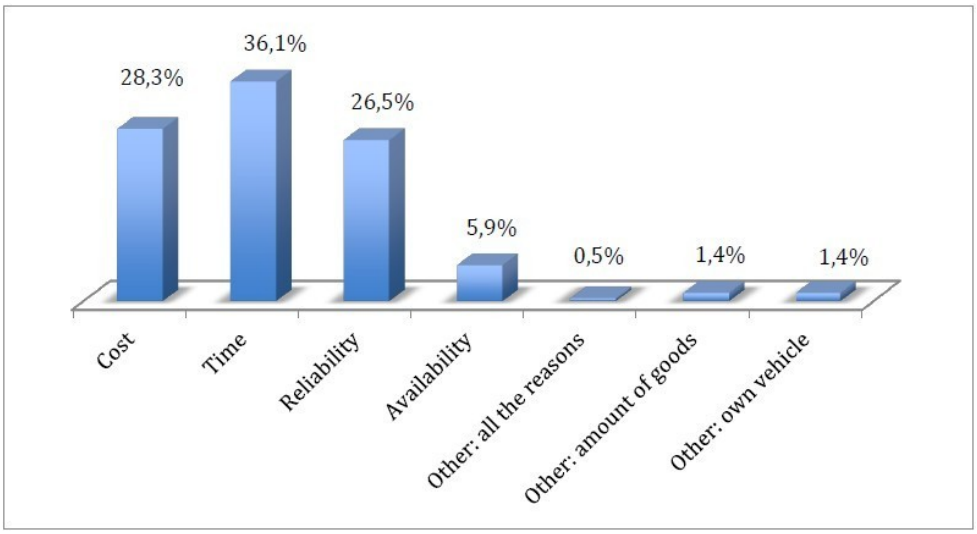
Figure 89: Type of vehicles used for freight transport



Source: NTM

The most frequent reason for a certain type of vehicle is time (36%) as the preferred choice, the second is cost (28%) and the third is reliability (27%). Warehousing/storage is the most common type of the origin and destination, although, it should be noted that transhipment is the most frequent one (37%).

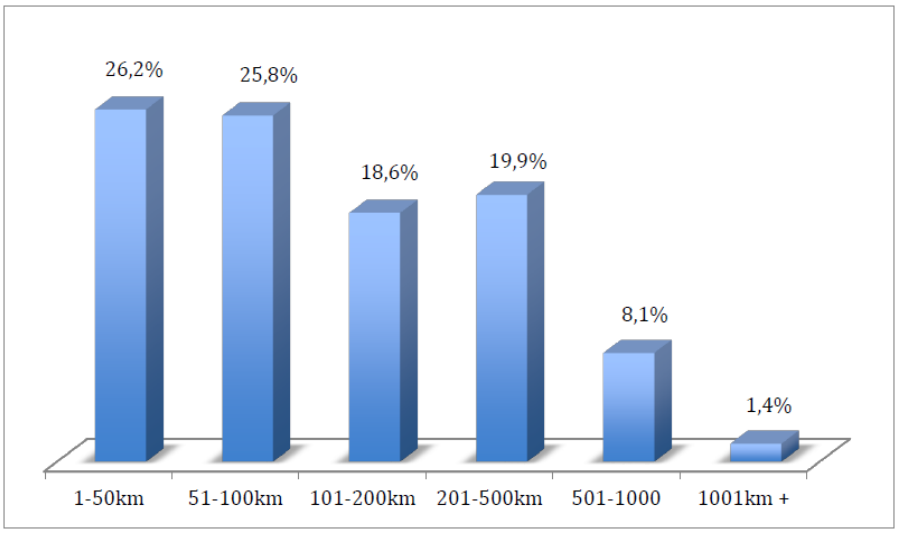
Figure 90: Reason of choice



Source: NTM

Shorter distances are dominant. The average distance is 197 km, the mean value in the series of distances is 98 km, and the most frequent distance is 7 km.

Figure 91: Distance travelled (km)



Source: NTM

The main problem within the freight transport is that there is no logistic chain between the different modes of transport.

Traffic counting results along the state road D8 (it is located near Adriatic coast) in 2013, shows that the LGV percentage in AADT is 8.0 – 13.6%, while the HGV percentage in AADT is 1.2 – 6.0%. LGV and HGV percentage altogether in AADT is 9.2 – 18.6%. Results are also showing that on some sections traffic volume is near the road capacity limit mostly due to the personal car traffic.

Table 2: Traffic counters locations on state road D8 and percentage of the LGV and HGV in AADT

Counter location	State road	AADT	LGV Numb./percent.	HGV Numb./percent.
Crikvenica	D8	11958	975/8.2	716/6.0
Senj	D8	3977	516/13.0	222/5.6
Karlobag	D8	1066	145/13.6	31/2.9
Murvica (Zadar)	D8	13239	1149/8.7	296/2.2
Bibinje (Zadar)	D8	12146	1067/8.8	253/2.1
Šibenik	D8	14252	1233/8.7	259/1.8
Omiš	D8	15893	1279/8.0	194/1.2
Brela	D8	6234	764/12.2	183/2.9
Zaton	D8	7879	783/9.9	296/3.8

Source: NTM

Traffic counting results on the motorway A1 entrance/exit (it connects Capital City of Zagreb with cities on the Adriatic coast) in 2013, shows that the LGV percentage in AADT is 3.8 – 10.4%, while the HGV percentage in AADT is 6.9 – 9.0%. LGV and HGV percentage altogether in AADT is from 11.9 – 18.4%. Results are also showing that the traffic volume on the motorway is not near the road capacity limit.

Table 3: Traffic counters locations on motorway A1 and percentage of LGV and HGV in AADT

Counter location	Motorway	AADT	LGV Numb./percent.	HGV Numb./percent.
Maslenica - jug	A1	13,793	1,356/9.8	1,183/8.6
Posedarje - jug	A1	13,175	1,033/7.8	912/6.9
Zadar 1 - jug	A1	10,454	800/7.7	819/7.8
Zadar 2 - jug	A1	10,838	1131/10.4	841/7.8
Šibenik - jug	A1	8620	818/9.5	757/8.8
Vrpolje - jug	A1	8677	831/9.6	730/8.4
Dugopolje - jug	A1	8026	304/3.8	648/8.1
Blato/Cetini - jug	A1	5522	444/8.0	386/7.0
Ravča - jug	A1	6459	395/6.1	583/9.0

Source: NTM

2.6.3. HYPOTHESIS

The main maritime port in Croatia is the Port of Rijeka, with a strong potential for further development.

Source

National Traffic Model for the Republic of Croatia (NTM); Transport Development Strategy of the Republic of Croatia (TDS); Port of Rijeka; Port of Rijeka Authority; National Plan for the

Development of Ports of special (international) economic interest for the Republic of Croatia - final report, november

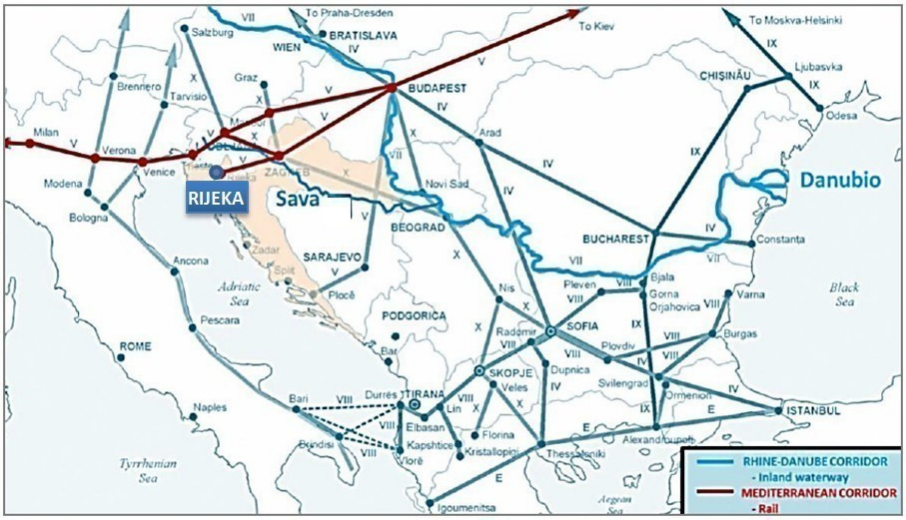
Key findings

- The majority of cargo transport in Croatian ports is carried out in the Port of Rijeka.
- Geostrategic position of the Port of Rijeka provides the shortest connection between overseas destinations and Central-Eastern Europe.
- The Port of Rijeka have the highest market potential for cargo transhipment.

Note

The Port of Rijeka is the largest port in Croatia and benefits from the deepest natural channel in the Adriatic. It is located on the coast of the protected Rijeka Bay. The area of the Port of Rijeka includes 5 locations. The central locations are the Rijeka and Sušak Basins, and are a part of the urban unit of the City of Rijeka. Separate parts of the Port of Rijeka are the Bakar Basin, Omišalj-Krk Basin and the Raša Basin.

Figure 92: Location and connectivity of Port of Rijeka



Source: NTM

The Port of Rijeka provides the shortest connection between overseas destinations and Central-Eastern Europe, both with respect to land and sea routes; the quality of service compares with those in other North Adriatic ports and covers all types of cargo.

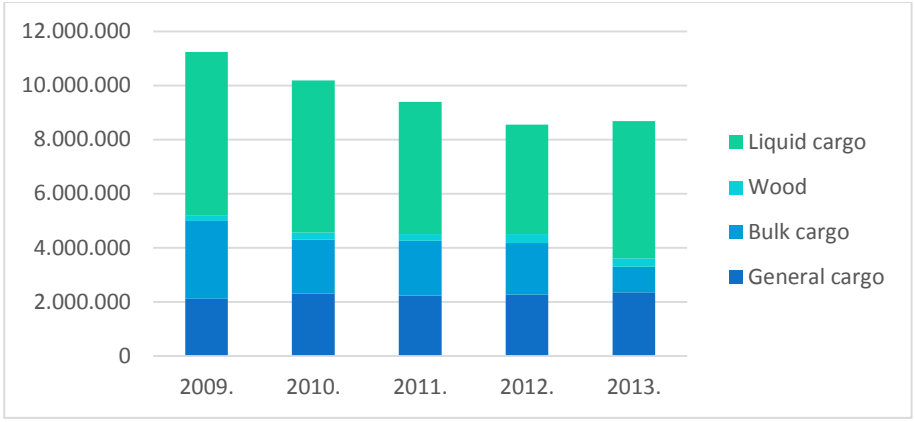
The most important traffic routes for the Port of Rijeka are the Pan-European Corridor V, Branch b and Corridor X. The traffic route directed to the Hungarian, Czech, Slovak market, as well as to the market of south Poland, connects Rijeka – Zagreb – Budapest on the Corridor Vb; it is 540 km long

and thanks to the newly constructed motorway, it takes six hours to get from one end to the other. A train needs 24 hours for the same route covering a distance of 592 km. The transit route for the markets in Bosnia and Herzegovina and Serbia is directed to the Pan-European Corridor X as well. Port of Rijeka is a core port (TEN-T), part of Mediterranean Corridor: Ljubljana/Rijeka – Zagreb – Budapest – UA border.

In addition to the road infrastructure, all locations (except for Omišalj) also have the railroad infrastructure. However, this railroad infrastructure does not fulfil the requirements and will not meet the expected increase in traffic volume. Much of the port's traffic is transit cargo to/from its wider hinterland in Central Europe, and is dominated in volume terms by liquid and dry bulk cargo followed by container and general cargoes.

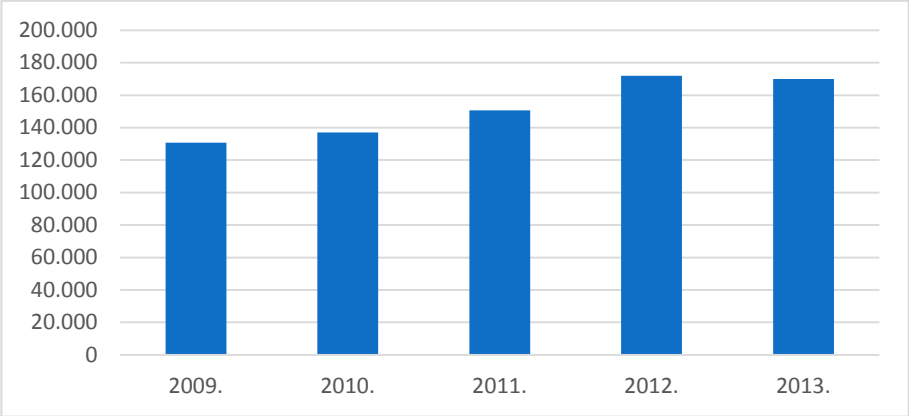
The majority of cargo transport in Croatian ports is carried out in the Rijeka and Ploče ports, totalling close to 90% of the total cargo transport of all Croatian ports. A total of 11 million tonnes of cargo was transported in the port of Rijeka, 3.1 million tonnes in Split port and 2.8 million tonnes in Ploče port.Container traffic since 2006 shows an overall growth rate of almost 9%, with a total turnover of 200,000 TEU in 2015. In addition to container freight traffic, in 2015, traffic amounted to 10 million tonnes of freight. However, traffic by dry cargo is more than 25% below pre-crisis levels. Particularly big decrease in transport occurred in bulk cargo, while traffic with general cargo and timber increased by 3.5 and 5.5% in 2006. Current cargo traffic grew slightly in 2015 and amounted to almost 6.6 million tonnes. The relatively small role of the port of Rijeka on the national circular traffic and ferry market is reflected in the constant reduction in the number of passengers. Through Rijeka, just over 150,000 passengers passed in 2015, compared to nearly 222,000 passengers in 2006.

Figure 93: Port of Rijeka - total cargo traffic (in tons) between 2009 - 2013. (green - liquid cargo, light blue - wood, dark blue - bulk cargo, dark blue - general cargo)



Source: Port of Rijeka

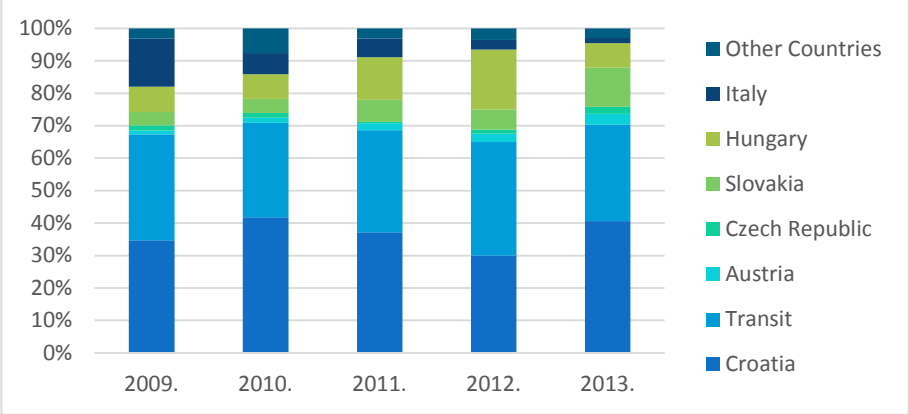
Figure 94: Port of Rijeka – total container cargo traffic (in TEU) between 2009 - 2013.



Source: Port of Rijeka

Statistics shows that most of the cargo (general, bulk and wood) ends up in the Republic of Croatia or in Transit. After Croatia cargo ends up in Hungary (7.0 - 18.0% of total cargo) and Slovakia (4.0 - 12.0% of total cargo).

Figure 95: Cargo transport by destination (liquid cargo is not included) between 2009 - 2013.



Source: Port of Rijeka

Construction of an additional part of the container terminal in the Port of Rijeka has been completed ("Brajdica", Phase 2), with a new quay of 330 metres, a terminal area of 3 hectares and a capacity increase of 250,000 TEU. Current and planned developments are part of the "Rijeka Gateway" project and include a new container terminal with an area of 22 hectares, a draft of 20 metre, and a total capacity of 600,000 TEU; and the urban redevelopment of the port facilities located in the Rijeka city centre. Port of Rijeka, together with the HŽ Infrastruktura carries out two projects funded by CEF related to the improvement of the railway infrastructure in the port of Rijeka (Brajdica, Zagrebačka obala). Future expansion of the container facilities of the Port of Rijeka will have to be found outside the Rijeka Basin. An increase in the Omišalj liquid cargo capacity is planned. Apart from bulk cargo, the Bakar basin is adequate for development of a RO-RO terminal,

especially considering the nearby industrial zone Kukuljanovo. Port of Rijeka should preserve the role of the most important freight terminal in the Republic of Croatia and strive to make Rijeka a freight transit port for Central and Eastern Europe. The port must use its potential and its advantages in the Mediterranean and Baltic-Adriatic TEN-T corridors. Secondary priority activities should be related to domestic passenger transport and cruise ships. The relationship between the port and the city is very important, especially because of the development of the port in the Rijeka basin.

2.6.4. HYPOTHESIS

Ploče port plays a key role for the maritime freight traffic mainly related to BiH.

Source

National Traffic Model for the Republic of Croatia (NTM); Transport Development Strategy of the Republic of Croatia (TDS); Port of Ploče; Port of Ploče Authority; National plan for the development of ports of special (international) economic interest for the Republic of Croatia

Key findings

- Port of Ploče is the main maritime gateway to Bosnia-Herzegovina because the majority of cargo transport goes to Bosnia and Herzegovina
- Port of Ploče has good geostrategic and traffic position and the great market potential for cargo transhipment.

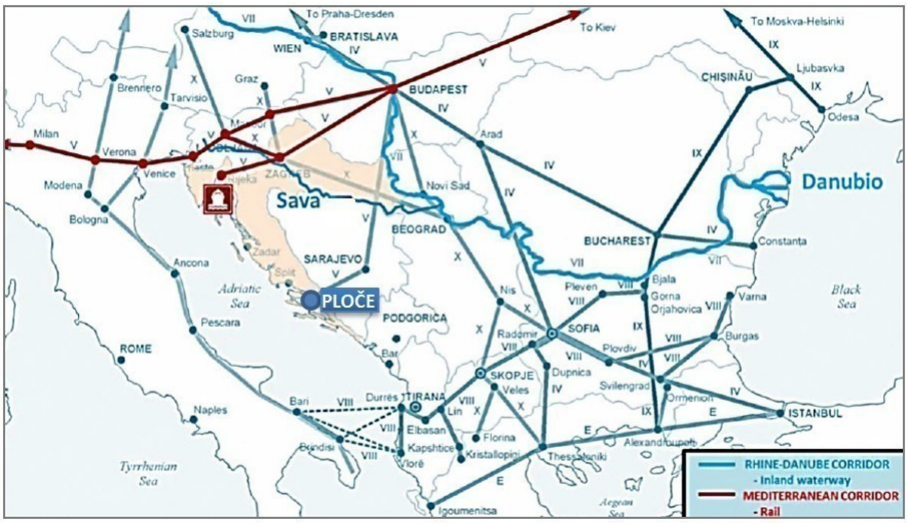
Note

The Port of Ploče is one of the main strategic Croatian ports. It is located in the southern part of Adriatic coast and consists of two locations: Ploče and Metković. It occupies more than 230 hectares of land and has 8 terminals for different types of cargo (general, bulk, wood, container and liquid). In Ploče terminals are arranged on 7 operative quays with a sea depth up to 14 m and they can accept ships up to the size of Panamax ships. An integral part of the port is the port of Metković which is located 20 km upstream on the river Neretva. It is specialised for transhipment of cement (silo), cinder, and granulated stone.

The Port of Ploče has good geostrategic position, which enables a quality maritime connection both with the cities on the Adriatic Coast and in Italy and with the ports in the entire world. Luka Metković is directly connected with the railway and road connections (E-73), along the Corridor Vc (Budapest - Osijek - Sarajevo - Ploče), connected to Bosnia and Herzegovina in its immediate hinterland, as well as to the northeastern part of the Republic of Croatia and Central Europe.

The Port of Ploče is also located next to the motorway (E-65 - the quickest connection between the port of Ploče and Zagreb), the state road (D8) that stretches from Trieste via Rijeka and Split to the extreme South point in this part of Europe.

Figure 96: Location and connectivity of Port of Ploče (blue - Rhine-Danube corridor - inner waterway, red-Mediterranean corridor - rail)



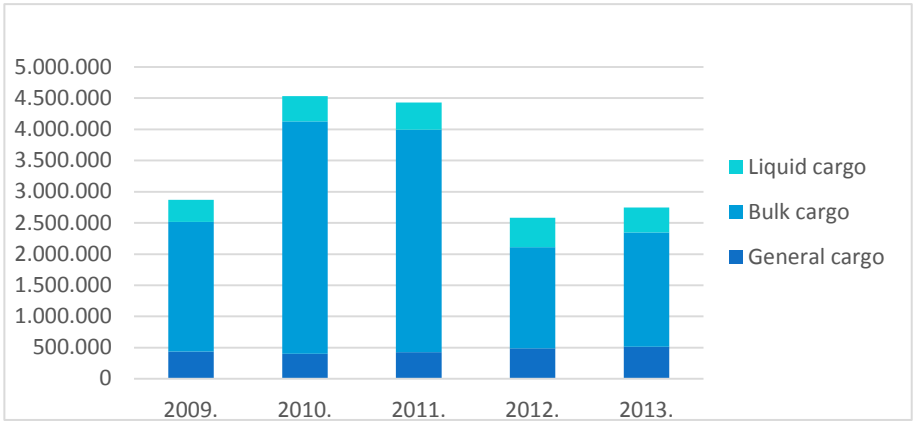
Source: NTM

Even though it is a Croatian port, Ploče port is of great importance for the economy of the neighbouring Bosnia and Herzegovina. Around 90% of the Port of Ploče activity is transit traffic since the port is the main maritime gateway to Bosnia-Herzegovina, and it features as the endpoint of the Pan-European corridor Vc (TEN-T comprehensive port). Completion of Corridor Vc Port of Ploče will extend its business further to other countries of Western and Central Europe, especially Hungary.

The statistical data for period between 2009 and 2013 shows that traffic of bulk cargo dominated Port of Ploče. Highest throughput was in 2010 with 3.72 million tons of bulk cargo. The statistical data also shows that total cargo traffic in the Port of Ploče between 2009 and 2013 decreased by 12.0% and between 2010 and 2013 it decreased by 50.9%. General and liquid cargo has almost constant throughput around 400,000 tons within the observed years.

Total, annual transhipment capacity of the port of Ploče is estimated around 4.8 million tons of general and bulk cargo (excluding terminals that are built in 2017), while the total storage capacity for liquid cargo is around 600,000 tons.

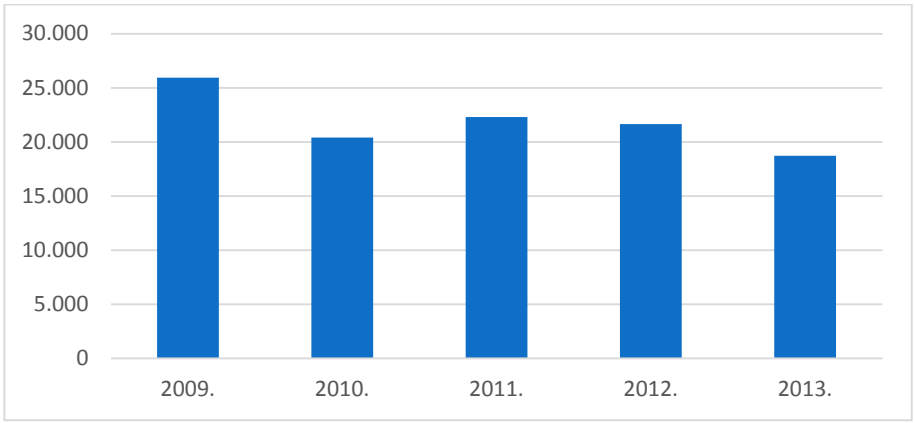
Figure 3: Port of Ploče - total cargo transport (in tons) between 2009 - 2013



Source: Port of Ploče

The container terminal was built and opened in 2011. The total storage area of the terminal is 38,000 square meters and capacity of 60,000 TEU. Sea depth is 13.80 m, and the length of coastline is 280 m. In the period 2009 - 2013 container transport registered a decrease of 27.8% (from 25,931 TEU in 2009 to 18,713 TEU in 2013).

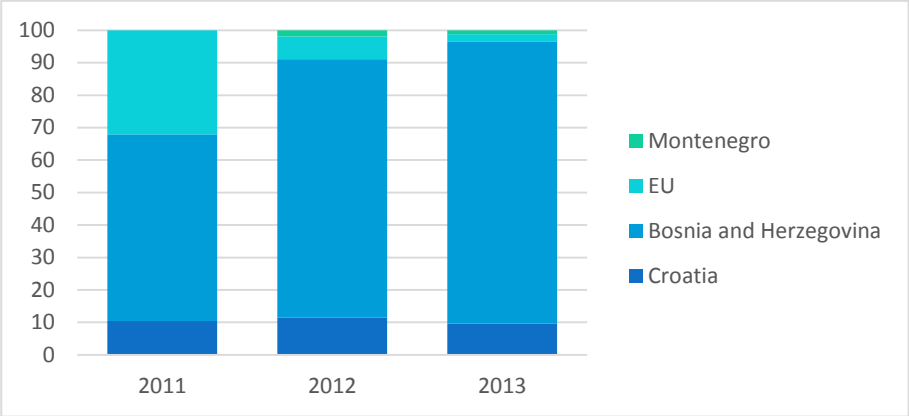
Figure 98: Port of Ploče – total container cargo transport (in TEU) between 2009 - 2013



Source: Port of Ploče

In year 2011 due to the increased delivery of energy coal, for the needs of the client from Italy, cargo traffic directed to EU increased to 32.08%. The domestic market was on level of 10.40%. The majority of cargo traffic volumes was on Bosnia and Herzegovina at the level of 57.52%. The bulk cargo handling in 2012 is related to Bosnia and Herzegovina at the level of 79.53%. The domestic market took up to 11.56% of total cargo traffic. The share of cargo traffic directed to Italy was at the level of 6.98%. In 2012 the cargo traffic directed to Montenegro emerged by 1.92%. In 2013 the largest share in cargo traffic was related to Bosnia and Herzegovina at the level of 86.74%. The domestic market occupied 9.63% of total cargo traffic, 2.43% went to the UK, and the rest was related to Montenegro by 1.20%.

Figure 4: Cargo transport by destination between 2011 - 2013



Source: Port of Ploče

Port of Ploče was awarded with the concession for setting up technology (reloading) equipment and devices, and the use of the terminal. New bulk cargo terminal is part of the existing port area and has an area of approximately 240,000 m². Planned developments are based on the investments in port infrastructure in order to develop additional port capacities. The new Dry Bulk cargo terminal will have annual capacity of 4.6 million tons and sea depth of 20 metres and it will be operational from 2017. As the only entry port in Bosnia and Herzegovina, Ploče port is faced with minimal to non-existent competition for most cargo. The main clients of Ploče port in the industry are in Mostar, Zenica and Lukavac in Bosnia and Herzegovina. The competitiveness of the port in this region hampers the interoperability problems of the railway line from Ploče to continental Croatia, which passes through Bosnia and Herzegovina. While the regional infrastructure is not significantly upgraded, it is unlikely that the Ploče and Split bases will meet in the Bosnian-Herzegovinian steel industry because there is no port that can can provide an economical alternative to the customers of the other port.

2.6.5. HYPOTHESIS

The ports of Zadar, Split, Šibenik and especially Dubrovnik have a very limited role for international maritime freight traffic.

Source

Port of Zadar Authority; Port of Šibenik Authority; Port of Split Authority; Port of Šibenik Authority; Transport Development Strategy of the Republic of Croatia (TDS); National plan for the development of ports of special (international) economic interest for the Republic of Croatia

Key findings

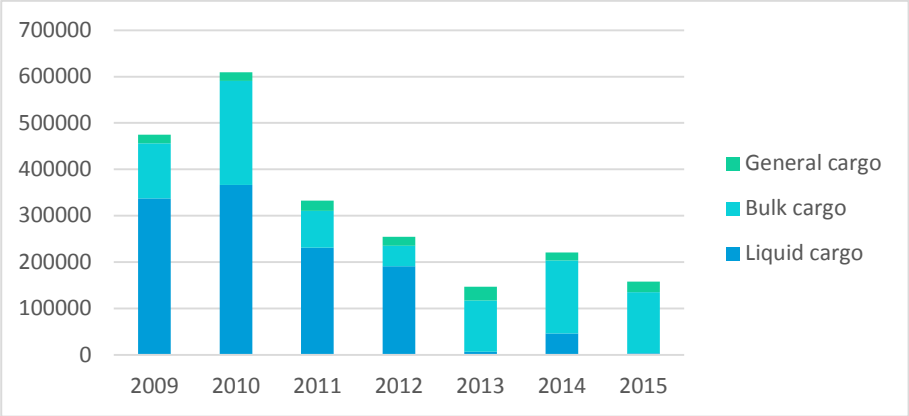
- Port of Zadar, Port of Šibenik and Port of Dubrovnik are not focused on international maritime freight traffic.
- Port of Zadar, Port of Šibenik and Port of Dubrovnik are focused on passenger and cruising passenger transport.

Note

The Port of Zadar is located at the central part of the Adriatic coast and is the second Croatian port for passengers. As such, the port has an important public function for island residents. The statistical data shows that total cargo traffic in the Port of Zadar between 2009 and 2015 decreased by 67.0% and between 2010 and 2013 it decreased by 76.0%. Highest throughput was in 2010 with 607 thousand tons of cargo. The statistical data for period between 2009 and 2012 shows that traffic of liquid cargo dominated in the Port of Zadar. The statistical data for period between 2013 and 2015 shows that traffic of bulk cargo dominated Port of Zadar. In the observed period, the overall cargo remains at almost constant 20 to 30 thousand tons of traffic. Over the last six years there has been a significant increase in the number of vessels on cruise trips. Since 2009, the number of cruise liners in Zadar reached an average of almost 34% annually, and in 2015 it amounted to 70,000 passengers. However, ferry traffic had inconsistent results. Domestic passenger traffic has stagnated since 2006; In 2015, less than 2.2 million passengers arrived in Zadar, while international ferry traffic consistently dropped, with 69,000 passengers as of 2006, to 33,000 passengers in 2015. Since 2006, domestic car traffic on ferries has experienced a moderate annual total growth of 2%.

The Gaženica port is well connected to the road infrastructure and is also connected to the railroad. However, the railroad from Zadar to Zagreb has bad technical characteristics. The Zadar port development is focused on RO-RO, passenger and cruising transport.

Figure 5: Port of Zadar - total cargo transport (in tons) between 2009 - 2015



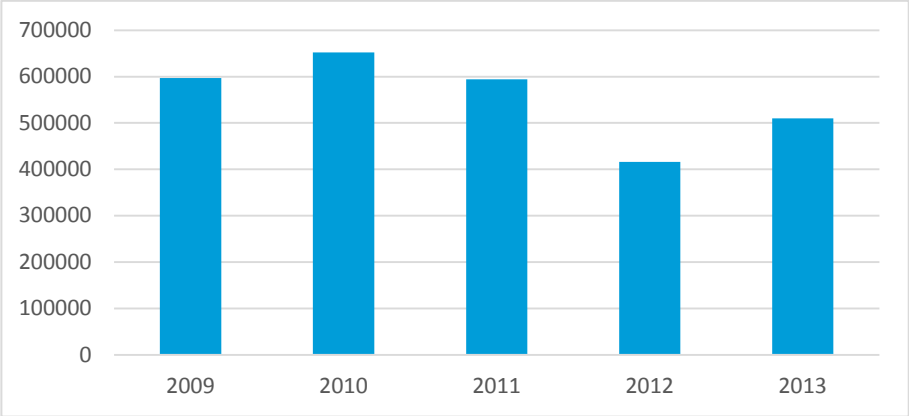
Source: Port of Zadar

The Port of Šibenik is primarily middle sized passenger port, located in the central part of the Republic of Croatia and part of the comprehensive TEN-T network. The port receives international travelers from cruise ships and domestic ferry passengers and vehicles on their newly built passenger bridge Vrulje. In addition, there is a small volume of freight transport in the port, including the import of aluminum and phosphate, and exports of fertilizers and wood products to some key customers associated with the port.

The statistical data shows that total cargo traffic in the Port of Šibenik between 2009 and 2013 decreased by 14.6% and between 2010 and 2012 it decreased by 36.4%. In period between 2012 and 2013 total cargo throughput increased by 22.8%. Highest throughput was in 2010 with 650 thousand tons of cargo.

Planned developments include the construction of a new RO-RO terminal, the completion of the new passenger terminal (currently under construction) and the modernisation of equipment and storage facilities at the bulk, general cargo, and timber terminals. The further development of Šibenik port is focused on passenger traffic, as a port for exclusive cruising vessels of smaller capacities (boutique vessels) and super-yachts.

Figure 101: Port of Šibenik - total cargo transport (in tons) between 2009 - 2013



Source: Port of Šibenik

The port of Dubrovnik is located at the far south of the Croatian coastline, has become in recent years one of the most popular destinations for cruise voyages in Europe. The main port of Gruž, which is managed by Dubrovnik port authority, currently handles over 1.2 million passengers and 20,000 vehicles annually, of which 700,000 are cruise ship passengers. On the other hand, the old town anchorage in the City of Dubrovnik is currently managed by Dubrovnik's county port authority. The anchorage received 220 calls and handled around 200,000 passengers in 2012. Planned developments include the modernisation and reconstruction of the passenger terminal and the expansion of ferry and cargo traffic facilities with a planned quay length of 426 metres putting the total new and existing area to 2.2 hectares. Development of Dubrovnik port is focused on cruising passenger transport. In accordance with the aforementioned, "narrow bottlenecks" are noted on the railway lines connecting these ports which are recommended to remove.

Figure 102: Location of the Port of Zadar, Port of Šibenik and Port of Dubrovnik in Croatia

Source: Port Authority of Šibenik

2.6.6. HYPOTHESIS

The ships used for the maritime PT system reached its end of economic life.

Source

Transport Development Strategy of the Republic of Croatia (TDS); Maritime Development and Integrated Maritime Policy Strategy of the Republic of Croatia for the Period from 2014 to 2020 (MDIMPS); Coastal Liner Shipping Agency (CLSA); Jadrolinija (official web page)

Key findings

- Public Transport is a key segment of Croatian shipping in the "coastal line passenger transport".
- The national fleet currently carries 100% of public maritime passenger traffic.
- Average age of the fleet of the main shipping company is 33.15 years and the average age of the fleet in national navigation is 46.2 years (the high age of traditional wooden ships also impacts the average age of ships in national navigation).

- It is necessary to adopt measures which will ensure survival and modernisation of the Croatian fleet for public transport.

Note

The coastal line passenger transport provides scheduled and regulated services between Croatian islands (73 island ports) and the mainland coast (22 mainland ports). The public transportation system according to the Decision of the Government of the Republic of Croatia on 22th of December 2016, includes 53 state lines (25 ferry lines, 15 fast shipping lines and 13 classic ship lines) maintained by 13 shipping companies with the fleet of 77 ships of which 17 passenger ships, 17 fast passenger ships and 42 ferries are participating.

The largest shipping company is Jadrolinija from Rijeka, owned by the state. In the total passenger traffic, Jadrolinija participates with the share of 84.9 %, and in the total vehicle traffic with the share of 86.4 %. Jadrolinija fleet consists of 51 ship (9 Catamarans, 37 Ferries, 4 Classic Ships and Hydrobus). 28 ships from the Jadrolinija fleet have more than 25 years, while the average age of the fleet is 33.15 years. So, the Jadrolinija fleet for the coastal public transport can be characterized as an old one.

Figure 103: Jadrolinija – Average Fleet Age

Source: Official website of Jadrolinija

Due to the size and age of the vessels the Croatian fleet has a low capacity. Taking into account the tradition and the existing know-how as basic preconditions for success, Republic of Croatia has to look after this industry branch.

2.6.7. HYPOTHESIS

The system of concessions can be improved in order to reach a higher level of efficiency.

Source

Act on Concessions (Official gazette 69/17); Coastal Shipping Agency (CLSA)

Key findings

- The main task of the Costal Liner Service Agency is granting concessions in maritime transport

Note

Governments are still principal entity in charge of creating and maintaining the transport infrastructure. However, other entities, including private-sector partners, have also become relevant for the implementation of a multimodal Trans-European transport network and the related investments, including regional and local authorities, infrastructure managers, concessionaires or port and airport authorities, etc. Through a better cooperation among them, better quality and more efficiency/effectiveness will be achieved. In addition, improved cooperation and engagement with the public will improve social inclusion and ensure development of a transport system which meets the needs of its users.

Quality organization of the transport system and reorganisation of the structure of the relevant stakeholders to optimise their resources are of crucial importance for improving the sustainability and quality of the transport systems.

The Croatian Government has established Costal Liner Service Agency (CLSA), on the basis of Liner Shipping and Seasonal Costal Maritime Transport Act (Official Gazzete 33/06, 38/09, 87/09, 18/11, 80/13, 56/16). The main task of the Agency are all activities related to granting concessions for public transport on state shipping, catamaran and ferry lines. the administration. The Agency hires a concessionaire for the management of a certain shipping, catamaran or ferry line, during a certain period of time, in exchange of fees for its operation.

The problems of applying a concession contract to public transport infrastructure is mostly in relation to the traffic demand estimation. For these reasons, it is frequent that concession projects of this type use mixed formulas of State public and private participation to limit the risk or to guarantee expected returns for the private initiative. A frequent formula is including in a single contract more attractive concessions for investors along with other less attractive ones, but both sharing the same field of application.

2.6.8. HYPOTHESIS

The better integration of the ports into the local logistic concept will lead to an increase of efficiency and reduce the environmental impact.

Source

Transport Development Strategy of the Republic of Croatia (TDS); North Adriatic Ports Association (NAPA); Maritime Development and Integrated Maritime Policy Strategy of the Republic of Croatia for the Period from 2014 to 2020 (MDIMPS)

Key findings

- Operations of port authorities are often not harmonized and coordinated.
- The competitiveness of Port of Rijeka is lagging behind other NAPA ports due to lack of cooperation between the various port terminals and an insufficient logistic offer.
- It is necessary to develop technical, technological and organisational measures to establish an effective system for acceptance of waste from ships and improve the conditions for the effective management of ship and sea waste.

Note

Generally, freight transport logistics focuses on the planning, organisation, management, control and execution of freight transport operations in the supply chain. Production and distribution networks depend on high-quality, efficient logistics chains to organise the transport of raw materials and finished goods across the EU and beyond. It is primarily a business-related activity and a task for industry. Nevertheless, the authorities have a clear role to play in creating the appropriate framework conditions.

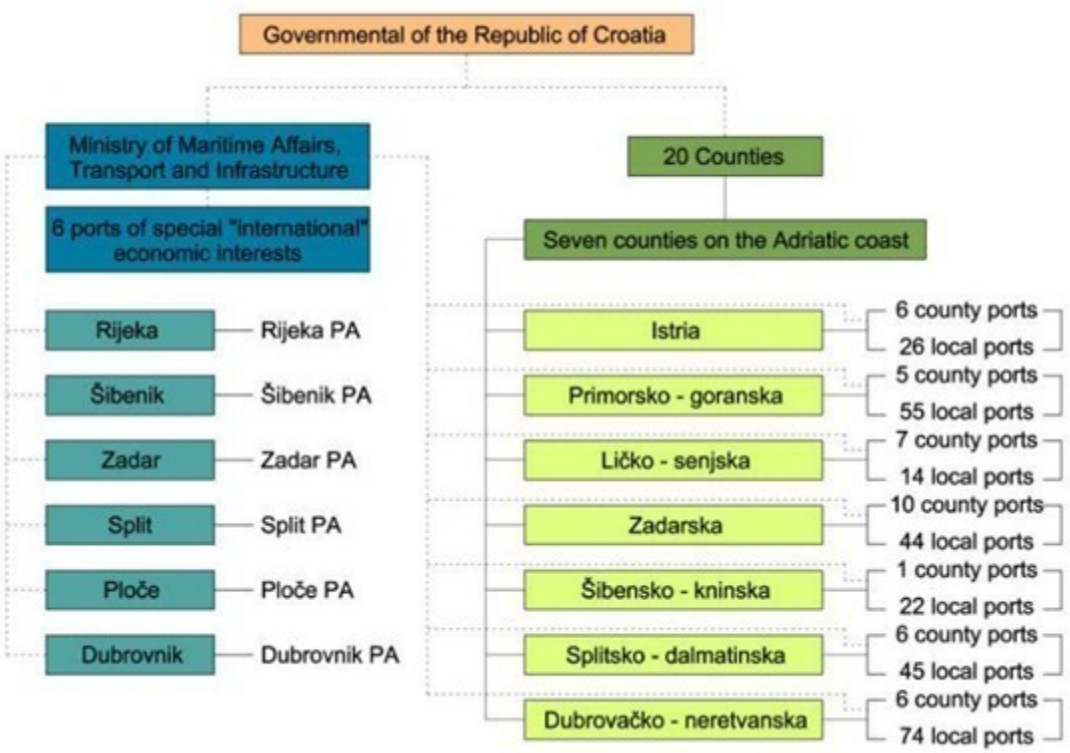
Logistics policy needs to be pursued at all levels of governance. There is a growing need for a coherent EU approach to logistics considerations that offers an opportunity for reinforced co-operation and co-ordination between the different dimensions of transport policy and must become an underlying factor in decision-making.

The general objective of the Logistics Action Plan, one of a series of policy initiatives jointly launched by the European Commission to improve the efficiency and sustainability of freight transport in Europe, is to mobilise untapped efficiencies in logistics in order to make more judicious and more effective use of freight transport operations. Through the actions proposed, the Logistics Action Plan pursues the principle of commonality, i.e. to improve the efficiency of each transport

mode and to overcome interoperability obstacles between modes in order to help mobilise capacity reserves in Europe's transport systems and put these on a path towards sustainable growth.

Organizationally, the Ministry of Sea, Transport and Infrastructure (MSTI) is the entity responsible for the elaboration of transport policies (including maritime) and the monitoring of their implementation. The provision, operations and management of transport services and related activities are carried out by affiliated agencies.

Figure 1046: Organisational structure of the port system in the Republic of Croatia



Source: Transport Development Strategy of the Republic of Croatia (TDS)

National port authorities, which are established by the Government of the Republic of Croatia, are responsible for the economic development of port and terminal facilities within the areas assigned to them. National port authorities are members of several international port associations. County port authorities, established by the counties, are responsible for managing county and local ports within the county borders.

The main drawback of this organisation of the management of main ports is the fact that it is often too bureaucratic and inflexible and not in compliance with the contemporary requirements of cost-rational and cost-efficient operations. The advantage is the fact that such an organisation may also harmonize development of other infrastructures (roads and railroads), which is not primarily motivated by profit and ensures liberty in the selection of the location for the construction of a new

port. It is necessary to review the method of management of the ports of county and local importance.

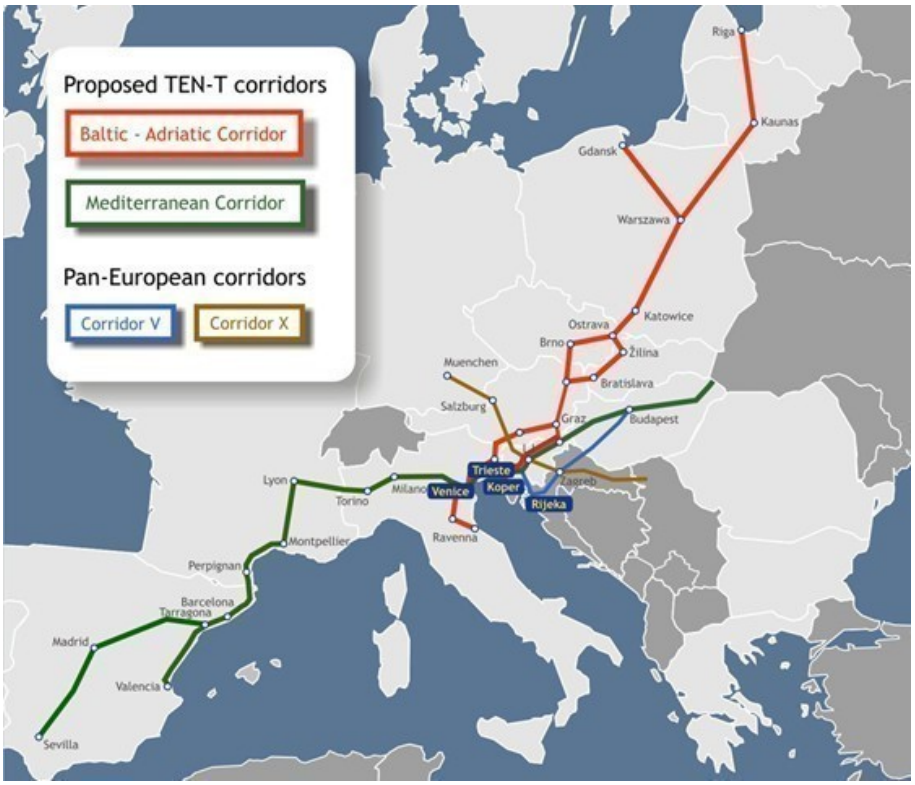
Major ports (Rijeka, Šibenik, Zadar, Split, Ploče and Dubrovnik) are declared as national ports or ports of special international economic interest. These seaports have an economic potential based primarily on a favourable geographic position. The main comparative advantage of these Croatian seaports compared to other ports of the European Union is the fact that the Adriatic reaches far inland into the continent which ensures the shortest and cheapest transport connection for countries located behind the Republic of Croatia to the east Mediterranean, and via the Suez Canal to Asian and east-African countries. In this sense, the multimodal TEN-T corridors spreading across the Croatian territory confirm the fact that the Croatian geographic position is not only its advantage, but also a duty towards the European Union. The Mediterranean corridor, the Baltic – Adriatic Corridor, the Rhine – Danube Corridor and the planned Adriatic – Ionian motorway undoubtedly integrate the Republic of Croatia in the transport and economic system of the European Union.

The majority of cargo traffic in Croatian ports is carried out in the ports Rijeka and Ploče, totalling close to 90% of the total cargo traffic of all Croatian ports of exceptional economic significance and making them the leading cargo ports of the Republic of Croatia. On the other hand, the majority of passenger transport is carried out in the Split and Zadar ports, and Dubrovnik is the port with the majority of traffic of cruising vessels.

Cargo transport in the past few years clearly shows that specialised terminals are competitive with other ports in the region, while those who are not as specialised in terms of cargo are in a gradual decline.

Port of Rijeka, Port of Koper, Port of Venice and Port of Trieste are part of North Adriatic Port Association. The four NAPA seaports are located at the northern tip of Adriatic Sea, a natural waterway that penetrates deep into the middle of the European continent, thus providing the cheapest naval route from the Far East via Suez to Europe with a distance that is about 2,000 Nm shorter than other North-European ports. According to NAPA the four entities combine their strengths in order to promote the Northern Adriatic route and present themselves as an alternative to the North-European ports. In addition, the association anticipates cooperation in the development of maritime and hinterland connections, visits from cruise lines, environmental protection, safety and information technology. The ports of NAPA will also invest efforts into the coordinated planning of road, rail and maritime infrastructure, as well as the harmonisation of regulations and procedures in the field of port service provision.

Figure 1057: Location and connectivity of NAPA ports (Red - Baltic - Adriatic corridor, green - Mediterranean corridor, blue - corridor V, brown - Corridor X)



Source: Official website of North Adriatic Ports Association (NAPA)

The Vision of NAPA is "The NAPA will form a European logistics platform, in particular with regard to servicing the markets of the Far East as well as Central and Eastern Europe market."

According to NAPA, Port of Rijeka is „Modernized Port of Competitiveness and High Efficiency". It is Croatia's leading port is undergoing transformation into key maritime hub. Thanks to the outstanding investment potential and complex projects of modernization it is set for continued strong growth vying for a position of a completely new, competitive and safe port in a stimulating business environment. Rijeka Gateway project known as a Rijeka Traffic Route Redevelopment Project is a complex development program which aimed at rehabilitation and modernisation of the entire port complex and improving the port traffic connection with the international road and railway corridors.

Port of Rijeka had lowest cargo throughput in 2014 in comparison with other NAPA ports, but it also had positive year over year growth especially for container traffic.

Table 4: NAPA ports' cargo volumes in 2014

	Container traffic		Freight traffic	
	TEU	Yoy (u %)	(mln tn)	Yoy (u %)
Koper	674,033	12.00	19,00	5.00
Trieste	506,007	10.30	57,15	1.00
Venice	456,068	2.10	21,80	-10.50
Rijeka	192,004	15.00	9,00	3.90

Source: NAPA

2.6.9. HYPOTHESIS

The reliability of accessibility to the islands (for example during strong wind) can be improved by investments into the port infrastructure as well as into the upgrading and modernization of boats.

Source

Ministry of the Sea, Transport and Infrastructure (MSTI); Zaninović, K., Gajić-Čapka, M., Perčec Tadić, M. et al, 2008: Climate atlas of Croatia 1961–1990., 1971–2000. Meteorological and Hydrological Service of Croatia, Zagreb, 200 p.; Maritime Development and Integrated Maritime Policy Strategy of the Republic of Croatia for the Period from 2014 to 2020 (MDIMPS); Jadrolinija (official web page)

Key findings

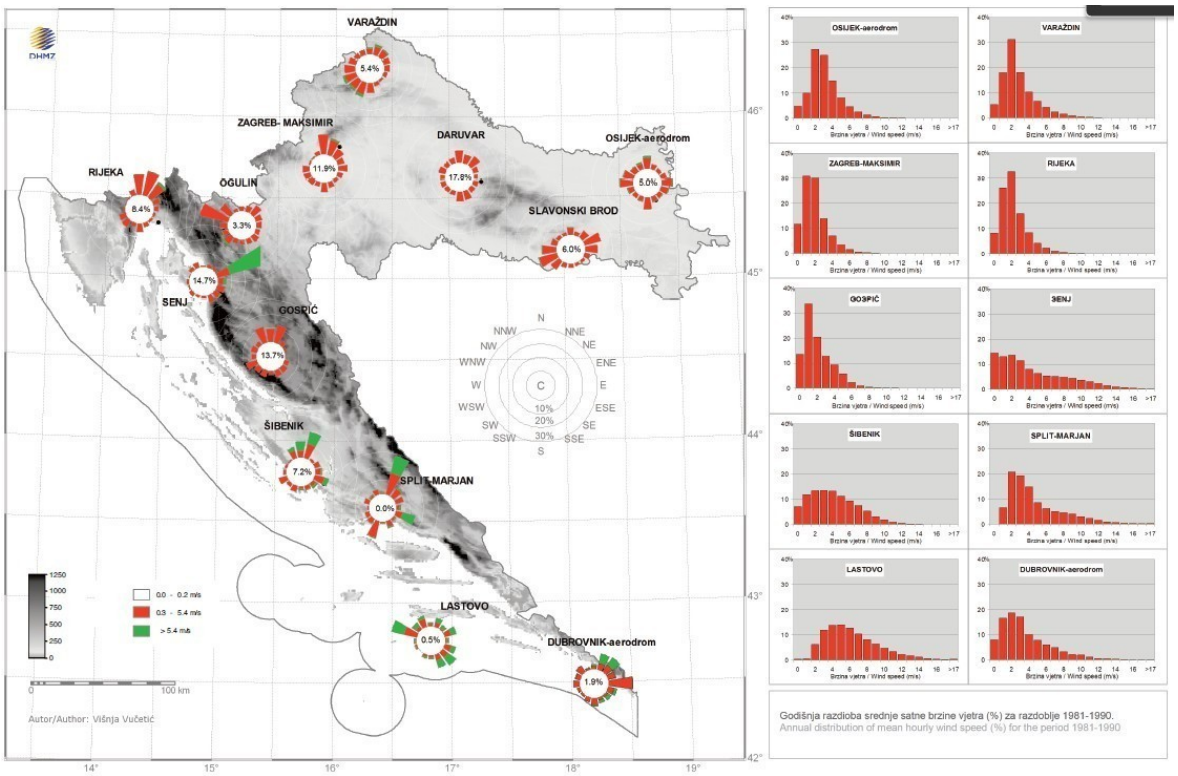
- Bura and jugo are most severe winds in the coastal region of the Republic of Croatia. They are more frequent and stronger in the cold season, although the intensity of the summer bura can create problems in road and maritime traffic.
- Being out at sea it is not recommended during strong and severe jugo, nor during strong and severe bura.
- There are some areas on the Adriatic coast and the islands which can be isolated because of the intensity of bura and jugo.
- Sometimes because of the exceptionally bad weather conditions caused by hurricane gusts of bura in the area of maritime traffic ships have problems with harbouring, they often become stranded and rescue operations must be undertaken
- Old port infrastructure and old maritime coastal shipping fleet can't provide reliable accessibility to the islands during the strong winds.

Note

According to (Climate atlas of Croatia 1961–1990., 1971–2000.) during the cold part of the year, especially in winter, the typical Northern Adriatic wind is bura. It blows from the north-eastern quadrant and is known for its gustiness, high speed and duration. Bura is not formed only on the edge of winter inland anticyclones, which stretch to the coastal mountains, but also when cold air from the ground layer descends from the mountains into the warmer area above the sea. Bura is the strongest when the general pressure gradient stimulates an air flow over the mountain ridge. Then it causes great damage, and, as a wind blowing to the open sea and dispersing surface wave tips, it reaches remote distances from the tens of kilometres per hour, but the speed of individual wind gusts is much higher. The highest speed recorded was 69 ms^{-1}, i.e. 248 km/h. Because of its gustiness, bura creates short but high waves, which then create difficulties to sea navigation. Strong bura at sea tears the wave crests and creates sea spray. A coast exposed to bura is covered in a thin layer of salt sediment from the evaporated seawater droplets drifted in with the sea spray. Bura is the prevalent and the strongest wind in the sub-Velebit area and it weakens as it moves away from the shore. It is also a dominant wind in the coastal area of Istria, although it is weaker and it is not present in the hinterland of the peninsula.

On the Middle and Southern Adriatic, bura is usually less intense and less frequent than on the Northern Adriatic. Jugo (sirocco) is a more intense and frequent wind in these areas. Jugo is a steady and strong wind which blows evenly with a speed similar to the bura average speed, being the highest in the conveniently positioned channels between the islands and the coastland. The wind occurs in the air flow from the southern quadrant and often has a southward direction into the open sea, while the coastal mountains turn it to SE. Winds from the NNW, S and SE are prevalent over the open sea and the outer islands. Strong jugo creates high waves; it is formed on the front side of the Mediterranean cyclone, and is often followed by large amounts of precipitation because of the moist air lifting at the atmospheric front and up the hills.

Figure 1068: Annual distribution of mean wind speed (%) for the period 1981 – 1990



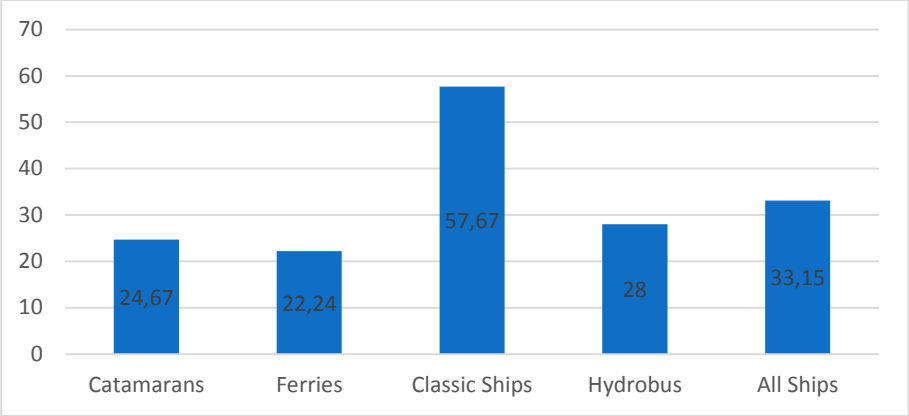
Source: Zaninović, K., Gajić-Čapka, M., Perčec Tadić, M. et al, 2008: Climate atlas of Croatia 1961–1990., 1971–2000.; Meteorological and Hydrological Service of Croatia, Zagreb, 200 p.; Jadrolinija (official web page)

Senj is also famous for frequent and strong bura, and its annual wind rose shows a 36% relative frequency of ENE direction. Senj is the only station on the Adriatic where such a high frequency of wind from the same direction has been recorded. This is caused by the closeness of the Vratnik Mountain Pass, which intensifies and channels the air stream towards Senj in bura situations. Some other areas are also famous for strong and severe bura: the Krk Bridge (58.9 ms^{-1}), the whole sub-Velebit Channel with the corresponding islands (the Pag Bridge, 65.2 ms^{-1}), and the Šibenik (41.0 ms^{-1}), Split (48.5 ms^{-1}), Makarska (59.0 ms^{-1}) and Dubrovnik (44.3 ms^{-1}) areas. In general, the relative frequency of strong bura decreases from the northern Adriatic towards the southern Adriatic, and also from the hinterland to the open sea. It is a completely different case with jugo, which is more frequent on the southern than on the northern Adriatic. The strongest jugo gust of 56.9 ms^{-1} was measured in Palagruža on 4 March 1974.

Ouality of maritime port infrastructure is a fundamental prerequisite for the development of the coastal shipping and accessibility of the islands. The priority in the construction, reconstruction and modernization of infrastructure should be in ports which are open to public traffic (coastal shipping docks). Those ports also have to be of county and local importance.

According to Maritime Development and Integrated Maritime Policy Strategy of the Republic of Croatia for the Period from 2014 to 2020 (MDIMPS) the coastal line passenger transport provides scheduled and regulated services between Croatian islands (73 island ports) and the mainland coast (22 mainland ports). The public transportation system includes 53 state lines (25 ferries, 15 fast shipping lines and 13 classic ship lines) maintained by 13 shipping companies with the fleet of 77 ships of which 17 passenger ships, 17 fast passenger ships and 42 ferries are participating.

Figure 1079: Jadrolinija – Average Fleet Age



Source: Jadrolinija (official web page)

2.7. INLAND NAVIGABILITY AND RIVER TRANSPORT

2.7.1. HYPOTHESIS

There is a potential for the development of Vukovar port (Danube),Osijek port (Drava), Slavonski Brod port (Sava)as the main relevant inland ports with the developing of the Sava River waterway to the required class and development of the port of Sisak and Slavonski Brod port.

Source

National Traffic Model for the Republic of Croatia (NTM); Port statistics; Regulation on the classification and opening of waterways on inland waters (OG 77/11, 66/2014 i 81/2015)

Key findings

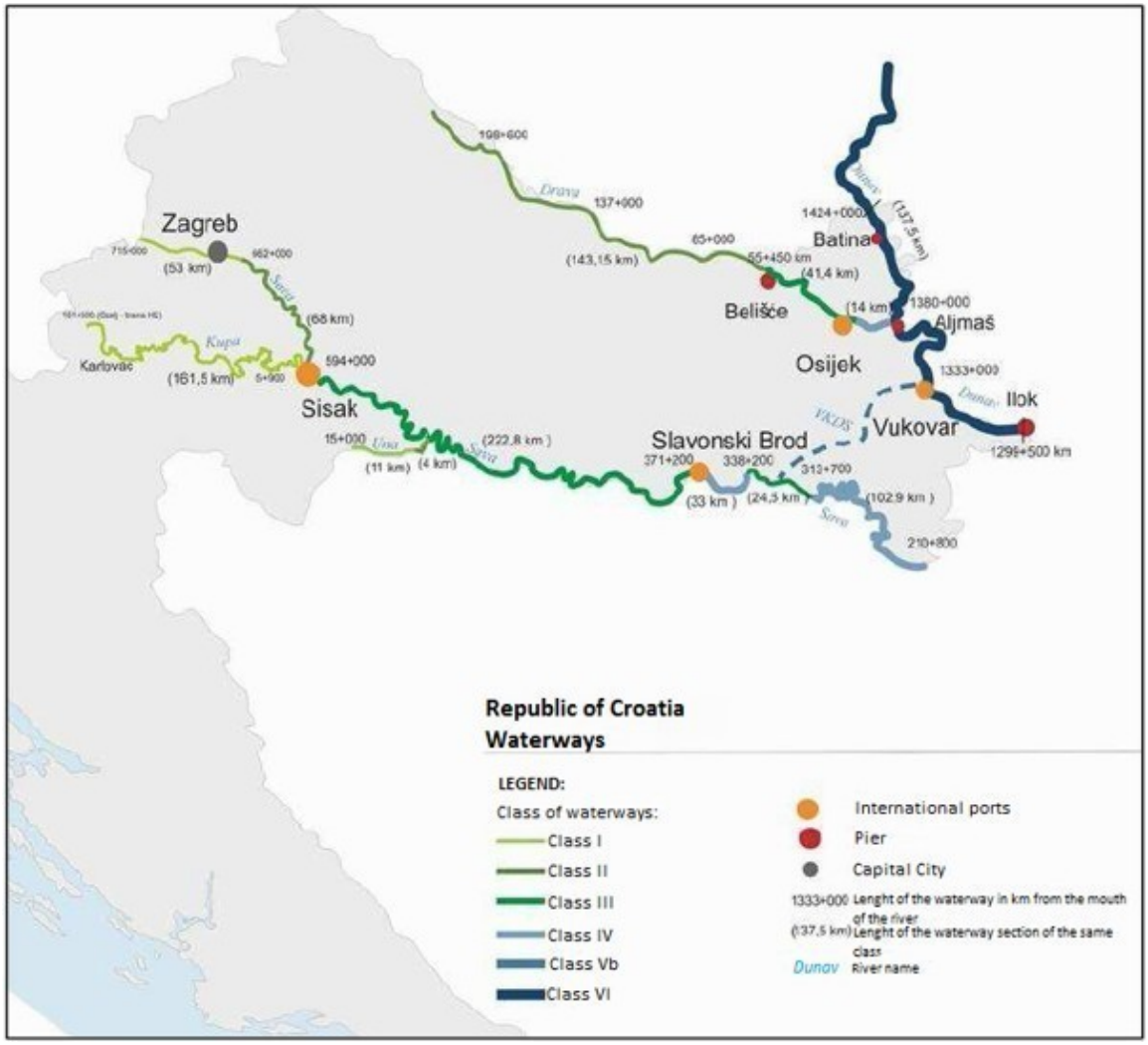
- The port of Vukovar is the biggest inland port of Republic of Croatia with yearly transport of 36,000 passengers and half of million tons of cargo
- The accessibility and reliability of operation of the port needs to be safeguarded
- Railway line Vinkovci - Vukovar is the EU funded plan of reconstruction and electrification starting in 2018.

Note

The Republic of Croatia has 4 inland ports: port Vukovar on the river Danube, port Osijek on the river Drava and ports Slavonski Brod and Sisak on the river Sava. Ports Vukovar and Slavonski Brod are classified as a TEN-T core port. Ports Osijek and Sisak are classified as a TEN-T comprehensive ports.

Reliability and safety of navigation on the waterways are crucial factors which influence the attractiveness of the ports. Waterway Danube with class VIc of navigability and waterway Drava which is from mouth of Danube to Osijek port Nemetin class IV of navigability, comply with the requirements of international navigation standards. On the other hand, two sections of waterway Sava (Slavonski Šamac – Oprisavci and Slavonski Brod – Sisak-Galdovo) are class III of navigability.

Figure 10810: Classification of inland waterways in Republic of Croatia

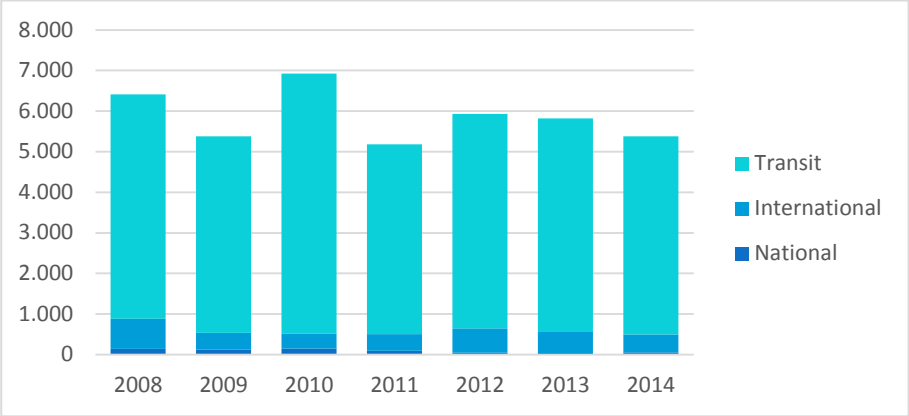


Source: MSTI

All ports have a good connection with other modes of transport, international railway and road network (corridors X and Vc). Port Slavonski Brod is important for the Republic of Croatia and Brod – Posavina Countyand is of particular importance for Bosnia and Hercegovina as it is located on the state border and is closely linked through road and rail corridor Vc. Also, the port of Slavonski Brod is the gateway to the European Union.

Internal inland waterways are used for transport of passengers and cargo, but the passenger transport is negligible compared to the transport of cargo. Most of the cargo transport is transit, with a small share of international transport and minimum share of national transport.

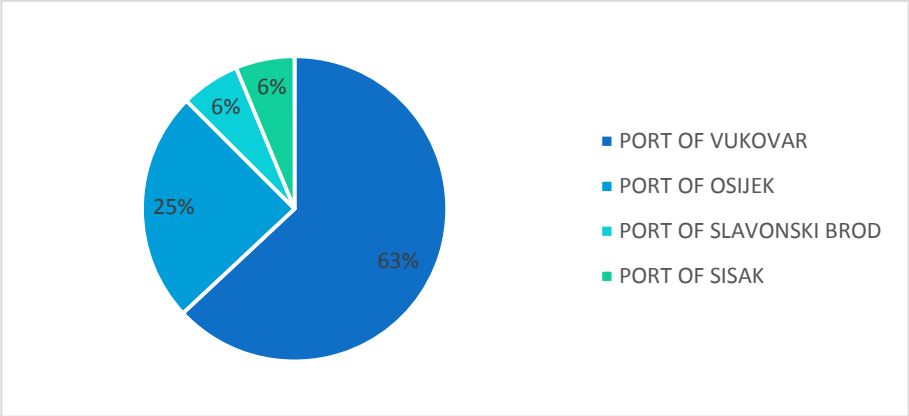
Figure 109: Transport of goods in inland waterways in ’000 tons



Source: CBS, The Statistical Report 'Transport and communication’

Freight transport mostly refers to industry or agriculture located in the wide surrounding of the ports. Official numbers are telling that port Vukovar is the biggest port in handling cargo. In 2016 port Vukovar has trans-shipped 292 thousand tons of cargo, mostly bulk cargo, fertilizers and corn. Port Slavonski Brod is the second largest port in handling cargo. It has open cargo spaces where sand and gravel is being transported, and in 2016 a total of transhipped cargo in the port was loaded with 197,812 tonnes of cargo (oil, general cargo, pebble and sand). Luka Osijek is the third in terms of quantity of handled cargo, with bulk cargo accounting for 60 percent, and agricultural products (wheat, sunflower and rapeseed) account for ten percent. Sisak port is the smallest freight traffic port. Almost all the share of the transhipment cargo is crude oil transported by ships from Luke Slavonski Brod to Port of Sisak, primarily for the supply of a Sisak refinery.

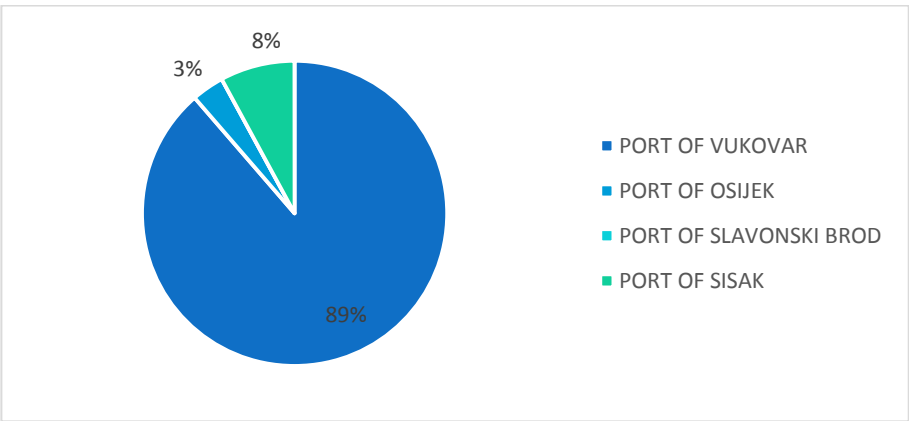
Figure 110: Distribution of transhipped cargo in inland ports



Source: Port statistics

Passenger transport is most important in the Vukovar and Sisak ports. Both ports are recording an increasing number of passengers, port Vukovar due to cruising transport on the Danube while port Sisak because of the local excursion transport. Looking at official statistics in 2016, port of Vukovar recorded 36,000 passengers and in the same year port Osijek 5,404 passengers and Port Sisak only 2,679. Due to the rise of tourists, a passenger port is planned at the port of Slavonski Brod on the river Sava.

Figure 11111: Distribution of passengers in inland ports



Source: Port statistics

Port Vukovar, as the most important port for the Republic of Croatia, has a big potential for development. The port is located on waterway Danube with class VIc of navigability and can service class 5 vessels. The installed capacities of the port enable the transhipment of up to 2,000,000 t per year. The port area in Vukovar covers a surface of about 26 ha and is enclosed to the north by the Danube River, to the south by a public road between the centre of Vukovar and Osijek/Vinkovci, to the east by a residential zone and to the west by a commercial and industrial development area (the "Borovo" zone).

The Osijek port, located on the waterway Drava, only 14 km from the Danube estuary, with the biggest total surface of the port area of approximately 160 ha, has a great opportunity to become an intermodal logistic centre due to the large port area and excellent potential from the point of view of the road and rail connections with the hinterland.

Attractiveness of the ports Slavonski Brod and Sisak largely depends on reliability and safety of navigation on the waterways. Port Slavonski Brod is importnant not only for the Republic of Croatia and Brod – Posavina County but of particular importance for Bosnia and Hercegovina. Currently, operations are oriented on the transport of crude oil from port Slavonski Brod to port Sisak which primarily serves the oil refinery in Sisak. The area of the Slavonski Brod port covers approximately 90 hectares, so besides the operational part, it has a potential for the development of the economic zone, which would contribute to the development of intermodality and logistics of the port of Slavonski Brod.

The attractiveness of the ports in Slavonski Brod and Sisak largely depends on the reliability and safety of navigation on the waterways.
Slavonski Brod port is of international significance and the gateway to the European Union. This port is particularly important in the international context as for the Republic of Croatia and Slavonia. In addition to transhipping oil, the port is also loaded in the harbor, and the port also has open cargo space where gravel and sand are transported. The area of the port Slavonski Brod is approximately 900,000 m². Apart from the operational part of the port, part of the port area is an economic zone that will contribute to the development of intermodality and logistics of the port of Slavonski Brod. In the economic zone of the port of Slavonski Brod is the realization of the TE-TO project and the bioethanol factory.

2.7.2. HYPOTHESIS

The navigability on the Danube is largely in line with the operational requirements.

Source

Regulation on the classification and opening of waterways on inland waters (OG 77/11, 66/2014 i 81/2015); National Transport Model for the Republic of Croatia (NPM); Harbor statistics;

Key findings

- Waterway Danube with Class VIc navigability comply with the requirements of international navigation standards
- The biggest draught of 2.50 meters in Apatin is secured 94% of the time during the year, and in Vukovar 98%.

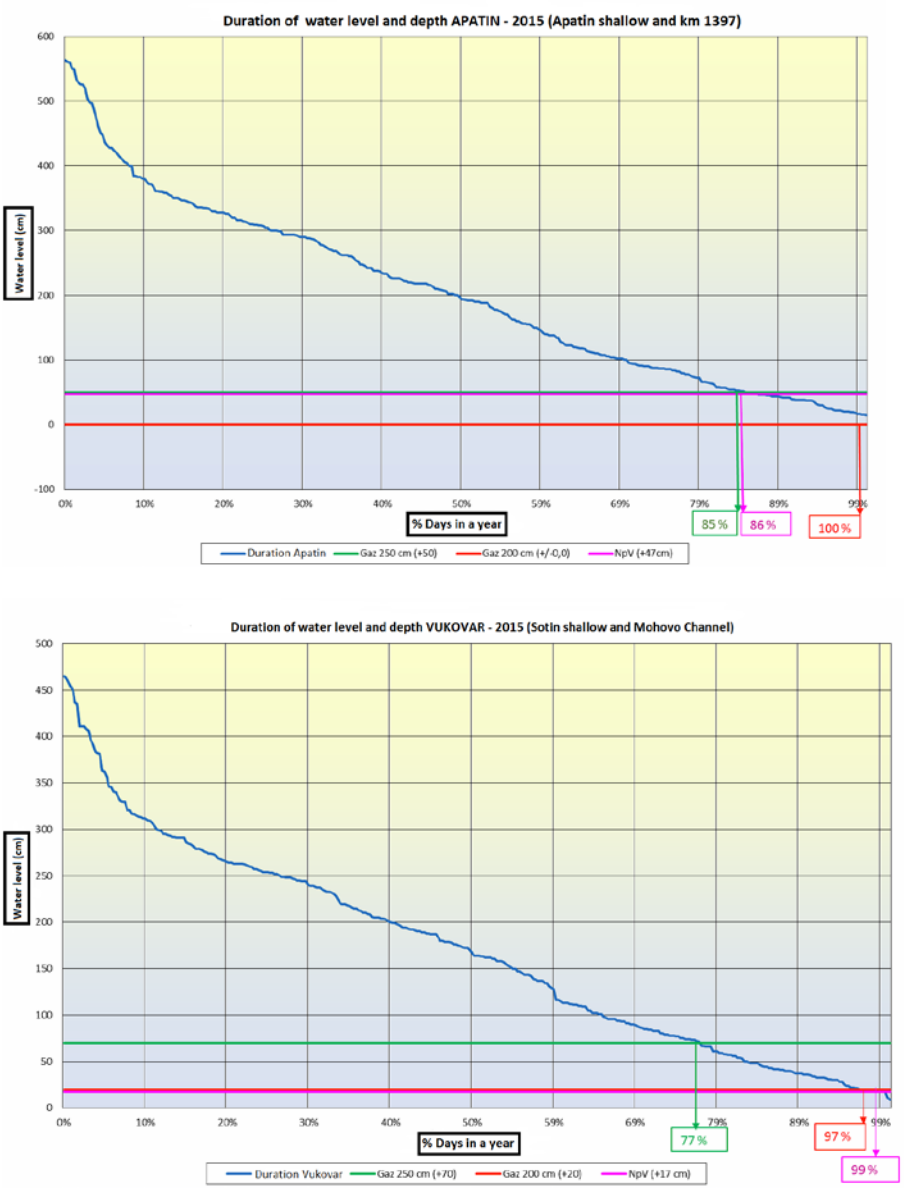
Note

Inland waterways are generally divided into navigable or non-navigable. Republic of Croatia has in total 1.016,80 km of navigable inland waterways. Only 287.4 km of total 534.7 km of existing inland waterways that are included in the European inland waterways network, comply with the requirements of international navigation standards, minimum class IV of navigability. Waterway Danube on the territory of the Republic of Croatia, from Ilok 1295+500 to Batina 1433+000, is classified with navigability class VIc.

According to European Agreement on Main Inland Waterways of International Importance (AGN) on international waterways with class VIc navigability, characteristic draught of 2.50 m needs to be secured during at least 240 days or 66% of the year. Minimum draught of 1.20 m needs to be secured during all year.

On known critical sections of the waterway Danube, in 2015, characteristic draught was secured more than 85% days of the year at Apatin and 77 % days of the year at Vukovar. Minimal draught was secured during all year.

Figure 11212: Water levels on critical sectors



Source: Agency for Inland Waterways

2.7.3. HYPOTHESIS

The Sava – Danube canal has a high potential for the improvement of the Modal Split in the Republic of Croatia in favour of more environmental friendly transport modes.

Source

National Traffic Model for the Republic of Croatia (NTM); Regulation on the classification and opening of waterways on inland waters (OG 77/11, 66/2014 i 81/2015); Port statistics

Key findings

- The construction of a Sava – Danube canal must be assessed under the mixed functionality of the investment (navigability, irrigation, flood protection, tourism, environmental protection, drinking water, etc.)

Note

The most significant inland waterways in Republic of Croatia are the Danube and the Sava rivers and part of the Drava Watergate (up to 22. km). The Danube is part of Rhine-Danube Corridor (TEN-T network): Wels/Linz – Wien – Bratislava – Budapest – Vukovar. The Rhine-Danube Corridor covers rail, road, airports, ports, RRT's and the inland waterways system of Main, Main-Danube Canal, the entire Danube downstream of Kelheim and the Sava river. Ports of Vukovar on Danube and Slavonski Brod on river Sava are TEN-T core ports. Inland waterways ports Sisak on river Sava and Osijek port on the river Drava are TEN-T comprehensive ports. The main inland waterways are not connected at Croatian territory. The River Sava and Danube join in Belgrade (Serbia).

Multipurpose canal Danube – Sava is planned to have four equally important functions: shipping, irrigation, drying out and equalisation of low water level. The canal would also connect the rivers of Danube and Sava on the Croatian territory. In addition to the fact that the canal connects the Croatian network of inland waterways, its construction would connect the Croatian maritime ports with the Danube and thereby with the Central Europe.

Figure 113: Classification of inland waterways, proposed canal Danube – Sava

Source: MSTI

The length of the canal between the Sava and the Danube is 61.4 kilometres. It starts in Vukovar (1334+700 of the Danube) and ends seven kilometres upstream from Slavonski Šamac (310+750 of the Sava). The canal route mostly follows the existing watercourses or their valleys, and mostly flows through the lowland agricultural area.

Transport exploitation of the canal would shorten the navigation route upstream from Vukovar and upstream from Slavonski Šamac by approximately 417 km, and downstream from the Sava mouth into the Danube and upstream from Slavonski Šamac by approximately 85 km. Navigation from Sava to the western Europe would be shorter by 417 km and to the eastern Europe by 85 km.

Waterways Danube (class VIc) and Sava downstream of Slavonski Šamac (class IV) meet the requirements of the minimum class IV navigability determined by the AGN. The parameters of the upper part of the waterway Sava do not meet the AGN standards. The canal is planned with class Vb navigability. According to AGN on international waterways, characteristic draught of 2.50 m needs to be secured during at least 240 days or 66% of the year.

Reports of navigability characterize navigability on the Danube and Sava in the first half of the year as very favourable. Due to the lack of rainfall in the second half of the year, especially in the summer months, navigability restrictions may occur on both waterways. Low water levels on waterways in summer could jeopardize the key functions of the canal, navigation and irrigation.

From transport perspective, all inland ports have a good connection with other modes of transport, international railway and road network (Pan-European corridors X and Vc). Aldo inland waterways are used for transport of both passengers and cargo, passenger transport is negligible compared to the transport of cargo.

Cargo transport mostly refers to industry or agriculture located in the wide surrounding of the ports. Port Vukovar, as largest inland port that has trans-shipped half of total cargo. Bulk cargo (sand, gravel, coal and troy) is mostly trans-shipped in ports Osijek and Slavonski Brod. Smallest port in terms of freight transport is port Sisak which primarily serves the oil refinery in Sisak. In numbers in 2016 port Sisak has trans-shipped 90 thousand tons of crude oil transported from inland port Slavonski Brod.

Even that waterway transport is the cheapest mode of transport, the potential of the Sava – Danube canal to shift traffic from road and rail to inland navigation is very limited. The admissibility of channel building will be assessed through the results of the Channel Feasibility Study.

2.7.4. HYPOTHESIS

The Sava navigability is sufficient for the current operational requirements.

Source

Regulation on the classification and opening of waterways on inland waters (OG 77/11, 66/2014 i 81/2015); Port statistics

Key findings:

- Sava river does not meet the international waterways navigability requirements on its entire length in the territory of the Republic of Croatia according to AGN.
- By increasing the navigability of the inland waterways, competition to parallel road and rail corridors with high level of service is difficult despite the comparative advantage of river transport as an economically more cost-effective and environmentally acceptable way of transport in relation to railway, and especially road traffic.

Note

Waterway Sava is included in European inland waterways network. From border with Serbia, the waterway runs through the bordering area with Bosnia and Herzegovina in the length of 304.2 km. Upstream from Jasenovac to border with Slovenia, the Sava is completely on the territory of the Republic of Croatia.

From border with Serbia to Sisak waterway Sava is classified as international inland waterway. The remaining part of the waterway Sava, from Sisak to border with Slovenia, is classified as national inland waterway. International part of the waterway Sava is divided into 4 sections of which two sections, section 210+800 (Račinovci) - 313+700 (Slavonski Šamac) and section 338+200 (Oprisavci) - 371+200 (Slavonski Brod-city), comply with the requirements of international navigation standards, Class IV navigability. Other two sections, section 313+700 (Slavonski Šamac) - 338+200 (Oprisavci) and section 371+200 (Slavosnski Brod-city) - 594+000 (Sisak-Galdovo), are Class III navigability. National part of waterway Sava is divided into two sections of which section 594+000 (Sisak) - 662+000 (Rugvica) is Class II and section 662+000 (Rugvica) - 715+000 (Bregana - Slovenian border on the right bank) is Class I navigability.

The ports Slavonski Brod and Sisak are an international port located on the waterway Sava, port Slavonski Brod is classified as TEN-T core port while port Sisak is classified as a TEN-T comprehensive port.

The potential the port Slavonski Brod, which is of particular importance for Bosnia and Hercegovina, and port Sisak is largely depending on the navigability of the river Sava. Reliability and safety of navigation on the river Sava are crucial factors which influence the attractiveness of the port. The main goods trans-shipment is port Slavonski Brod are crude oil together with general cargo.

The potential of the port of Slavonski Brod as well as the port of Sisak depends greatly on the quality of the river Sava.

The rehabilitation of the navigability of the Sava river will have a positive impact on the connection between Slavonski Brod port and the metal and wood industry of the region, and on the development of intermodal transport and logistics. The improvement of the Sava river navigability will have a positive impact on the development of intermodal transport and logistics, the development of the economic zone in the port area of Slavonski Brod, as well as on the connection between Luke Slavonski Brod and the metal and wood industry. The most important type of cargo for transhipment in Slavonski Brod port is currently crude oil, and then general cargo.

Table 5: Classification of inland waterways in Republic of Croatia, 2011

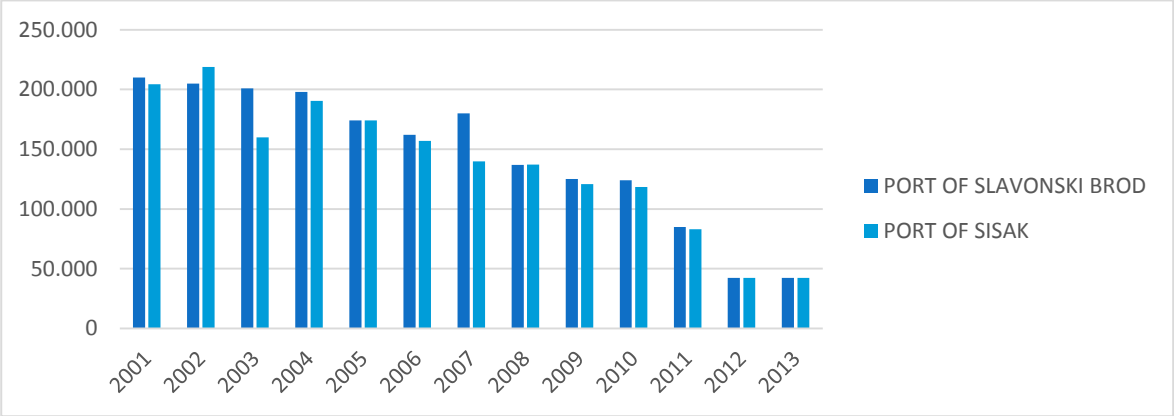
River	River section	Length of waterway (km)	Class of waterway
INTERNATIONAL INLAND WATERWAYS			
DANUBE	1295+500 (Ilok) - 1433+000 (Batina)	137.50	Class VIc
SAVA	210+800 (Račinovci) - 313+700 (Sl.Šamac)	102.90	Class IV
	313+700 (Sl.Šamac) - 338+200 (Oprisavci)	24.50	Class III
	338+200 (Oprisavci) - 371+200 (Sl.Brod-city)	33.00	Class IV
	371+200 (Sl.Brod-city) - 594+000 (Sisak-Galdovo)	222.80	Class III
DRAVA	0+000 (mouth of Danube) - 14+000 (Osijek port Nemetin)	14.00	Class IV
	14+000 (Osijek port Nemetin) - 55+450 (Belišće)	41.45	Class III
	55+450 (Belišće) - 70+000 (Hungarian border)	14.55	Class II
KUPA	0+000 (mouth into Sava) - 5+900 (mouth of Odra)	5.90	Class I
UNA	0+000 (mouth into Sava) - 4+000 (Tanac)	4.00	Class II
	4+000 (Tanac) - 15+000 (Hrvatska Dubica)	11.00	Class I
Total length of international inland waterways		611.60	
INTERSTATE INLAND WATERWAYS			
DRAVA	70+000 - 198+600	128.60	Class II
Total length of interstate inland waterways		128.60	
NATIONAL INLAND WATERWAYS			
Classified national inland waterways			
SAVA	594+000 (Sisak) - 662+000 (Rugvica)	68.00	Class II
	662+000 (Rugvica) - 715+000 (Bregana - Slovenian border on the right bank)	53.00	Class I
KUPA	5+900 (Mouth of Odra) - 161+500 (Ozalj-dam HE Ozalj)	155.60	Class I
Total length of national classified inland waterways		276.60	
TOTAL LENGHT OF CLASSIFIED INLAND WATERWAYS		1,016.80	

The Sisak Port is located on the Sava river and has been classified as a TEN-T comprehensive port. Reliability and safety of navigation on the river Sava are crucial factors which influence the attractiveness of the port. Cargo transport in the port is mainly related to the Sisak oil refinery, i.e. transportation of crude oil. Port Sisak also serves passenger transport.

Transport of cargo in both ports is, as said before, in direct connection. Crude oil is transported by vessels from port Slavonski Brod to port Sisak. Quantity of trans-shipped cargo is declining on an annual basis, from 200,000 tons to only 42,000 tons of trans-shipped cargo in roughly 10 years. A

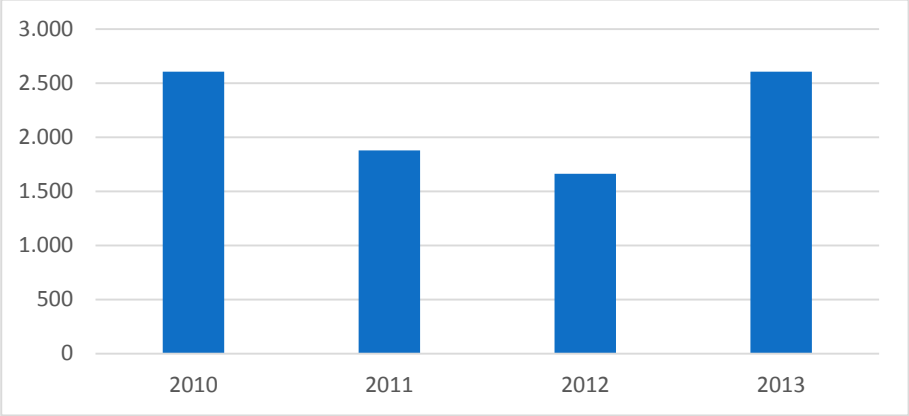
good part of the cargo reduction was caused by the transfer of freight from the Sava river to road traffic which is more expensive, more environmentally dangerous and leads to the destruction of the road infrastructure.

Figure 114: Overview of trans-shipped cargo in tons



Port Sisak is also the passenger inland port, mainly for local transport. Port has transported in 2013 a little more than 2,500 passengers.

Figure 13: Overview of passenger traffic



All along the waterway Sava is situated corridor X international railway and road network, both part of TEN -T core network. Increasing navigability on the section 313+700 (Sl.Šamac) - 338+200 (Oprisavci) from class III to class IV of navigability, may increase the attractiveness of the existing inland ports Slavonski brod and Sisak, but it is difficult to compete with the high level of service offered on existing road and rail corridor.

Transport of only crude oil, the only cargo that is transported from port Slavonski Brod to port Sisak, suggest that minimal navigability of Class III on the waterway Sava (max. lenght of vessels and barges 67-70 m, max. beam 8.20 – 9.00 m, draught 1.60 – 2.00 m and tonnage 470-1,200 t) is sufficient for the current operational requirements. On the other hand, the lower class of

navigability of the Sava from the stipulated AGN agreement limits the achievement of the European policy goals for the transfer of road transport to internal waterways and railways.

The principles of European transport policy, contained in the "White Book" of the European Union, encourage the development of inland navigation as an environmentally acceptable and safer mode of transport. Contamination and problems with road traffic capacities are the reason for moving traffic to modes of transport that consume less energy, that less pollute the environment, and can transport larger amounts of cargo. The large network of European waterways meets the requirements, and as the Croatian water system is an integral part of the European system, measures are being taken to curb first and foremost the road traffic and increase the need for river transport.

2.7.5. HYPOTHESIS

The port of Slavonski Brod plays a key role for the freight transport system in Bosnia and Hercegovina.

Source

Port statistics

Key findings

- Bosnia and Herzegovina does not have a port on this section of the Sava River
- With capacity of 1.5 million tons of cargo port Slavonski Brod is of importance for BiH and Slavonian region.

Note

The Port Slavonski Brod with the determined port area is situated on the left coast of the river of Sava, on the 363. river kilometre. Port is located approximately 4 kilometres southeast from the town Slavonski Brod. Port is situated at the intersection of roads and railways that connect eastern part of Europe and the Mediterranean and represent the meeting point of all roads that connect the Central Europe with the southern part of European continent.The regional significance of the Slavonski Brod Port is defined by its proximity to Bosnia and Herzegovina, which does not have a port on this section of the Sava River. Aside from this, the port capacities of Slavonski Brod Port can contribute to the competitiveness of the economy in the northern hinterland.

The port area covers approximately 900,000 m2 with capacity of 1.5 million tons of cargo. Port of Slavonski Brod is divided into the economic and operational part. The economic part of the port is intended for manufacturing activities that will use the operational part of the port for the input of raw materials and deliveries of finished products. The operational part of the port is intended for cargo transportation. From the Sava river to the mainland and vice versa, and further to the railway and road transport. Only 42,000 tons of crude oil was transhipped in the port in 2013, exclusively in national traffic for transport from Slavonski Brod to Sisak refinery. Increasing the Sava river class and removing bottlenecks on critical sections will allow shipping bigger amounts of cargo on the Sava river as well as the amount of overburdened cargo in the ports of Slavonski Brod and Sisak.

2.7.6. HYPOTHESIS

There is a potential for the integration of the inland navigation system in agglomerations with higher density with the public transport system (for example Sisak).

Source

Port statistics

Key findings

- Passenger transport in inland waterway ports Vukovar and Sisak is increasing
- Increase in the number of passengers pertains to passengers on cruise ships in Vukovar, Osijek, Ilok and Batini, as well as tourists.
- Integration of the inland navigation system with the public transport system should be examined by the master plans for functional regions

Note

Generally speaking, passenger transport on inland waterways in the Republic of Croatia is increasing, but it is negligible compared to the transport of cargo. Port Vukovar recorded almost 30.000 passengers on cruiser ships in 2013 which is almost 90% of all passengers recorded in all inland ports in the Republic of Croatia. Port Sisak is the second largest inland port for passenger transport. In the same year port Sisak recorded 2.607 passengers (local passenger, touristic transport). In the passenger port of Osijek, in the year 2016, the turnover of 4,180 passengers was recorded, and in 2017 more than 80 cruisers are expected, which means almost 10,000 passengers. In 2016, the passenger ports of Vukovar, Ilok and Batina had a turnover of 36,000 passengers, and Sisak 2,679 passengers (excluding excursion tourism in Lonjsko polje, Lake Bajer and Plitvice lakes).

Waterways provide a strong potential for developing shuttle services by making use of the geographic features of the area. Rivers often form barriers, thereby lengthening the time taken for overland travel. In these configurations, transportation by water helps to open up isolated areas and link neighbourhoods that are separated geographically. By enabling direct routes to be taken for crossings, waterways provide time savings as compared with the same journey made using land-based transportation and make the shuttle service attractive.

Improving the accessibility of urban areas or neighbourhoods is not only a question of transport policy but is even more so one of urban development.

2.7.7. HYPOTHESIS

There is lack of logistic concepts for the use of the existing port infrastructure.

Source

Communication from the Commission - Freight Transport Logistics Action Plan

Key findings

- Current characteristic of inland waterway ports is underdeveloped and unrelated logistics network
- It is necessary to develop a business plan for all inland waterway ports

Note

Current characteristic of inland waterway ports in Republic of Croatia is underdeveloped and unrelated logistics network. Ports of Vukovar, Osijek, Slavonski Brod and Sisak, and their port areas need to be developed according to the logistic and intermodal strategy. Ports should be developed as a logistics centres that will other than conventional service like storage, loading and trans-shipment provide through business zones the services with additional value. Business zones should allow economic activities involving distribution and freight logistics, refinement and processing of goods, and industrial activities including production, which allows fuller economic utilization of port facilities.

2.7.8. HYPOTHESIS

The RIS system for the Danube and Sava has been introduced.

Souce

Ministry of the Sea, Transport and Infrastructure (MSTI)

Key findings

- The RIS system (CRORIS) is available for the Danube and international Drava section up to Osijek and Sava section up to Sisak.

Note

Although the number of accidents in Republic of Croatia has not been large during the last five years, the expected growth in traffic, and the consequent increased risk of accidents and the impact

of potential incidents on the water require the existing safety level to be brought up on a higher level.

River Information Services system has been designed to operate within the European network of information services in the inland navigation. Republic of Croatia has placed the project of the River Information Services development at the top of its priorities in inland waterways transport.

In the Republic of Croatia, it is called RIS and it is compatible with service systems available in other countries of the Danube river basin. This service ensures reliable, accurate and comprehensive information on a certain inland waterway, dangers or restrictions for navigation, contributing to accident risk minimization.

RIS concept in Republic of Croatia is based on the fairway and vessel information and their interconnection with the cargo information within intermodal transport chain. This concept is based on the following components:

- Electronic navigational charts that are in compliance with the Inland ECDIS standard, for the display of fairway and ship position information,
- Automatic identification system (AIS) for automatic vessel positioning with corresponding Shore and on-board ICT infrastructure,
- Notices to Skippers (NTS) standard in a form of a web application on the internet,
- Electronic ship reporting system.

Calamity abatement service provides support in the form of minimizing losses and hazards in the cases of distress or other accidents on vessels or other objects on inland waterways. This type of service relates to the procedures that must be undertaken after the accident in order to minimize the effects as much as possible. In the case of the accident RIS control centre delivers data, in accordance with the protocol.

The CRORIS service is available for the Danube and international Drava section up to Osijek and international Sava section up to Sisak and covers 542,8 km of inland waterways. The RIS service has been developed for the Kupa river sections in the area of Sisak.

Within the Agency for waterways, the RIS National Center Service has been formed, which has the role of coordinating at the national level and at the international information exchange center. In addition, it is necessary to determine the organizational structure and the RIS hierarchy in the Republic of Croatia. It is important to clarify and define the legal framework for the use of RIS, the

powers of competent bodies, as well as to strengthen the administrative capacity of the system users.

3. OBJECTIVES

Transport Development Strategy is based on the analysis of the current situation of the Country having identified opportunities and problems and having analysed best solutions to accomplish and respond to existing needs.

The Strategy is a document which determines a medium and long-term development in the Republic of Croatia and constitutes a positive development in relation to the existing situation and the achievement of a new stage, which consists in increasing the quality of transport system and the transport infrastructure. For that purpose, the definition of accurate objectives is considered a basic and crucial stage of the Transport Development Strategy process.

As a result of EU/CRO policies and EU/CRO strategies the list of **general objectives** was set. Second list is composed of **specific objectives** which are resulting from the analysis of the Croatian transport system. Specific objectives are further divided by the sector to which it refers.

3.1. GENERAL OBJECTIVES (GO)

- CO1 –Modification of the passenger Modal Split in favour of Public transport (PT) and 0 emission modes. This includes agglomeration PT and PT in local regional context (trams, local buses, etc.), rail transport and maritime PT (boats), regional and long distance buses as well as pedestrians and bikers.
- CO2 – Modification of the freight Modal Split in favour of rail transport, maritime freight transport and inland water transport
- CO3 – Modification of the transport system (operation, organization and infrastructure development and maintenance) according to the principle of economic sustainability.
- C04 – Reducing the Climate change impact of the Croatian transport system
- C05 – Reducing the impact on the Environment of the Croatian transport system (Environmental sustainability)
- C06 – Improve the traffic safety in the Croatian Transport system
- C07 – Improve the interoperability of the Croatian transport system (PT, rail, road, maritime, inland water and air)
- C08 – Improve the integration of transport modes in Croatia (operation, VTMIS, ITS, P&R, etc.)
- C09 – To further develop the Croatian TEN-T (core and comprehensive) network

3.2. SPECIFIC OBJECTIVES (SO)

- Specific objectives which apply cross sectorial
    - SC – To better harmonize the transport operations with neighbouring countries (BiH – Ploče Port and Slavonski Brod, road and rail connections BiH, Slovenia, Serbia, Italy, Montenegro and Hungary
    - SC – To complement the touristic sector development as the main economic factor in some parts of Croatia where relevant, by adequate transport development especially in favour of PT and green mobility
    - SC – To improve accessibility to remote areas of Croatia (for example island, Southern Dalmatia, mountainous and boundary areas…)
    - SC – To develop on the potentials of the main logistic centres (Rijeka maritime port, Ploče maritime port, Split maritime port, Vukovar inland port, Osijek inland port, Slavonski Brod Inland port, Zagreb hub via Sisak inland port)
    - SC – Strengthening of Croatia as a logistic hub for the wider region with particular focus on Zagreb.
    - SC – To improve the integration of the transport sector into the social and economic developments of the regions (Functional Regional Concepts)
    - SC – To address the specific situation in Croatia related to the seasonality of traffic
- Specivic objectives for public transport and 0 emission transport modes
    - SC1 – To develop on the potential for road PT (regional and national) where other PT modes are not economic
    - SC2 – To improve the competitiveness of the tram systems in Zagreb and Osijek
    - SC3 – To better integrate the international/national transport system with the local and regional transport systems (passenger hubs, integrated ticketing, etc.)
    - SC4 – To increase the efficiency and to reduce the economic impact of PT operations/organization
    - SC5 – To increase the attractiveness of PT by improving operational concepts and modernizing the rolling stock
- Specific objectives for rail transport
    - SC1 – To improve the rail freight corridors from Port of tiRijeka towards the markets with the biggest potential for the port (Hungary, BiH, Slovakia, Italy, Southern Poland and Serbia)

  - SC2 – To better utilize the Croatian railway system in the main Croatian agglomerations (Zagreb, Rijeka, Split, Varaždin, Osijek) and within and between functional regions (subregions)
  - SC3 – To improve the LOS and environmental impact of rolling stock
  - SC4 – To improve the integration of the railway system into the local transport systems (safety and security of stations, interfaces with other transport modes, etc.)
  - SC5 – To improve the safety at level crossing with roads
  - SC6 – To improve the efficiency of the Croatian rail system (traffic management, operations etc.)
  - SC7 – To safeguard the maintenance of the infrastructure taking into account economic considerations
- Specific objectives for road transport
  - SC1 – To improve the safety of the road system
  - SC2 – To better utilize the Croatian road system for PT (Local, regional and national bus systems)
  - SC3 – To reduce the environmental impact the oldest parts of the Croatian motorway network
  - SC4 - To optimize and harmonize the different tolling systems in Croatia
  - SC5 - To improve the technical requirements for road design addressing more economic technical solutions, safety standards, green mobility and the integration of 0 emission modes
  - SC6 – To increase the road accessibility of areas, where the existing infrastructure reached the capacity limits and alternative modes (rail, maritime PT) are not economically justifiable (touristic centres in Adriatic Dalmatia) including the introduction of a sustainable traffic concept in favour of PT and 0 emission modes
  - SC7 – To increase the connectivity to neighbouring countries in order to reach a higher level of cooperation and territorial integration
  - SC8 – To increase the accessibility of areas in Croatia, where the capacity limits have been reached, and no alternative road infrastructure is existing (parallel motorways ect.) – Zagreb towards Bjelovar and Varaždin towards Koprivnica and Krapina
  - SC9 – To reduce congestion in heavily burdened agglomerations taking into account the specific requirements of protection of National Heritage
- Specific objectives for air transport

  - SC1 – To support the development of Zagreb airport "Franjo Tuđman" in order to safeguard the international accessibility of the Croatian capital
  - SC2 – To improve the operations and the operational reliability of Dubrovnik airport in order to safeguard the accessibility of Southern Dalmatia
  - SC3 - To improve the accessibility of the airports in general and in relation to PT in specific
  - SC4 – To improve the safety standards on the airports and in air traffic
  - SC5 – To improve the security standards with Schengen requirements where applicable
- Specific objectives for maritime transport
  - SC1 – To improve the development and competitiveness of Rijeka port as the main maritime port of Croatia
  - SC2 – To reduce the environmental impact of maritime transport (development of the fleet, measures of prevention and suppression of pollution from marine facilities, environmental protection)
  - SC3 – To improve the Modal Split of freight transport across the Adriatic sea or along the coastline in favour of maritime transport
  - SC4 - To improve the reliability of maritime (transport PT and supply chains) in case of difficult weather conditions
  - SC5 – To improve the level of economic efficiency of the maritime transport system
  - SC6 – To improve the safety of the maritime transport system
  - SC7 - Better integration of the ports into the local transport system (passenger/freight)
- Specific objectives for inland navigability and river transport
  - SC1 – To improve the competitiveness of Vukovar and Osijek as the main inland freight ports
  - SC2 – Determine the role of Slavonski Brod port, which, in addition to the Croatian part of the hinterland, also relies on the hinterland of BH, and on the Sisak port, which is hinterland of the entire Central Croatia, and can be an important factor in transit traffic between northern Adriatic ports and Central and Eastern Europe.SC3 – To use the potential of the of inland waterways navigation in the tourism segment
  - SC4 - To adapt the conditions of sailing to transport needs and to maintain the necessary level of navigation and to improve the level of sailing on Drava from 0 to 13 rkm and to Sava.

- SC5 - Remove the bottleneck on the waterways (Danube, Sava, Drava).
- SC6 - Improve operational and organizational conditions in river traffic (economic viability).

4. MEASURES

Based on the analysis of the current situation and in order to address the defined general and specific objectives, a set of measures has been identified in each sector. The measures propose interventions not only related to improve the infrastructure of the different transport systems but also related to operational and organisational aspects, since isolated interventions on the infrastructure will not have a big impact on the efficiency and sustainability of the system if they are not accompanied by adequate changes in the setup of the system, and the operations are not adapted to the real demand needs.

The following tables show the list of general measures and measures per transport sector including a detailed description of the measure to facilitate the understanding of their content.

In order to distinguish between group of measures, taking into account their alignment with the Transport Development Strategy objectives, the following colour code, which is included as well in the tables below, has been defined.

	Aligned with the Strategy; the measure is needed and well defined, even if some further studies might be necessary.
	Missing data to determine the apparently alignment with the Strategy; some further studies are required to asses or verify the eligibility of the measure.
	Non-aligned with the Strategy; the eligibility is remote, unless new data proves their need in relation to current and medium-term traffic demand. If the new studies evaluate and determine the justification for the investment, the compatibility of the measure with the Strategy will be changed.
	Measure covered by General measure

4.1. GENERAL MEASURES

Code	General measure	General measure description
G.1	National concept for cargo logistics	Republic of Croatia shall define a national concept for freight logistics that would cover all aspects of traffic. It is very important, among other things, to determine the role of the Port of Rijeka and Port of Ploče, as well as the Zagreb hub. A special study shall be developed to include all relevant stakeholders. As it is generally said that the transport system of the Republic of Croatia has large unused capacities, it is necessary to investigate whether it is possible to switch traffic from other countries where bottlenecks have been identified, such as Italy.
G.2	Increasing access to international airports through public transport	The accessibility of airports by public transport is inadequate and therefore individual solutions tailored to the specific features of each airport shall be found. Solutions shall be considered in the context of the master plans of functional regions, taking into account the potential functionality of connections such as the connection between Velika Gorica and Zagreb, Trogir and Split.
G.3	Improving the safety of the transport system	• Since safety is one of the main goals of the Transport Development Strategy, it is imperative to raise the safety level in all aspects of the transport system.To increase the level of safety of the railway system specific measures such as: o Denivelation or removal of level crossings (if justified by the traffic flows). If there is justification to denivelate or eliminate a rail-road crossing, it is necessary to assure it with adequate safety devices. In order to increase safety at level crossings it is necessary to develop and implement educational marketing campaigns in order to raise awareness of drivers of road vehicles. o Introduction of ERTMS on all lines that are part of the TEN-T core network o Integrate railway safety in all the stages of project implementation via road safety impact assessments which will demonstrate, on a strategic level, the implications on railway safety of the different alternatives of an infrastructure project and they will play a relevant role in the selection of the routes and final alternative. At a more advanced stage of the project phase, during construction and operation, railway safety audits should identify, in a detailed way, unsafe features of a railway infrastructure project and propose corrective measures. o Train stations should be equipped with adequate signaling and TK devices o Railways/ ailway stations equip with axle load detectors, axle overheating detectors and other devices to increase safety in rail traffic. Additional studies will show in which places it is necessary / justified to set up such devices • In terms of road safety, the Commission has set as its overall objective that the number of fatalities needs to be moved to zero by 2050. Road safety audits must be aligned with the 2008/96 Road Safety Directive. In order to improve road safety in the Republic of Croatia, the following measures should be implemented: o Integrate road safety in all the stages of project implementation via road safety impact assessments which will demonstrate, on a strategic level, the implications on road safety of the different alternatives of an infrastructure project and they will play a relevant role in the selection of the routes and final alternative. At a more advanced stage of the project phase, during construction and operation, road safety audits should identify, in a detailed way, unsafe features of a road infrastructure project and propose corrective measures. o By constructing new hiking trails, ie footpaths that would make access to stations, terminals and public transport stops easier, attention should also be paid to traffic technical

Code	General measure	General measure description
		measures at intersections where most traffic in urban traffic takes place o To reduce the negative impacts of accidents, the procedures to be followed in case of accidents will be reviewed and improved to reduce the response time. The information channels will be as well improved and simplified and the situation on the black spots will be monitored. • In order to develop the maritime sector in a safe and sustainable manner it is necessary to increase the share of energy-efficient vessels by modernization of the fleet and to improve public service of search and rescue at sea. The goal is to constantly raise the efficiency of the system of control over vessels and floating facilities. It is also necessary to establish an effective monitoring system of recreational craft and smaller passenger and cargo ships and strengthen the capacities for the supervision of naval facilities by strengthening the relevant inspection services. Security of ports and waterways and security protection need to be enhanced by investments in the objects of navigational safety, security devices and equipment, ensuring the necessary depth in the port area and improving the conditions of navigability of waterways and official maps of waterways. It is necessary to develop a system of targeted inspections and technical inspections on maritime facilities and vessels in order to establish the highest international, European and national safety standards. Strengthening the professional capacity for inspection of the maritime property can be achieved by raising the efficiency of the maritime control system. • To raise up the safety level on waterways to a higher level, besides the implementation of the River Information Services (RIS) and the availability of timely and accurate information regarding the movement of vessels, it is necessary to establish clear procedures regarding the actions which should be taken in cases of incidents, as well as upgrading the existing systems of marking and monitoring the navigability of the inland waterways. For safety reasons, it is also necessary to modernize and upgrade the ports with safety systems. For a more effective safety control and inspection, and installation and maintenance of signalization system on waterways, it is necessary to increase the fleet of safety and environmental protection vessels. • Safety and security in urban areas should be improved at least on two different levels: o Identifying and eliminating black spots such as rail-road crossings, signalling pedestrian crossings, providing additional protection to pedestrians and cyclists by constructing new pedestrian footpaths and bike paths where needed, constructing pedestrian islands to minimize crossing distances, extending curbs where necessary andconstruction of new pedestrian sidewalks / footpaths to improve the accessibility to the main public transport stations and terminals. o The rolling stock and vehicles for public transport will be modernized. Procurement of new public transport vehicles that comply with the highest safety and quality standards is a priority. These vehicles are to incorporate the latest advances in safety and control and surveillance devices (e.g. video cameras). The infrastructure and stations will also be modernized with the necessary adaptations to increase safety and accessibility to the public transport and with the installation of surveillance and control devices to improve the security.
G.4	Improvement of passenger intermodality and development of intermodal passenger hubs	To ensure the sustainability of the transport sector as a whole, it is important to increase the interoperability to be able to use the potential of each transport mode and in particular to encourage modal transport modification to active travel (cycling and walking), public transport and/or mobility schemes, such as bicycle and car sharing, to reduce pollution in cities. A network of intermodal terminals shall be set up, enabling passengers to easily switch from one transport mode to another. A well-designed, balanced

Code	General measure	General measure description
		intermodal network is key to achieving the maximum efficiency of the entire system and reducing customer inconveniences to the level as low as possible. The location and form of each terminal shall be determined according to the studies for the specific area (e.g. master plan) In the road transport sector, it is important to provide an appropriate level of accessibility in accordance with the needs, i.e. hubs in gravitation areas (such as sea, river and air ports, railway stations, workplaces, business zones, etc.). Larger number of parking spaces linked to public transport systems, sea, river and air ports shall stimulate the transition from one transport mode to another in favour of public transport, and thus reduce the number of bottlenecks on the roads.
G.5	Maintenance concept for different transport sectors	The owner of the national infrastructure should have a maintenance concept that shall guarantee the long-term sustainability of different transport modes. An appropriate structure and organization of maintenance needs to be established to enable railway service to be efficient and effective, that is, sustainable. The concept shall be derived from the purposeful and concrete analysis of the situation in Republic of Croatia and the company "HŽ Infrastruktura d.o.o.", taking into account the technical and financial conditions as well as the needs of users, as set out in Directive 2008/57/EC on the interoperability of the relating to Railway applications - The specification and demonstration of Reliability, Availability, Maintainability and Safety (RAMS) (HRN EN 50126). HRN EN 50126, Tehničke specifikacije za interoperabilnost željezničkog sustava (TSI)). Road maintenance is essential for preserving the roads in their original state, protecting nearby resources and user safety as well as traveling comfort along the route. It is necessary to introduce a maintenance system that is efficient and effective, that is, sustainable and characterized by an appropriate structure and organization. The concept of the maintenance system shall be derived from the purposeful and concrete analysis of the situation in Republic of Croatia and relevant stakeholders, taking into account technical and financial conditions and the needs of users. The concept of maintenance for the maritime sector can be divided into maintenance of ports and port infrastructure, on the one hand, and maintenance of the fleet, on the other. An appropriate structure and organization of maintenance needs to be established to provide a maritime transport service that shall be efficient and effective, i.e. sustainable. The concept of maintenance system shall be derived from the purposeful and concrete analysis of the situation in Republic of Croatia and vessel operators, taking into account technical and financial conditions and the needs of users.. The concept of river traffic maintenance includes the maintenance of ports and port infrastructure in inland waterway ports, the maintenance of fleets and maintenance of inland waterways, which should be such as to enable safe sailing with the maximum permissible draught in an economically acceptable period throughout the annual period. This concept must be environmentally friendly in a way that does not prevent navigation and directs traffic to other modes of transport.
G.6	Improve energy efficiency in transport system	According to the guidelines for the development of the trans-European transport network, promoting efficient and sustainable use of infrastructure is one of the priorities in infrastructure development. In this sense, it is necessary to raise the level of energy efficiency and to identify low-carbon energy sources and power systems as a priority. Further studies shall aim at analysing specific requirements.
G.7	Reorganization of the transport system to increase financial sustainability	Public Service Contract(s) in compliance with EU Reg. 1370/2007 are a fundamental tool to assure transparency and efficiency in the provision of public transport services. A widespread implementation of PSCs is therefore required not only for compliance purposes, but also as a first step towards an improvement in sustainability of Croatian's transport system. Typology and duration of the PSC will have to be determined on a case-by-case analysis, together with the applicability of the in-house model (either based of pure compliance issues or after a thorough assessment of technical and financial requirements). Increasing financial sustainability is one of the goals of the trans-European transport network. To achieve this goal, the organization of transport systems shall be optimised and the efficiency of operations and maintenance

Code	General measure	General measure description
		shall be raised. The financial sustainability of the transport system aims to reduce the system dependence on the subsidies from public revenue.
G.8	Harmonization of legislatives and planning guidelines taking into account relevant EU requirements and policies	The legislation and planning guidelines shall support sector development and follow best practices and European regulations, particularly in the area of safety, interoperability, sustainability and environmental protection. The entire legal framework shall be aligned to enable large infrastructure projects to be implemented, individual procedures need to be simplified, and the definitions shall be harmonised in all legal and subordinate acts.
G.9	Preparation and adaptation to Schengen requirements	Possible future development of Croatia and neighbouring countries entering the Schengen Agreement area shall increase the importance of international traffic. Adaptation of transport systems requires removal of infrastructure and administrative bottlenecks. The removal of bottlenecks to neighboring countries outside the area of application of the Schengen Agreement will contribute to the growing importance of international transport in some corridors with international ties. Specific studies will assess the technical conditions to be met in each particular case.
G.10	Increase administrative capacity/training	Lack of administrative capacity and properly trained staff are some of the key problems that have been identified in the transport sector and one of the priorities of the European Union's cohesion policy. The introduction of new technologies and increased demand for traffic and traffic control implies the necessity of training existing staff and newcomers in accordance with their specific needs.
G.11	Improvement of the public perception of the transport system in Croatia	Creating and promoting a positive image of the public transport system as a reliable, safe and ecological way of transport, it is important for boosting demand and thus investment. Better promotion requires the existence of complete and up-to-date information and knowledge of infrastructure, opportunities and development plans. In the road transport sector, users' traffic and weather conditions are extremely important for informing about alternative traffic directions, as well as the number of accidents. It is also important for drivers to be notified of changes to existing and new regulations relevant to the users as well as the current notification of incidents on motorways that require driving at a lower speed or a driving-ban in certain directions. For these reasons, it is extremely important that information technology and information channels are constantly adapted and renewed in order to improve the whole sector. It is also important for the media to constantly update the road traffic information in transmitting. In the railway sector, it is extremely important for the user to be informed about the movement of the trains in order to enable the adequate planning of travel or planning of the economic operators, thus increasing the attractiveness of the railway traffic. For these reasons, it is extremely important that information technology and information channels are constantly adapted and renewed in order to improve the whole sector. It is also important for the media to include more in transmitting information. In the public transport sector, it is extremely important for the user to be informed about the traffic situation and weather conditions, so that by informing about alternative routes, traffic cuts and the number of accidents can be reduced. It is necessary to introduce the possibility of planning intermodal journeys in order to enable better utilization of the transport system and to facilitate the transition from personal to public transport. For these reasons, it is extremely important that information technology and information channels are constantly adapted and renewed in order to improve the whole sector. It is also important for the media to include more in transmitting information. In the maritime transport sector, it is necessary to continuously update the information platforms and integrate them to ensure reliable and complete data and information for all users. It is also necessary to establish an effective data exchange system based on interoperability principles, integrate the management of all maritime ICT services in line with the needs of the shipping industry, the port community and citizens, improve maritime meteorology services, establish online e-business services for all users of public services (single window system), to establish a unique port information system (PCS) in ports to improve business processes and

Code	General measure	General measure description
		enhance port competitiveness, establish a hydrographic information system, develop ICT solutions to work in extraordinary
G.12	Reduce environmental impact of transport	Based on environmental monitoring, efficient planning / implementation of infrastructure and the establishment of necessary ecological protection measures, the negative environmental and socio-economic impacts of the transport system shall be reduced. The mitigation of negative environmental impacts of traffic shall be realised with greater energy efficiency, especially by using energy sources with low or zero hydrocarbon emissions and by reducing noise emissions and the volume of continuous pollution and waste generation. To prevent the pollution of the Adriatic Sea from marine facilities and vessels, it is necessary to renew and modernise the fleet of cleaning vessels, ensure availability of services, equipment and devices for operative action, in particular for interventions in case of large-scale sea pollutions. The conditions for a sustainable and accessible service for the reception and disposal of ship waste and freight residues shall be provided in accordance with international and EU regulations and ballast water management shall be enhanced based on the risk assessment and in accordance with internationally agreed guidelines. The timely response to prevent sea pollution is particularly important, as sudden pollutions of the sea may have far-reaching consequences. It is necessary to establish and maintain an operational oceanographic model system, which is essential for the operation of traffic-technological incidents and interventions in the case of sudden sea pollution in maritime traffic.
G.13	Adaptation and mitigation of climate change	The development of the transport sector in Republic of Croatia shall take into account the need to reduce CO2 emissions, and thus mitigate the impact of the traffic on climate changes. At the same time, the transport infrastructure and business shall be built, taking into account possible consequences of climate changes and extreme weather conditions on them.
G.14	Improvement of data collection	For the further development of the transport sector it is necessary to have all the necessary and quality data needed for traffic planning. The data collection system needs to be improved and simplified for easier access to data. Consideration should be given to the possibility of planning a central access point as a unique place for collecting and distributing traffic data in the Republic of Croatia and other neighboring countries.
G.15	Improvement of interoperability with neighbouring countries	Improvement of the interoperability of the Croatian transport system, in all the sectors, with the neighbouring countries is very important to ensure the proper connectivity and consolidate the role of Republic of Croatia as a transport hub for the Western Balkans, Central and Eastern Europe and thus, increasing the transport demand in Croatian territory. Harmonisation of the technical standards in the different sectors and simplification of the procedures at the border crossings with Schengen and non-Schengen countries, are examples of the tasks to be undertaken. Specific studies are necessaries in each sector to identify the bottlenecks and propose solutions.

4.2. SPECIFIC MEASURES

4.2.1. URBAN, SUBURBAN AND REGIONAL TRANSPORT

Code	Measure	Alignment	Description of the measure
URBAN, SUBURBAN AND REGIONAL TRANSPORT			
Infrastructure			
U.1	Intermodal terminals development		Covered by the general measure G.4
U.2	Infrastructure development		Appropriate analysis of the existing situation and the anticipated development of the transport system and socio-economic context in urban and regional areas in the perspective of the functional region shall identify the needs for restoration/upgrading of the existing infrastructure or creation of new ones where the level of mobility allows it. On the other hand, this may also mean the termination or functional reduction of some parts of the network where the expected level of mobility becomes irrelevant. Infrastructure investments shall primarily focus on public transport and low/zero level of harmful emissions, and shall be accompanied by complementary mobility management policies and interventions along with appropriate ITS installations.
U.3	Station development		Appropriate analysis of the current state and expected movement in the transport system in the socio-economic context in urban and regional areas, and in the perspective of Sustainable urban mobility plans / Integrated transport plans shall identify the need for restoration/upgrading of existing stops or setting new ones where justified by the level of mobility. On the other hand, this may also mean the termination or functional reduction of some existing stops where the level of mobility is expected to become irrelevant. The development of the station shall primarily focus on improving access for passengers, particularly persons with reduced mobility, ensuring the safety of passenger movements and introduction of the information and speaker system.
U.4	Separation of modes - prioritization to PT, removal of bottlenecks		Public transport (mainly buses and trams) should simultaneously operate with personal cars, as available space in the cities is limited. In order to increase the efficiency of public transport, the level of separation of individual transport by cars and public transport shall be increased by the construction of dedicated public transport lanes and / or corridors intended for public transport (for trams and buses) and the implementation of the measures aimed at increasing the priority of public transport through traffic management systems such as traffic lights. Furthermore, obstructions and bottlenecks hindering the efficient operation of public transport shall be removed. Such obstructions and bottlenecks usually cause traffic jams for public transport vehicles and may even endanger road safety (e.g. rail-road crossings).
U.5	Increase of intermodality (P&R, etc.)		Covered by the general measure G.4

Code	Measure	Alignment	Description of the measure
U.6	Filling stations for alternative fuel		Alternative fuels have considerably improved over the past few years, especially with regard to public transport in urban and suburban settlements. Consideration shall be given to constructing alternative fuelling stations with the aim of reducing the consumption of conventional fuels, CO2 emissions and poisonous particle emissions. In any case, in order to identify appropriate technology, special studies are required within the concept of functional regions.
U.7	Environmental protection		Covered by the general measures G.12 and G.13
U.8	Improvement of safety and security		Covered by the general measure G.3
Management/Organization			
U.9	Sector reorganization		Covered by the general measure G.7
U.10	Improvement of data collection		Covered by the general measure G.14
U.11	Adjusting the legal framework and enforcing the provisions		Covered by the general measures G.7 and G.8
U.12	Increase financial sustainability		Covered by the general measure G.7
U.13	Ticketing and common ticket systems		One of the biggest advantages for the users of integrated transport systems is the introduction of integrated tariff systems. The level of tariff integration and the type of tickets and technology for use (unique tickets and / or electronic tickets, smart cards) or contactless payment methods, etc.) shall be analysed case by case based on the expertise of the responsible traffic authorities, taking into consideration all options as well as the option to use "smart cards" for the payment of “Park & Ride” service, parking on the street, customs zone , bearing in mind the need for interconnection and interoperability of different systems
U.14	Introduction of public transport services on-demand		Taking into account that some parts of the Croatian territory do not have enough demand to justify the introduction of regular public transport lines (e.g. rural or disperse areas), the introduction of on-demand public transport services will provide the opportunity to also offer public transport services to these areas.
U.15	Harmonisation of timetables (coordination)		In order to increase the share of public transport modes in the urban, suburban and regional transport, To create common lines of all modes of transport involved in public transport of passengers. This also includes the rearrangement of the timetable (eg timetable), the gravitational timetable, etc. with the aim of improving the connectivity, efficiency and coordination of different modes of transport, bearing in mind the needs of passengers.Further studies will analyse this possibility taking into account origin-destination patterns and the operational and infrastructural requirements.

Code	Measure	Alignment	Description of the measure
U.16	Administrative capacity and training		Covered by the general measure G.10
U.17	Purchase of the new fleet		Except for some exceptions, the existing public transport fleet is old and is based on obsolete and inefficient technology. In order to increase the competitiveness of public transport vehicles in relation to personal cars, it is necessary to modernise the fleet and ensure the highest standards of quality, safety and environmental protection as well as access to persons with reduced mobility. The purchase of new rolling stock will be performed in coordination to the foreseen improvements on the infrastructure and to the development/update of an EC Regulation 1370/2007 compliant PSC. The first step in the development of this measure is the development of a comprehensive analysis, of existing supply and demand, and a forecast of future traffic demand. It is also necessary to take into account the current organizational and operational frameworks and ways of maintaining the fleet at relevant operators by analyzing future requirements and the use and maintenance plan. Tolls. Once the real needs are determined, further research will determine the quantity, functional and technical requirements of the fleet.
U.18	Transport reorganisation		Providing options competitive to the use of personal cars (taking into account the potential of car sharing service) is important for achieving the objectives of the Strategy and ensuring the sustainability of the transport system. Different transport hierarchy models shall be re-considered and transport shall be reorganised and integrated in order to give priority to the public transport and low-emission transport modes in relation to the transport by personal cars. At the same time, more pedestrian zones shall be built in urban areas, bike paths for daily ride, public bicycle systems shall be introduced and traffic plans shall be developed with the aim of adapting to the requirements of the seasons.
U.19	Information platform		Covered by the general measure G.11
U.20	Support to non-profit organisations in the transport sector		The role of non-profit organisations promoting the use of alternative means of transport in relation to personal cars has proved to be very significant in many European cities. Among other things, there are organisations that promote the daily use of bicycles, organisations dealing with the rights of passengers, maintenance of footpaths or traffic control. These organisations (neighbouring associations or groups of common interest, non-governmental organisations, etc.) can assist local administration and traffic authorities in carrying out their duties and promoting the use of public transport vehicles. The involvement of these associations, local groups and non-governmental organisations in planning traffic-related decisions shall be further considered and promoted.
U.21	Traffic and logistics management and information		New technologies enable, among other things, the collection of real-time data and control of traffic conditions and the use of public transport. In order to use the benefits of new technologies, centres for centralised public transport management shall be constructed and equipped with the latest ITS devices. New public transport vehicles shall also be adequately equipped, ITS travel planning platforms shall be used and traffic signs shall be modernised, which shall then be integrated into the central management system (e.g. "Smart traffic lights" or setting priority measures relating to public transport). These measures shall lead to a quality improvement of public transport

Code	Measure	Alignment	Description of the measure
			planning and control, use of information, traffic control and collecting data on traffic congestion and arrival time of public transport vehicles.
U.22	Review/updating of local/regional Master Plans		Regarding traffic planning obligations, functional regions and/or cities shall be required to develop relevant master plans for functional region (following the principles of the Sustainable Urban Mobility Plan - SUMP). These master plans for functional regions shall analyse the existing transport system status taking into account not only the infrastructure but also the operational and organisational aspects, and based on the results of these analyses, future needs shall be identified. The existence of these plans is a prerequisite for investments into the public transport system. The master plans shall be periodically reviewed and updated and shall be aligned with the high-level planning instruments such as the Transport Development Strategy of the Republic of Croatia.

4.2.2. RAILWAY TRANSPORT

Code	Measure	Alignment	Description of measure
RAILWAY TRANSPORT			
Rail network elements			
R.1	Zagreb – state border with Slovenia towards Ljubljana (TEN-T core network/TEN-T Mediterranean corridor / Pan-European corridor)		The M101 railway is part of the TEN-T core network and RH1 corridor and is one of the major international connections towards Zagreb and the only urban node of the core railway TEN-T network in Croatia. RH1 has historically been the most important corridor in terms of long-distance passenger transport. Future scenarios such as the entry of Croatia into the Schengen area shall increase the volume of traffic on this railway line. Although some activities are being developed to improve this railway line, the fact is that some parts of the M101 railway currently have a speed limit of up to 60 km/ h. The local/regional functionality of line M101 should be assessed in the Functional Regional Concept, which shall take into account eastern parts of Slovenia. Further studies will assess the technical requirements to be achieved in terms of capacity and permissible speed, taking into account also economic and environmental aspects. As the line is as well relevant for freight traffic, it will have to meet the following minimum technical criteria: 22.5 axle load, 750 m siding length, ERTMS.
R.2	Zagreb – Karlovac (TEN-T core network/TEN-T Mediterranean corridor/Pan-European corridor RH2)		The corridor connecting Zagreb and Rijeka is primarily important for cargo transport and partly for suburban passenger transport. The analysis shows that suburban passenger transport primarily takes place on the section from Zagreb to Karlovac. Currently, this part of the M202 railway is mostly single-track, which limits the potential to increase capacity. It is expected that the importance of this railway line for cargo transport shall increase in the medium to long term, given that Rijeka is defined as the main Croatian port within the TEN-T network. Further studies shall analyse the optimum track of the railway, bearing in mind the possible construction of the container terminal on Krk and the connection to the Dalmatian railway, planned speed and capacity needs, taking into account economic and ecological aspects. In addition to the capacity increase, cargo transport requires that the railway line meet the following technical criteria: axle load (mass per axle) 22.5 t/a; ERTMS; usable length of railway tracks for reception and dispatch depending on the logistic concept.
R.3	Karlovac to Rijeka (TEN-T core network/TEN-T Mediterranean corridor/Pan-European corridor RH2)		The analysis shows that this part of the corridor connecting Zagreb and Rijeka is mainly used for cargo transport. Currently, this part of the M202 railway is mainly single-track and electrified, with some parts having a speed limit of 50 km / h. Rijeka is defined as the main Croatian port within the TEN-T network and therefore, it is expected that the importance of this railway line for cargo transport shall increase in the medium to long term. This section should therefore meet the following technical criteria: axle load (mass per axle) 22.5 t/a; usable length of railway tracks for reception and dispatch depending on the logistic concept, ERTMS. According to feasibility studies, the best variant of the railway, "low-lane", was chosen bearing in mind the possible construction of a container terminal on Krk and a connection to the Dalmatian railway, the planned speed and capacity needs, taking into account economic and ecological aspects.
R.4	Railway network of railway node Rijeka		According to current preliminary analyses, there might be potential for the reorganisation of the Rijeka railway node with the introduction of suburban lines, giving priority to the modal shift from the use of personal cars. Additional analyses should explore the capacity of the railway, taking into account the logistics concept and capacity of the Port of Rijeka terminals. The remaining capacity can be utilised for regional passenger transport. Improvement of the connection with Slovenia shall be

Code	Measure	Alignment	Description of measure
			harmonised with measures R.2 and R.3.
R.5	Zagreb – Križevci (TEN-T core network/TEN-T Mediterranean corridor / Pan-European corridor RH2)		The corridor connecting Zagreb and Rijeka with Eastern Europe via Hungary is primarily important for cargo transport and partly for suburban transport. The analysis shows that suburban travels in this part of the corridor are mostly related to Dugo Selo (15 568 passenger trains in 2012) and Križevci (11 516 passenger trains in 2012). Currently this part of the M201 line is double-railed up to Dugo Selo and same-railed to KriževciThis fact limits the potential to increase capacity, especially if it is taken into account that the importance of this railway line for cargo transport shall increase in the medium to long term given that Rijeka is defined as the main Croatian port within the TEN-T network. Since this line is important for cargo transport, in addition to increasing capacity, it shall meet the following minimum technical criteria: axle load (mass per axle) 22.5 t / a; usable length of railway tracks for reception and dispatch 750 m, ERTMS. Construction works on the second section of the Dugo Selo-Križevci line are ongoing.
R.6	Križevci – state border with Hungary towards Budapest (TEN-T core network/TEN-T Mediterranean corridor / Pan-European corridor RH2)		The analysis shows that this part of the corridor connecting Zagreb and Rijeka with Eastern Europe via Hungary is most important for cargo transport and partly for suburban transport. Hungary is currently working on the further development of this corridor (development of Gysev and Szekesfehervar network - the development of the Boba railway line). Currently, this part of the M201 railway is mainly single-track and electrified, with some parts having a speed limit of 80 km / h. Rijeka is defined as the main Croatian port within the TEN-T network and therefore, it is expected that the importance of this railway line for cargo transport shall increase in the medium to long term. For this reason and taking into account that this section is a part of the core network and TEN-T corridor, it shall meet the following minimum technical criteria: axle load (mass per axle) 22.5 t / a; usable length of railway tracks for reception and dispatch 750 m, ERTMS.
R.7	Zagreb – Novska (TEN-T core network/Pan-European Corridor RH1)		The railway lines M102 and M103 are part of the core TEN-T network and RH1 corridor and are one of the major international connections towards Zagreb, the only urban node of the core railway TEN-T network in Croatia. RH1 has historically been the most important corridor in terms of long-distance passenger transport (over 59,000 passenger trains between Zagreb and Dugo Selo in 2012). Although some activities are being developed to improve the railway line from Dugo Selo to Novska, the fact is that currently some parts of both lines have a speed limit of up to 50 km / h. Further studies shall analyse planned speed and capacity needs, taking into account economic and ecological aspects. Since this line is also important for cargo transport, it shall meet the following minimum technical criteria: axle load (mass per axle) 22.5 t / a; usable length of railway tracks for reception and dispatch 750 m, ERTMS.
R.8	Novska – state border with Serbia (TEN-T core network/Pan-European Corridor RH1)		The M105 railway is part of the core TEN-T network and RH1 corridor and one of the major international connections towards Zagreb. RH1 has historically been the most important corridor in terms of long-distance passenger transport. Future scenarios such as the entry of Croatia into the Schengen area or the entry of neighbouring countries like Serbia into the European Union shall increase the volume of traffic on this line. At present, the M104 railway line is double-track between Novska and Tovarnik, which was constructed as a border crossing between Croatia and Serbia on the core rail network. Further studies shall assess the technical requirements to be met, taking into account both the economic and environmental aspects. Since this line is also important for cargo transport, it shall meet the following minimum technical criteria: axle load

Code	Measure	Alignment	Description of measure
			(mass per axle) 22.5 t / a; usable length of railway tracks for reception and dispatch 750 m, ERTMS.
R.9	State border with Hungary – Osijek – State border with Bosnia and Herzegovina (TEN-T core network/Pan-European Corridor RH3)		The M303 railway is part of the core TEN-T network in Croatia, and Slavonski Šamac is the border crossing of the core railway network with Bosnia and Herzegovina. The railway lines M301 and M302 are part of a comprehensive network, but serve as a link between Bosnia and Herzegovina - Croatia - Hungary, following the Pan-European Corridor Vc. The potential of this international corridor shall increase if the Schengen borders move in relation to the current position.
R.10	Regional link Vinkovci – Vukovar (TEN-T core network/access to Pan-European Corridor RH1)		The railway line M601 Vinkovci - Vukovar shall serve as a railway connecting RH1 and the only Croatian port of internal waters of the core TEN-T network on the Danube, Vukovar. Future scenarios related to Vukovar port development shall increase the importance of cargo transport on this line in the medium to long term perspective. Since this line is also important for cargo transport, minimum technical criteria in terms of axle load (mass per axle) and useful length of receiving-freight railway tracks.
R.11	Zagreb node		Current configuration of the Croatian railway network and the fact that Zagreb is the only urban node of the TEN-T core network demonstrate the importance of the Croatian capital in the entire transport system. In order to increase the importance of the role of the railway in the regional connection and the urban transport system, further studies shall analyse specific conditions to be met.
R.12	Zagreb cargo transportation		Covered by the general measure G.2
R.13	Povezanost sa Zračnom lukom Zagreb		Covered by the general measure G.2.
R.14	Zagreb Central Station		Zagreb Central Station shall play a key role not only in long-distance transport but also in local and regional transport. It shall probably be necessary to adapt the existing access and platforms and the organisation of the movement of passengers inside and outside the station in favour of the modal hub. Specific technical requirements shall be the result of further studies that shall take into account economic, social and ecological aspects.
Rail network			
R.15	ETCS L1, L2 on other railway lines, GSM-R		Installation of the European Train Control System – ETCS) on railway lines, except those described in other measures (Railway Network Elements) would enable the increase in the interoperability of the entire network. Depending on the operative concept, the installation of the ETCS system and GSM-R system (Global System for Mobile Communications – Railway) could be feasible on other Croatian network railway lines as well (comprehensive and those that are not part of the TEN-T). Through the concept of functional regions, specific needs shall be defined an technical parameters that shall be met in each individual case.
R.16	Electrification of other railway lines		Depending on the operational concept, the electrification of railways would increase the efficiency of the existing infrastructure. Further studies shall define the specific needs and technical parameters as the source of electricity (ensuring the environmental performance of the measure) to be met in each individual case.

Code	Measure	Alignment	Description of measure
R.17	Renovation of other railway lines and stations, and construction of new ones		Individual case studies (Lika railway, Una railway, Lepoglava linkage, etc.) will determine the need for the reconstruction and construction of new railway stations, stops, in addition to those already described in the previous measures, taking into account the operational concept of the economic and ecological aspects. In order to maximize the competitiveness of the Dalmatian ports and enable their further development, it is necessary to modernize the railway lines (Lika railway and the sections from the Dalmatian ports to Knin) connecting them with the Mediterranean corridor in the Republic of Croatia since only the rail can provide the transport of large quantities of cargo. The fee for the use of the railway infrastructure shall be proportionate to the emission and is hence guided by the principle that those who pollute have to pay.
R.18	Regional transport except Zagreb and Rijeka (Split, Varaždin, Osijek, etc.)		Railway transport can also play an important role in regional transport in regional centres that are not part of the basic TEN-T rail network due to the existing network configuration in these areas. Through the concept of functional regions, potential shall be analysed in cities such as Split, Varaždin and Osijek and the possibility of using the railway network within and between functional regions. An example of a railway linkage important within the functional region is the line between Čakovec-Varaždin-Zabok-Zagreb connecting Varaždin region with the center of the functional region of Central Croatia with Zagreb where the construction / renewal of the line between Varaždin - Lepoglava-Zabok can significantly reduce the travel time between larger centers of the functional region. An example of regional importance is the railway line Čakovec-Kotoriba-Koprivnica-Osijek, which has its contribution to regional and international connections, and also represents the shortest connection of the Corridor Vc with corridors X and Xa and the other branches of Corridor V. In order to maximize the competitiveness of Dalmatian ports and enable their further development, it is necessary to modernize the railway lines (Lika railway and the sections from the Dalmatian ports to Knin) that connect them with the Mediterranean Corridor in the Republic of Croatia, since only the railways can ensure the transport of large amounts of cargo. Increasing the competitiveness of the railway sector will reduce environmental pollution and enable intermodal transport. In this respect, in order to define the scope of the modernization of the Dalmatian railway lines in the next period of time, the feasibility study will be used to select the optimal variant of modernization of all Dalmatian lines. These studies shall also assess the required technical parameters for each individual case.
R.19	Improvements and new marshalling yards and logistics center		Through the concept of functional regions based on demand estimates, the need for the development of new railway yards or the improvement of existing ones shall be analysed in order to increase the railway potential in the cargo transport sector.
R.20	Improvement of safety at crossing, axle load detectors, hot axle detectors, etc.		Covered by the general measures G.1 and G.3
R.21	Added value services and improvement of the railway image		Covered by the general measure G.11
R.22	Intermodal passenger hubs		Covered by the general measure G.4

Code	Measure	Alignment	Description of measure
R.23	Intermodal freight hubs		Covered by the general measure G.1
R.24	Development of concept of maintenance of the existing infrastructure		Covered by the general measure G.5
R.25	Energy efficiency		Covered by the general measure G.6
Management/Organization			
R.26	Reorganisation of charging fees for the use of railway infrastructure		The fee for the use of railway infrastructure can be used as a tool to improve the sustainability of the railway transport system. The fee for the use of the railway infrastructure shall be proportionate to the emission and is hence guided by the principle that those who pollute have to pay. Coordination of charging fees for the use of railway infrastructure with railway managers in neighbouring countries shall facilitate international traffic.
R.27	Multi annual PSC		Covered by the general measure G.7
R.28	Increase financial sustainability		Covered by the general measure G.7
R.29	Reorganization of the railway transport system		Covered by the general measure G.7
R.30	Improving the rolling stock for passenger transport		The existing rolling stock is outdated and is based on obsolete and inefficient technologies. In order to increase the competitiveness of rail transport in comparison with other means of transport, it is necessary to modernise the railway vehicles, in coordination with the anticipated infrastructure improvements. The first step in the implementation of this measure is a detailed analysis of current organisational and operative structures and the maintenance structure of the railway operator, whereby future needs, operative plan and maintenance plan shall be analysed. Once actual needs are identified, further studies shall define specific technical requirements for the rolling stock.
R.31	Improving the rolling stock for cargo transport		The existing rolling stock for cargo transport consists mostly of conventional covered and open wagons, some of which are suitable for combined traffic operations. A large number of locomotives need to be replaced and it is estimated that as much as 70% of locomotives shall reach the end of their life span in the next decade. The first step in the implementation of this measure is a detailed analysis of current organisational and operative structures and the maintenance structure of the railway operator, whereby future needs, operative plan and maintenance plan shall be analysed. Once actual needs are identified, further studies shall define specific technical requirements for the freight rolling stock.
R.32	Updating of legal regulations and planning guidelines		Covered by the general measure G.8

Code	Measure	Alignment	Description of measure
R.33	Prepare for changes in Schengen borders		Covered by the general measure G.9
R.34	Preparation/adaptation of non-Schengen borders		Covered by the general measure G.9
R.35	Liberalisation of passenger transport		Gradual opening of the transport market and the provision of equal opportunities for all potential operators is one of the main criteria of compliance that Croatia has met in the process of aligning with the acquis communautaire, in accordance with the White Paper goals. Croatian administrative bodies such as regulatory and the security agenc shall be prepared for the future.
R.36	Liberalisation of cargo transport		The liberalisation of the freight rail sector in Croatia has already begun and the following freight operators are active on the Croatian market: HŽ Cargo d.o.o., PPD Transport d.o.o., Rail Cargo Carrier Croatia d.o.o., RAIL & SEA d.o.o., RTS Rail Transport Service GmbH, Train Hungary Kft, SŽ — Tovorni promet d.o.o. and Transagent d.o.o. Administrative bodies, such as the Regulatory and Security Agency, must be further technically and organisationally reinforced.
R.37	Increasing administrative capacity/training		Covered by the general measure G.10
R.38	Business/timetable reorganisation		In order to increase the share of rail mode, reorganization of time schedules (e.g. TAKT) is necessary to improve connectivity and efficiency of the services provided. This option shall be analysed through the concept of functional regions, taking into account the patterns of the structure "destination-point of departure" as well as operational and infrastructure requirements.
R.39	Information platforms		Covered by the general measure G.11
R.40	Environmental impact reduction		Covered by the general measures G.12 and G.13
R.41	Improving the data collection system		Covered by the general measure G.14

4.2.3. ROAD TRANSPORT

Code	Measure	Alignment	Measure description
ROAD TRANSPORT			
Road network elements			
Ro.1	Gradiška bridge connection		Gradiška bridge over the river Sava is a part of the road corridor HU border - Virovitica - Okučani – BiH border (Stara Gradiška). This road is located in the corridor of the existing D5 road, being the bridge part of international agreement between Republic Croatia and Bosnia and Herzegovina. The Republic of Bosnia and Herzegovina has already finished the motorway from Banja Luka (B&H) to Gradiška, however, the planned bridge is required for the connection of the motorway from Bosnia and Herzegovina to the existing Zagreb – Lipovac Motorway (A3). Gradiška is one of two major border crossings between the Republic Croatia/EU and Bosnia and Herzegovina for all types of traffic.
Ro.2	A5 Osijek - HU border Pecs (TEN-T comprehensive network/paneuropean corridor Vc)		The A5 motorway is a part of the comprehensive TEN-T network and Pan-European corridor Vc. The total length of the A5 motorway is 88.6 km and it goes from the Bosnia and Herzegovina border towards Osijek, Beli Manastir to the Hungarian border. For the purpose of connecting the constructed sections of the A5 with the Hungarian motorway, it is necessary to build up sectiona Osijek - Beli Manastir (24.6 km) and Beli Manastir - Hungarian border (5 km). For the section Hungarian border - Beli Manastir project documentation is currently being prepared, while the works for the Beli Manastir -Osjek section have already begun. The current status of the works on the Beli Manastir - Osijek section is as follows: the bridge over the river Drava (2.5 km long) has been constructed and the documentation for the technical inspectionis is under preparation, while the works on the construction of the subsection bridge Halasica - Bridge Drava (length 0, 8 m) and Bridge Drava - Osijek (3.8 km long) are in progress. Functional Region Concept will analyse the phasing and timing of the remaining sections, as well as the required technical parameters, taking into consideration the expected demand and economical and environmental aspects, e.g. the planned section passes through some “Natura 2000” areas.
Ro.3	A5 from A3 to BIH border (TEN-T comprehensive network/paneuropean corridor Vc)		The A5 motorway is part of the comprehensive TEN-T network and corridor Vc, being Svilaj included in the list of border crossing points of the EU core network. The total length of motorway A5 is 88.6 km and it goes from the Bosnia and Herzegovina border towards Osijek, Beli Manastir to the Hungarian border. Until now, section from Osijek up to the bridge over the Sava River has been built in the length of 58.7 km. The section from the Sredanci (highway A3) to the border with Bosnia and Herzegovina is 3.5 km long and constructed, except for the bridge across the Sava River. Construction of the bridge across the Sava River (640 m long) is underway. The continuation of the section on the Bosnian-Herzegovinian side is in a high degree of construction. The completion dynamics will be aligned with the pace of bridge construction across the Sava River.
Ro.4	A7 Križišće to Žuta Lokva (comprehensive/Adriatic-ionian corridor)		The outcomes of the NTM show that there are some capacity issues in this corridor, mainly during the summer season and linked to local/regional traffic (including short distance movements from tourists in the area). Due to that, some interventions in this corridor might be necessary to improve the level of service. The Functional Regional Concept will identify the problems in more detail and further specific studies will define the required technical parameters, taking into consideration the expected demand and economical and environmental aspects, especially geographic features due to very complex coastal relief terrain.

Code	Measure	Alignment	Measure description
Ro.5	A11 Lekenik - Sisak		The A11 motorway (Zagreb – Sisak), with total length of 41.9 km is divided into three sections: Jakuševec – Velika Gorica south (10,9 km), Velika Gorica – Lekenik (20,2 km) and Lekenik – Sisak (10,8 km). Two of them, Jakuševec – Velika Gorica south and Velika Gorica – Lekenik, with total length of 31.1 km, were already built. The Functional Region Concept will analyse whether further development of the motorway to Sisak is necessary. In such case, specific studies will define the phasing and timing of the remaining sections in the light of inter-modality, as well as the required technical parameters, taking into consideration the expected demand, tolling concept and economical and environmental aspects. The Functional Regional Concept will assess on the phasing and timing of the remaining sections.
Ro.6	DC 10 Vrbovec - Križevci - Koprivnica - Hungarian border towards Kaposvar		The DC10 State road was previously categorized as a motorway, the A12. The A12 motorway is a partially built motorway in central Croatia, northeast from Zagreb, extending towards the city of Vrbovec. A 23 km dual carriageway exists between the A4 motorway and Sveta Helena. The DC10 represents the western arm of the so-called "Podravina Y", as the eastern arm is planned to be the DC12 and will finally connect Zagreb with the Hungarian border towards Kaposvar. The corridor is divided into several sections and the stage of project documentation (project design and permits) varies from section to section. Functional Region Concept will assess on the phasing and timing of the remaining sections, as well as the required technical parameters, taking into consideration the expected demand and economical and environmental aspects.
Ro.7	DC 12 Vrbovec 2 interchange - Ivanja Reka - Vrbovec - Bjelovar - Virovitica - Hungarian border towards Barcsu		DC12 represents the eastern arm of the so-called "Podravina Y", as the western arm is planned to be the D10 and will finally connect Zagreb with the Hungarian border towards Pecs. Only the Vrbovec 2 interchange, the starting (western) terminus of the D12 has been completed. The rest of the corridor is divided into several sections, and the stage of project documentation (project design and permits) varies from section to section. The Functional Regional Concept will assess on the phasing and timing of the remaining sections, as well as the required technical parameters, taking into consideration the expected demand and economical and environmental aspects.
Ro.8	Zagreb main network reorganization		Zagreb is the capital of Croatia and the interchange of main road corridors. Currently all the motorway corridors are connected through the Zagreb bypass, the road with the highest traffic load in the Republic of Croatia. The main road network inside the city should be reorganised as well taking into account the outcomes of the Functional Region Concept.
Ro.9	D2 from Slovenian border to Serbian border		D2 is the existing state road for transit traffic in the northern areas of the Republic of Croatia, and spans from the border crossing with Slovenia at Dubrava Križovljanska in the west via Varaždin, Osijek, Vukovar, ending at the Ilok–Bačka Palanka Bridge border crossing to Serbia. Most of the D2 route runs parallel to the Drava River (Podravska magistrala). Relevant intensity of very high heavy traffic is affecting the features of the existing lanes and thus the level of safety is clearly decreasing. A new corridor for the D2 is planned but Functional Region Concept will assess on the phasing and timing of its development, as well as the required technical parameters, taking into consideration the expected demand and economical and environmental aspects. The outcomes of the NTM show that there are capacity issues in several sections of this road, but adequate solutions for specific problems on the state road D2 will be tried to find through feasibility studies.

Code	Measure	Alignment	Measure description
Ro.10	Rijeka network reorganization		The Rijeka road junction is one of Croatian main traffic junctions and plays an important role in linking the Croatian motorway network: A7 motorway links A8 motorway (Istrian Y) and A6 motorway (Rijeka – Bosiljevo). In order to achieve complete connection of the Croatian motorway network in this node, there is a lack of connection between the A7 and A8 motorway (Istrian Y), as well as the section from the entrance to the Učka tunnel to the full profile of Istrian Y. Through specific studies, it is necessary to determine the possibility of linking this node to a single entity. Further, the Port of Rijeka is the main Croatian port (core port), and the development of the port must be harmonised with the road development. The planned west container terminal in Rijeka port will be connected with the planned state road D403, the feasibility of which has been proven and accepted in a specific FS. The Rijeka bypass is part of the A7 motorway, being one of the roads in Republic of Croatia with the highest traffic intensities. All these measures must be coordinated with the reorganisation of the internal road network in the City of Rijeka taking into account the necessities for public transport and soft modes, the development of the port and the development plans of other relevant stakeholders such as the railway company. For that reason, further analyses through Functional Region Concept are necessary to define the final set of interventions as well as the required technical parameters, taking into consideration the expected demand and economical and environmental aspects.
Ro.11	Dubrovnik - Montenegrin border		The Corridor Dubrovnik – MNE border is at different stages of development per sections. The development will increase connectivity of the Dubrovnik airport and the city of Dubrovnik. Functional Region Concept will assess on the phasing and timing of its development, as well as the required technical parameters, taking into consideration the expected demand and economical and environmental aspects. One of the priorities is the construction of a link between the city of Dubrovnik and the Airport of Dubrovnik, for which Hrvatske ceste is preparing the necessary documentation.
Ro.12	Increase of capacity - dedicated PT lane between Zagreb and Karlovac		Road corridor from Zagreb to Karlovac is included in the EU core network because of international and regional relevance of the traffic coming from Rijeka to inland, as well as from the European Union to the Adriatic coast. Section Zagreb – Karlovac is one of the oldest part of motorway network in the Republic of Croatia with quite low environment standards. According to feasibility study capacity limitations are caused by existing tolling system. The potential change of the tolling system, see measure Ro.17, would have a clear impact on this road section. If a significant increase in the number of vehicles on this section continues, it would be necessary to consider an option for the construction of a third lane. Specific interventions to increase the safety and environmental standards of this section are also justified. Further analysis and studies will show the character and justification of capacity expansion in line with indicators and conclusions of the Master Plan of Transport Infrastructure Development on the Zagreb-Karlovac Motorway, which serves as the basis for sustainable development of the section. At this point there is no justification for building a dedicated public transport lane, as at the same time there is a plan to invest in the reconstruction of the railway on the Hrvatski Leskovac-Karlovac section, and this is also the meaning of marking this measure as red.
Ro.13	Increase of capacity - dedicated PT lane Zagreb bypass		The Zagreb bypass is the busiest traffic route in Republic of Croatia and the level of traffic is constantly increasing. Some sections of the Zagreb bypass need upgrade with a new PT lane. Functional Region Concept will analyse the existing options to increase the capacity, assess on the phasing and timing of its development, as well as the required technical parameters, taking into consideration the expected demand and

Code	Measure	Alignment	Measure description
			economic, social and environmental aspects, as well as the developments planned in other modes of transport.
Ro.14	Slavonski Brod port access improvement		Slavonski Brod, as the main port on the river Sava, is the only inland port in Republic of Croatia in the Sava river included in the list of nodes of the EU core network. The development of the port and the additional business zone must be coordinated with the improvement of other transport infrastructure, especially road. The NTM shows that there is no accessibility issue, also the design and construction of an eastern link road with a link to the port is underway.
Ro.15	Split network reorganization		Split is one of the main centres of tourism in Croatia. Of special relevance for the road network is the tourism linked to the cruises as it creates a heavy seasonal burden on the road network. It is necessary to reorganise the road network in Split taking into account as well the public transport system and planned developments in the city, the port and other relevant transport systems such as rail. One of the potential measures is the Split bypass: Project new multimodal platform of Split agglomeration Solin - Stobrec - Dugi rat -Omiš which has been planned for regional and local traffic, being several sections at different stages of development. Functional Region Concept will define the final set of interventions as well as the required technical parameters, taking into consideration the expected demand and economical and environmental aspects.
Ro.16	Preparation for accessibility of Dubrovnik when Croatia joins Schengen (Pelješac bridge) the continuation of the Adriatic-Ionian Corridor		Long distance accessibility will be certainly solved through the airport connection in the mid-term scenario. For the further continuation of the road infrastructure development, it is necessary to build the "Peljesac" bridge, in combination with the road network on Peljesac and the Ston bypass. The continuation of the construction of the Adriatic - Ionian Corridor from Ploče to the state border with the Montenegro and its route will be established after the studies have been conducted and taking into account the European transport corridors
Ro.17	Reconsideration of tolling system in Croatia		Tolling system in the Republic of Croatia is mostly under jurisdiction of four different concessionaires with different ways of charging the toll. Unique way of charging is needed. Further study will analyse the full range of existing options, as well the possibility of introduction of EETS or EU vignette.
Road network			
Ro.18	Develop maintenance concept (including maintenance stations) of the road network		Covered by the general measure G.5
Ro.19	Public roads and connecting		To ensure the cohesion of the territory and provide the proper accessibility to the high-level network, the status of the existing secondary and tertiary roads will be analysed to identify the needs for their rehabilitation. One example of connecting with the road of high importance is the fast road from Čakovec via Varaždin, Ivanec, Lepoglava, Krapina to Zagreb.The main problem affecting these categories of roads is lack of maintenance and funding. It is necessary to provide the conditions for proper maintenance, especially taking into account the existing and forecasted levels of traffic on these roads. The Functional Regional Concepts will identify the development needs for these roads and specific studies will define the required technical parameters, taking into consideration the expected demand, tolling concept and economical and environmental aspects.

Code	Measure	Alignment	Measure description
Ro.20	Develop a resting station concept for the high level road network		According to EU Directive 2008/96/EC, sufficient roadside parking areas are very important with regards to road safety. Parking areas enable drivers to take breaks and continue their journey with full concentration. The provision of sufficient safe parking areas should therefore form an integral part of road infrastructure safety management. While some service facilities along the motorways and fast roads have been built, the number is still not sufficient, given the increase in traffic, especially during the tourist season. Additionally, Directive 2010/40/EU states that it is necessary to improve infrastructure for secure parking for trucks and buses. At the same time, renewal of the old parking lots with other facilities (gas stations, restaurants, toilets, playgrounds, electric charges), is planned.
Ro.21	Traffic management, monitoring, traffic counting and information system		New technologies must be introduced to improve methods and ways of gathering information to ensure that the traffic management information collected has the content and quality required at international level. New technologies allow among others for real time data gathering and control of traffic conditions. In order to take advantage of these new technologies, the need for new centres for centralized management of the traffic, equipped with the latest advances in ITS solutions, will be analysed. Traffic management and control at this time is the biggest problem in larger cities, but the concept of functional regions will further determine the possibilities for introducing this measure. Traffic management and monitoring is of special relevance to manage incidental situations and traffic jams in the peak traffic seasons. This will allow for a qualitative improvement in the planning and monitoring of alternative routes, passenger user information, traffic control and real time data gathering regarding congestion.
Ro.22	Interchange development plan		In order to improve the connectivity of the high level road network, it is necessary to develop an interchanges development plan. The plan will take into account the functionality of each road to identify the number and location of interchanges to avoid for example excessive amounts of local traffic in long distance corridors which might endanger the level of service. Specific seasonal requirements due to the touristic season will be considered as well. New tolling system should be proposed and evaluated.
Ro.23	Road safety		Covered by the general measure G.3
Ro.24	Network development to intermodal hubs, agglomerations in line with demand		Covered by the general measure G.4
Ro.25	Improve interoperability (intermodal hubs, P&R, etc.)		Covered by the general measures G.4 and G15
Ro.26	Reduce environmental impact		Covered by the general measures G.12 and G.13
Ro.27	Energy efficiency		Covered by the general measure G.6
Road operation/organization			

Code	Measure	Alignment	Measure description
Ro.28	Update legislation and planning guidelines		Covered by the general measure G.8
Ro.29	Increase administrative capacity/training		Covered by the general measure G.10
Ro.30	Preparation/adaptation for Schengen borders		Covered by the general measure G.9
Ro.31	Preparation/adaptation of non-Schengen borders		Covered by the general measure G.9
Ro.32	Improve financial sustainability of the road network and tolling system		Covered by the general measure G.7
Ro.33	Information platforms		Covered by the general measure G.11
Ro.34	Recategorization of the road network		It is necessary to develop a study to analyse the need to recategorize the road network to adapt to the real demand and functionality of each road to increase the efficiency and sustainability of the system.
Ro.35	Implementation of security measures		In the White Paper on European transport policy for 2010: time to decide the Commission has set as its overall objective in terms of road safety that the number of fatalities needs to be moved to zero by 2050. It appears from research that enforcement is an important and effective way of preventing and reducing accidents, deaths and injuries, but enforcement actions are only optimally effective if they are combined with actions to make the public aware of such enforcement actions and of the reasons why they are being held. Further studies will assess on specific actions both in public awareness, enforcement and cross border information management.
Ro.36	Improvement of data collection		Covered by the general measure G.14

4.2.4. AIR TRANSPORT

Code	Measure	Alignment	Measure description
AIR TRANSPORT			
Airports			
A.1	Dubrovnik airport development (comprehensive TEN-T network)		Dubrovnik is one of the main destinations on the Dalmatian coast. The airport suffers from bottlenecks due to seasonal peaks. Given the characteristics and meteorological environment of the surrounding territory, an enclave, transport links must be maintained and enhanced to ensure the proper accessibility. The planned measures include expansion of existing transport/infrastructure capacity in order to maintain existing service quality levels, reduction/elimination of bottlenecks, reconstruction of existing and construction of new pavement structures and facilities necessary for the safe and smooth operation of the airport, implementation of environmental protection measures, implementation of measures aimed at improving energy efficiency and acquisition of necessary equipment and devices.
A.2	Pula airport development (comprehensive TEN-T network)		Pula airport is relevant for the long distance accessibility of the region. Traffic at the airport is seasonal which may lead to bottlenecks given the limited facilities. Two important operational aspects which must be considered include: 1) Quality of service, mainly because of competition with neighbouring foreign airports; 2)The balance of safety vs. operational capacity. These aspects, among others, highlight the need to increase the capacity of the airport by upgrading certain elements: approach lighting system, runway, aprons, terminal and accesses. The Airport Master Plan will identify the feasibility of these measures and prioritise them, taking into account environmental requirements and the real needs and potential according to the expected demand.
A.3	Brač airport development		The development of Brač Airport is planned to eventually increase the long distance connectivity of the Island of Brač and therefore the Centre of Dalmatia; while complying with a variety of different safety and traffic demand requirements. The analyses show the need to achieve the ICAO 3C Code and to comply with ICAO, EASA and national standards. The Airport Master Plan will identify the feasible measures and prioritise them, taking into account environmental requirements and the real needs and potential according to the expected demand.
A.4	Mali Lošinj airport development		The development of Mali Lošinj Airport is planned to eventually increase the long distance connectivity of the Island of Lošinj and therefore the North of Dalmatia; while complying with traffic demand requirements. The analyses show the potential necessity to extend the runway, apron and terminal area. The Airport Master Plan will identify the feasibility of these measures and prioritise them, taking into account environmental requirements and the real needs and potential according to the expected demand.
A.5	Osijek airport development (comprehensive TEN-T network)		Regional and long distance connectivity, apart from national cohesion, is the main reason for the expansion of Osijek airport considering cargo as well due to synergies with other modes of transport. The Airport Master Plan will identify the feasible measures and prioritise them, taking into account environmental requirements and the real needs and potential according to the expected demand.
A.6	Rijeka airport development (comprehensive TEN-T network)		Airport Rijeka presents large passenger traffic growth and has additional cargo potential due to the synergy with the Port of Rijeka. As part of the airports plans for development and alignment with ICAO, EASA and national standards, the reconstruction / expansion /

Code	Measure	Alignment	Measure description
			displacement of apron and operations and control tower equipment planning is in progress. In order to achieve energy efficiency and environment protection it is planned to realize projects related to the solar power plant, terminal building facade and waste liquids separator. The Airport Master Plan will identify the feasibility of these measures and prioritise them, taking into account environmental requirements and the real needs and potential according to the expected demand.
A.7	Split airport development (comprehensive TEN-T network)		With a level of traffic similar to Dubrovnik airport, Split is the other main gate to the Dalmatian coast in term of passengers. The airport also suffers from bottlenecks due to seasonal peaks. The expansion of both landside and airside facilities are under construction, tackling the issues of seasonality and quality of the service.
A.8	Zadar airport development (comprehensive TEN-T network)		Long distance connectivity of Central Dalmatia is the main driver for the expansion of the airport. The analyses show that the investment should be focused on the improvement of the airports transport and infrastructure capacities for the operation of ICAO 4E Code airplanes. The Airport Master Plan will identify the feasible measures and prioritise them, taking into account environmental requirements and the real needs and potential according to the expected demand.
A.9	Zagreb international airport "Franjo Tuđman" development (TEN-T basic network)		Airport Franjo Tuđman is the main gateway to Republic of Croatia operating as a hub for domestic and international destinations. At present, it is operated by a concessionaire who established a new company Zagreb International Airport Jsc., whose investment plan is reviewed periodically with the MSTI. Company Zagreb Airport d.o.o. Is still active and now provides expert and technical assistance to the concessionaire in the implementation of the Concession Contract for Construction and Management of Zagreb Airport between the Republic of Croatia and International Airport Zagreb dd, with the aim of further development of infrastructure and all segments that are not subject to the concession agreement . If the concessionaire withdraws from the project and the management of the airport, the Airport Zagreb d.o.o. Will immediately take over the airport from the concessionaire to ensure continuous and uninterrupted operation of the Zagreb Airport. The development plans for the airport included the construction of a new terminal to increase capacity.
A.10	Accessibility of airports		Covered by the general measure G.2
A.11	Airport safety		One of the main objectives of the TDS is the development of highest level standards of air transport safety on international, regional and national level, in order to effectively reduce dangers of air transport reduce the possibility of accident occurrences and limit the negative consequences of such accidents. Airport infrastructure and planes must comply with all the international safety requirements.
A.12	Energy efficiency		Covered by the general measure G.6
A.13	Closure or change of role/ownership of regional airports		In order to enhance the efficiency and sustainability of the system, new managing strategies must be developed for airports; while considering the possible change of role/ownership or of non-sustainable airports.
Air traffic operation/organization			

Code	Measure	Alignment	Measure description
A.14	Adaptation of legal national framework and as the implementation rules		Covered by the general measure G.8
A.15	Improvement of the cooperation with the relevant regional authorities		Even though the main role of air transport is linked to long distance passengers, proper cooperation with the relevant regional and local authorities is necessary to improve the accessibility of the airports and ensure that the airport development plans are in line with the development plans of the relevant cities and regions.
A.16	Restructuring of Croatia Airlines		In order to improve the sustainability of the system restructuring of Croatia Airlines was implemented. An additional analysis should facilitate the process of preparation for the privatisation of the company and search for strategic partners which would bring in additional capital and create clear plans for future development and growth of Croatia Airlines.
A.17	Information platform		Covered by the general measure G.11
A.18	System reorganization and planning		Covered by the general measures G.7 and G.8
A.19	Cooperation with aeronautical industry		The development of the aviation sector has to be achieved as well by means of joint innovation projects in air navigation and fleet modernisation, research and development and environmental protection, with the joint participation of private investors and the government in the form of special funds for this purpose. More attention has to be devoted to the implementation of innovations in transport technology and compliance with the new technical standards.
A.20	Air traffic management, Single European Sky, SESAR		Elaboration of a national agenda for the development of coordination regarding the implementation of SESAR program and the Centralised Services Concept. Definition of a national priorities policy within FAB CE integrations as well as improve coordination and cooperation with neighbouring countries and within the wider region. Notwithstanding Croatia Control Ltd.'s competitiveness in respect of the region and similar size providers, there is a need for capacity building, implementation of safety standards, cooperation in terms of joint air navigation and development of educational centre for flight controllers.
A.21	Improving consumer satisfaction awareness		To increase the customer satisfaction awareness, it is necessary to monitor the quality of service through KPIs. This should help to identify the differences (if any) between high and low season, the requirements of the passengers, their perception of the facilities, etc. The results should be disseminated in a clear and concise manner to include the opinions of the public and stakeholders.
A.22	Increase financial sustainability of airports		Covered by the general measure G.7
A.23	Limit environmental impact		Covered by the general measures G.12 and G.13

Code	Measure	Alignment	Measure description
A.24	Review/update Airport Masterplans		The planning of infrastructure and its response to traffic demand is essential for the development of a sustainable airport system in the Republic of Croatia. The first step will be to coordinate actions and activities being carried out in each airport in an Airport Master Plan. Once the Master Plan is completed, the next step will be to coordinate and prioritise the plan of actions.
A.25	Cooperation/agreements with other international airports		Although Croatian airports are competitive with those of neighbouring countries, there is a need for cooperation in terms of border control, security and safety standards that will benefit all parties. It may even be possible to reach agreements on specialisation, i.e. cargo airports, operative bases for airlines, etc.
A.26	Increase administrative capacity/training		Covered by the general measure G.10
A.27	Improvement of data collection		Covered by the general measure G.14

4.2.5. MARITIME TRANSPORT

Code	Measure	Alignment	Measure description
MARITIME TRANSPORT			
Ports and navigability			
M.1	Increase intermodality and accessibility		The modal share of maritime transport is still very low, against road transport. It can be increased by increasing the intermodality and accessibility of ports. The development of national ports must be linked to the development of intermodal infrastructure (road and railway connections and logistics areas). The planned expansions and developments of the ports must take in consideration, all the possibilities offered by the location for further development.
M.2	Implementation of the "Motorways of the sea" projects		Although there are RO-RO lines connecting Croatian and Italian ports, the "Motorways of the Sea" projects have yet to be implemented in a structured way in Republic of Croatia. The stages for implementation of the "motorways of the sea" projects in Republic of Croatia are: - together with EC, establish the main corridors (combined "land-maritime" routes), - if necessary, upgrade the Croatian ports on the corridors to receive ro-ro traffic, - if necessary, upgrade road and railway connections to/from port. The Motorway of the sea concept needs to be harmonized with the logistic concept (measure G1) and consider the effect they may have on air pollution.
M.3	Environmental protection		Covered by the general measures G.12 and G.13
M.4	Bunkering facilities for gas powered and eco ships		The Croatian shipping fleet will be modernised in order to develop energy-efficient ecoshipping, by stimulating the procurement/construction of new ecoships and by adapting existing ships according to the highest environmental standards and the MARPOL 73/78 Annex VI - Regulations for the prevention of air pollution from ships. Parallel with developing ecoshipping it is necessary to develop bunkering facilities for gas powered and ecoships.
M.5	Sigurnost na moru		Covered by the general measure G.3
M.6	Improve the accessibility of islands, port development		Public transport in the coastal line passenger transport is considered to be one of the key factors in the maritime transport segment, given that it ensures permanent and regular connection of the islands and the mainland and between the islands, and without it the sustainable development of inhabited islands would be jeopardised. For the proper provision of maritime public transport it is necessary to ensure safety, regularity, reliability and comfort and to coordinate the services among them and with the integrated transport systems in the mainland. The ports must be adapted and if necessary upgraded for coastal line passenger transport and the accessibility and connectivity to the ports improved.
M.7	Other ports development (e.g. Korčula, Pula…)		Croatia has 409 ports open for public traffic, 95 of which have at least one shipping line. Apart from the 6 main ports of special (international) economic interest, there are numerous county and local ports. Their development is important for the sustainability of

Code	Measure	Alignment	Measure description
			the islands themselves, as well as for tourism. Where relevant, the existing public ports in the counties must be adapted to receive coastal line passenger ships, and in the case of ports of interest to tourists, to receive smaller cruise ships. The need to upgrade and reconstruct the existing county and local public ports for the needs of the local population, and for tourists should take into account National plan for development of ports.
M.8	Specialise Rijeka port (container, liquid cargo transport)		Rijeka has been classified as the TEN-T core port of Republic of Croatia. It is a port open to public traffic of special (international) economic interest for the Republic of Croatia. It is the largest port in Croatia and benefits from the deepest natural channel in the Adriatic. The major part of the traffic is transit cargo to/from its wider hinterland in Central Europe, and is dominated in terms of volume by liquid and bulk cargo followed by container and general cargoes. Further development of the port will be focused on the specialisation to container and liquid cargo transport For the success of the port it is necessary to ensure the interoperability and accessibility of the port and ensure that the port development is complemented by the necessary developments of the road and railway infrastructure, as well as logistic areas. At this point, a number of projects on the island of Krk, such as the LNG terminal and the container terminal, are planned, and according to further projects, adequate infrastructure needs to be planned in terms of accessibility (road, rail) to the island of Krk.Further analyses will identify the necessary project to achieve this specialisation and prioritise them, taking into account environmental requirements and the real needs and potential according to the expected demand. Emphasis will be put on improving warehouse facilities and better alignment with the hinterland. If there is a significant increase in transport demand, it is necessary to analyze the possibility of using the locations on the island of Krk.
M.9	Specialise Ploče port (container and bulk cargo)		The Ploče port has been classified as a TEN-T comprehensive port of Republic of Croatia and is of specific importance for BiH. Further development of the port will be focussed on the specialisation to container and bulk cargo transport. According to the development plans, the focus will be on the construction of a new dry bulk cargo terminal, a container terminal, modernisation of existing port infrastructure and a new logistic area. In particular liquid cargoes with regard to the market interest shown and the technical documentation with the certificates of main turnover. In the framework of this Strategy, the Port of Ploce should be developed in line with the development of the previous years. This means that large investments in the infrastructure of the new harbor located on the southern part of the port systematically from the city will leave the activities that cause the biggest disruption (especially coal traffic). Once investment that are currently underway are finished, it is anticipated that no new infrastructure will be needed to meet demand in the future. The port has 50 hectares of land available for future development. Although outside the scope of this strategy, it is necessary to mention that the success of the port is clearly linked to the development of the road and railway infrastructure across the Republic of Bosnia and Herzegovina. Further analyses will identify the feasibility of these measures and prioritise them, taking into account environmental requirements and the real needs and potential according to the expected demand.

Code	Measure	Alignment	Measure description
M.10	Specialise Dubrovnik port (cruising vessels)		The Dubrovnik port has been classified as a TEN-T comprehensive port of Republic of Croatia. It is a port open to public traffic of special (international) economic interest for the Republic of Croatia. The port of Dubrovnik has become in recent years one of the most popular destinations for cruise voyages in Europe, so its development is directed to cruising passenger transport. Planned developments include the modernisation and reconstruction of the passenger terminal and the expansion of ferry traffic facilities. The development of the port of Dubrovnik as a harbor for cruise ships needs to be aligned with the receiving capacity of the protected heritage of Dubrovnik as well as the City as a whole. The development of the port of Dubrovnik can have a negative impact on the wider visual environment of the world heritage monuments, especially on the physical, spatial and visual integrity of the summer houses (Bunić Kaboga and Stay) and the urban area of the suburbs of Dubrovnik. Further analyses will identify the feasibility of these measures and prioritise them, taking into account environmental and cultural heritage requirements and the real needs and potential according to the expected demand.
M.11	Specialise Split port (Ro-Ro, passenger and cruising)		The Split port has been classified as a TEN-T comprehensive port of Republic of Croatia. It is a port open to public traffic of special (international) economic interest for the Republic of Croatia. The port of Split, also called gateway to the islands, is the largest passenger port in Croatia, therefore, its development is mainly directed to passenger and cruising transport. Planned developments will be focussed on the construction of new berths for ferry, Ro-Ro (to be seen/assessed in line with the "motorways of the sea" concept as described in measure M.2) and cruise vessels including the extension of the passenger wharves (city pool). Further analyses will identify the feasibility of these measures and prioritise them, taking into account environmental requirements and the real needs and potential according to the expected demand. Port Split has the potential to develop freight transport on a market basis, in particular with the appropriate specialization and the corresponding development of the railway freight infrastructure.
M.12	Specialise Zadar port (Ro-Ro, passenger and cruising)		The Zadar port has been classified as a TEN-T comprehensive port of Croatia. It is a port open to public traffic of special (international) economic interest for the Republic of Croatia. The port of Zadar is the second largest Croatian port for passengers. Freight traffic has a great potential for development, especially since there is a railway infrastructure in the vicinity and it is also necessary to plan a possible link to the new port in Gaženica. The port development is directed to Ro-Ro (to be seen/assessed in line with the "motorways of the sea" concept as described in measure M.2), passenger and cruising transport. The construction of a new passenger port outside old town, in Gaženica infrastructurly has been completed, and the construction of a terminal building for the reception of domestic and international passengers is in progress.. The new port will provide an extended berthing capacity for larger international ferries and modern cruise ships ("home port") and international standard on-shore facilities for passengers and vehicles. Further analyses will identify the necessary projects to achieve this specialisation and prioritise them, taking into account environmental requirements and the real needs and potential according to the expected demand.
M.13	Specialise Šibenik port (small capacity cruising and super-yachts)		The Šibenik port has been classified as a TEN-T comprehensive port of Croatia. It is a port open to public traffic of special (international) economic interest for the Republic of Croatia. Further development of the port will be focussed on the specialisation to passenger traffic, as a port for exclusive cruising vessels of smaller capacities (boutique

Code	Measure	Alignment	Measure description
			vessels) and super-yachts. Modernization of equipment and storage facilities at the terminals for bulk and general cargo and wood is also planned. Further analyses will identify the necessary projects to achieve this specialisation and prioritise them, taking into account environmental requirements and the real needs and potential according to the expected demand.
M.14	Development of special purpose ports (shipbuilding ports, nautical ports, military ports, industrial ports, fishing ports, sport ports)		Depending on the activities carried out, special purpose ports are classified as shipbuilding ports, nautical ports, military ports, industrial ports, fishing ports, and sport ports. The Croatian coast has developed as a tourist destination and special purpose ports have also been developed in that direction: new nautical ports, dry docks and warehouses for floating objects, etc. Industrial ports are mostly shores connected to an industrial port facility in the port, such as thermal power stations and oil refineries. Fishing ports on islands are needed for sustainable island development. Industrial ports are mainly docks for industrial plants, such as thermal power stations and oil refineries. Further analyses will identify the feasible measures regarding the development of special purpose ports and prioritise them, taking into account environmental requirements and the real needs and potential according to the expected demand.
M.15	Energy efficiency		Covered by the general measure G.6
M.16	Establish economic development of unused and abandoned former industrial, military or similar facilities		Some military, industrial and shipbuilding ports are unused. It is necessary to decide how to make use of these unused or abandoned ports for the purpose of economic development (tourism, fishing and small industries). Further analyses will identify the feasible measures in this regard and prioritise them, taking into account environmental requirements and the real needs and potential according to the expected demand.
Maritime operation/organization			
M.17	Cooperation with shipping industry		The support for shipping has to be achieved by means of joint innovation projects in shipping and shipbuilding, research and development and environmental protection, with the joint participation of private investors and the government in the form of special funds for this purpose. More attention has to be devoted to the fleet modernization, implementation of innovations in transport technology in compliance with the new technical standards and on improving, in cooperation with the administration, of the automated data exchange with a shipping company IT platforms.
M.18	Strategical Maritime definition		Croatian maritime strategy and the strategy for intermodal transport must be developed in order to increase intermodality and accessibility to maritime transport.The development plans of ports of international economic interest (Rijeka, Šibenik, Zadar, Split, Ploče, Dubrovnik), must be harmonised with the national development plans and the transport infrastructure development plans. It is necessary to make a risk assessment on the safety of navigation and pollution of the marine environment caused by maritime transport with a proposal of risk management. Also, it is necessary to classify the navigable areas and define projects and measures with optimal dimensions for the safety of navigation and protection of the sea from pollution from maritime facilities.
M.19	Adaptation of national legal framework as well as implementation rules		Covered by the general measure G.8

Code	Measure	Alignment	Measure description
M.20	Improvement of operational plan (ship routing, etc.)		A key segment of Croatian shipping is coastal line passenger transport, and it is necessary to improve and to develop an adequate operational plan for optimising ship routing and service schedules coordinated with the public transport systems in the relevant mainland cities. Ship routing should consider if necessary opening and closure of lines between islands. Irrespective of public transportit is necessary to improve the operational plan for coastal liner traffic taking into account the need for passenger ships on cruises in ports with important lines of navigation due to the congestion of the port and the city.
M.21	Traffic management and IT system, VTMIS, enavigation		It is necessary to improve traffic management with ITS system (Intelligent Transport Systems) for public maritime transport. Improvement in maritime safety and security and environmental protection, can be reached by enhanced cooperation with neighbouring countries, modernization of the Croatian Coast Radio Stations and upgrading of Vessel Traffic Monitoring and Information System (VTMS), in order to establish a comprehensive maritime surveillance and management service in the inland waters, the territorial sea and the protected ecological and fishing zone of the Republic of Croatia in the technical and operational segments. Furthermore, it is necessary to establish a system of early detection and removal of maritime safety risks through the establishment, development and implementation of the e-Navigation concept for the collection, exchange and analysis of safety data, in particular for cruise ships.
M.22	Improvement of the maritime education and training (MET) systems		Covered by the general measure G.10
M.23	Training and capacity building		Covered by the general measure G.10
M.24	Reorganization of the maritime transport system		Covered by the general measure G.7
M.25	Information platform, database		Covered by the general measure G.11
M.26	PSC concession reorganization		Covered by the general measure G.8
M.27	Maritime safety, inspections, SAR cooperation		Covered by the general measure G.3
M.28	Modernisation of the vessels (safety, energy efficiency and environment)		The maritime industry has to develop in a safe and sustainable manner. The objective is to continuously increase the efficiency of safety oversight and security safeguards of Croatian vessels and floating structures and to increase the share of energy efficient vessels. It is necessary to develop a system of targeted inspection and technical control to implement the highest international, European and national safety standards to Croatian vessels and floating structures according to established priorities. An efficient monitoring system of recreational craft and marine must be established as well.

Code	Measure	Alignment	Measure description
M.29	Cooperation/agreements with other international ports		In order to increase the traffic in Croatian ports, to be more competitive on international market and to be up to date with new port technologies, it is necessary to increase the cooperation with other international ports in Adriatic sea.
M.30	Increase the financial sustainability		Covered by the general measure G.7
M.31	Development of concept of maintenance		Covered by the general measure G.5
M.32	Improvement of data collection		Covered by the general measure G.14

4.2.6. INLAND NAVIGATION

Code	Measure	Alignment	Measure description
INLAND NAVIGATION			
Ports and navigability			
I.1	Upgrading Danube and Drava until Osijek		The Danube and Drava are part of the Rhine-Danube Corridor (TEN-T network). The total length of the Danube running through the Republic of Croatia is 137.65 km. A tributary of the Danube, the Drava is also considered an international waterway up to Osijek. As such, it is necessary to ensure the navigability in these international rivers in line with the required navigability level according to the European Agreement on Main Inland Waterways of International Importance (AGN), VIc class for the Danube and IV for the Drava up to the port of Osijek. To achieve that navigability requirements the dimensions of the waterway will be increased and the bottlenecks eliminated (trough among others dredging and/or construction of new waterways structures). On international waterways in the Republic of Croatia there are no winterlings. Possibilities for wintering, maintenance and overhaul of cruise ships are opened in Opatovac.
I.2	Upgrading Sava		Sava river does not meet the international waterways navigability requirements on its entire length in the territory of the Republic of Croatia according to AGN. Level of navigability is sufficient for the current operational requirements. Depending on the development plans and the Transport Strategy in the Republic of Croatia, and the development of the ports of Sisak and Slavonski Brod, it is necessary to regulate Sava on the IV navigability class as a minimum class of international waterways.
I.3	Vukovar port development (TEN-T basic network)		The Vukovar Port is located on the Danube river and has been classified as a TEN-T core port. Vukovar is an inland port that can service class 5 vessels. Danube is classified as a waterway class VIc. The traffic of goods and passengers in the port is increasing. Further analyses will identify the necessary measures and prioritise them, taking into account the real needs and potential according to the expected demand. While waterway transport has the potential to bring about the modal shift and can contribute to reducing emissions, noise etc., the environmental requirements related to Water Framework Directive, protection of sensitive protected areas and Natura 2000 sites will be applied during the development of the measure.
I.4	Osijek port development ((comprehensive TEN-T network)		The Osijek Port is located on the Drava river and has been classified as a TEN-T comprehensive port. The traffic of goods and passengers in the port is increasing. The Osijek port has a great opportunity to become an intermodal logistic centre due to the large port area and excellent potential from the point of view of the road and rail connections with the hinterland. Further analyses will identify the necessary and feasible measures and prioritise them, taking into account the real needs and potential according to the expected demand. While waterway transport has the potential to bring about the modal shift and can contribute to reducing emissions, noise etc., the environmental requirements related to Water Framework Directive, protection of sensitive protected areas and Natura 2000 sites will be applied during the development of the measure.
I.5	Slavonski Brod port development (TEN-T basic network)		The Slavonski Brod Port is located on the Sava river and has been classified as a TEN-T core port. The potential of Slavonski Brod, which is of particular importance for Bosnia and Herzegovina and region Slavonija, is largely dependent on the development of navigability of the Sava river and the developments in Bosnia and Herzegovina and Serbia. Reliability and safety of navigation on the

Code	Measure	Alignment	Measure description
			river Sava together with possible negative environmental impacts are crucial factors which influence the attractiveness of the port. The main goods transported are trans-shipment of crude oil together with general cargo. Further development of the port depends on the logistics concept and the specialisation of the economy in the new economic zone in the port area.Further development of the port depends on the logistical concept.
I.6	Sisak port development (comprehensive TEN-T network)		The Sisak Port is located on the Sava river and has been classified as a TEN-T comprehensive port. Reliability and safety of navigation on the river Sava are crucial factors which influence the attractiveness of the port. It is based on three locations: in the town Sisak on the river Kupa, on a location next the settlement Crnac on the river Sava, and in Galdovo on the river Sava. The potential of Sisak is largely dependent on the development of navigability of the Sava river in BiH and Serbia and/or on the construction of the Danube - Sava canal through Slavonia together with possible negative environmental impacts. A new port of Sisak is planned south of the Crnac settlement. Cargo transport in the port is mainly related to the Sisak oil refinery, i.e. transportation of crude oil. Further development of the port depends on the logistical concept.
I.7	Building the multipurpose Danube - Sava canal		Multipurpose canal Danube – Sava is planned to have four equally important functions: navigation, tourism, irrigation, drainage. Due to its multiple functions, the canal will have an important impact on the Croatian economy. From a traffic perspective, the canal is part of the 560 km long intermodal transport corridor of the Danube River, which includes the Sava River's waterway and the rail link to port Rijeka. The accessibility of the canal construction will be evaluated through the results of the Feasibility Study.
I.8	Safety, RIS, signalization system, etc.		Covered by the general measure G.3
I.9	Interoperability, accessibility with other modes		Covered by the general measures G.4 and G.15
I.10	Energy efficiency		Covered by the general measure G.6
I.11	Dangerous goods terminal and waste management facilities		In accordance to the European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways (ADN), the duty of port authorities is to ensure separate warehousing, processing and disposal of hazardless and dangerous waste in ports, as well as reception of waste from ships. Croatian inland ports are undeveloped, and in order to increase the safety and environmental protection it is necessary to build and upgrade terminals for dangerous goods and upgrade ports with waste management facilities, primarily international ports, but also other ports where necessary.
I.12	Environmental protection		Covered by the general measures G.12 and G.13

Code	Measure	Alignment	Measure description
Inland navigability operation/organization			
I.13	Adaptation of legal national framework as well as the implementation rules		Covered by the general measure G.8
I.14	Increase administrative capacity/training		Covered by the general measure G.10
I.15	Increase the financial sustainability		Covered by the general measure G.7
I.16	Cooperation with Croatian shipping industry		The support for shipping has to be achieved by means of joint innovation projects in shipping and shipbuilding, research and development and environmental protection, with the joint participation of private investors and the government in the form of special funds for this purpose. More attention has to be devoted to the fleet modernization, implementation of innovations in transport technology and compliance with the new technical standards.
I.17	Information platform		Covered by the general measure G.11
I.18	Support to water transport companies		It is important to establish support instruments which will relieve the integration of shipping companies into the European transport market. The stimulation of inland shipping implies different measures of fiscal policy towards the sector, especially in the area of forming fuel prices.
I.19	Reorganization of the sector		Covered by the general measure G.7
I.20	Increase the fleet of safety and environmental protection vessels		For a more effective safety control and inspection, and installation and maintenance of signalization system on waterways, it is necessary to increase the fleet of safety and environmental protection vessels.
I.21	Cooperation/agreements with other international ports		The Sava, Drava, Danube, and Una rivers, at some sections are bordering rivers; therefore the close cooperation with the neighbouring countries is necessary, especially in the field of safety and implementation of River Information Services. Close cooperation of Croatian inland ports with other international ports is also needed in order to be more competitive on international market and to be up to date with new port technologies.
I.22	Improvement of data collection		Covered by the general measure G.14

5. MEASURES IN RELATION TO OBJECTIVES

To facilitate understanding the link between the objectives and the measures, the following matrices by transport sectors has been created. The cells highlighted in **green** indicate that there is a clear and confirmed link between the objective and the measure; the **yellow** ones mean that there might be a link but further analysis is needed to confirm their linkage and finally the **blank** cells show that there is no link.

5.1. PUBLIC TRANSPORT AND ZERO-EMISSION MODE

Table 6: List of objectives in public transport and zero-emission mode

General objectives		**1**	Developing the passenger Modal Split in favour of Public transport (PT) and zero-emission modes. This includes agglomeration PT and local regional context (trams, local buses, etc.), rail transport, maritime and inland water PT (boats), regional and long distance buses as well as pedestrians and bikers.
		2	Developing the freight Modal Split in favour of rail transport, maritime freight transport and inland water transport
		3	Developing the transport system (operation, organization and infrastructure development and maintenance) according to the principle of economic sustainability.
		4	Reducing the Climate change impact of the transport system
		5	Reducing the impact on the Environment of the transport system (Environmental sustainability)
		6	Improve the traffic safety in the Transport system
		7	Improve the interoperability of the transport system (PT, rail, road, maritime, inland water and air)
		8	Improve the integration of transport modes in Croatia (operation, ITS, VTMIS, P&R, etc.)
		9	To further develop the Croatian TEN-T (core and comprehensive) network
Specific objectives	**Cross sectorial**	**1**	To better harmonize the transport operations with neighbouring countries (BiH – Ploče Port, road and rail connections BiH, Slovenia, Serbia, Italy, Montenegro and Hungary
		2	To complement the touristic sector development as the main economic factor in some parts of Croatia where relevant by adequate transport development especially in favour of PT and green mobility
		3	To improve accessibility to remote areas of Croatia (for example island, Southern Dalmatia…)
		4	To develop on the potentials of the main logistic centres (Rijeka maritime port, Ploče maritime port, Split maritime port, Vukovar inland port, Osijek inland port, Slavonski Brod inland port, Zagreb hub)
		5	Strengthening of Croatia as a logistic hub for the wider region with particular focus on Zagreb
		6	To improve the integration of the transport sector into the social and economic developments of the regions (Functional Regional Concepts)
		7	To address the specific situation in Croatia related to the seasonality of traffic
	Public transport	**1**	To develop on the potential for road PT (regional and national) where other PT modes are not economic
		2	To improve the competitiveness of the tram systems in Zagreb and Osijek
		3	To better integrate the international/national transport system with the local and regional transport systems (passenger hubs, integrated ticketing, etc.)
		4	To increase the efficiency and to reduce the economic impact of PT operations/organization
		5	To increase the attractiveness of PT by improving operational concepts and modernizing the rolling stock

Table 7: Measures in relation to objectives in public transport and zero-emission mode

Code	**Measure**	**General objectives**									**Specific objectives**											
											Cross sectorial							**Public**				
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**1**	**2**	**3**	**4**	**5**

Code	Measure	General objectives									Specific objectives											
											Cross sectorial							Public				
		1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	1	2	3	4	5
URBAN, SUBURBAN AND REGIONAL TRANSPORT																						
Infrastructure																						
U.2	Infrastructure development						■		■	■				■	■	■		■	■	■		
U.3	Stations and stops development						■							■	■	■		■	■	■		
U.4	Separation of modes - prioritization to PT, removal of bottlenecks	■		■			■					■		■					■			
U.6	Filling stations for alternative fuel	■			■	■						■										
Operation and organization																						
U.13	Fare collection and joint ticketing systems	■		■				■						■	■				■	■	■	■
U.14	Introduction of on-demand PT services	■		■								■	■		■	■	■	■		■	■	
U.15	Adjustment of timetable (coordinated)	■		■				■					■	■	■		■		■	■		■
U.17	Purchase of new rolling stock	■			■	■	■								■				■			■
U.18	Traffic reorganization	■		■				■	■				■		■		■			■		
U.20	Support of non-profit groups in the transport area																				■	
U.21	Traffic and logistics management and information	■		■				■	■				■		■		■			■	■	
U.22	Review/update local/regional Transport Masterplans								■	■			■		■	■		■		■		

5.2. RAILWAY TRANSPORT

Table 8: List of objectives in railway transport

General objectives		1	Developing the passenger Modal Split in favour of Public transport (PT) and zero-emission modes. This includes agglomeration PT and local regional context (trams, local buses, etc.), rail transport, maritime and inland water PT (boats), regional and long distance buses as well as pedestrians and bikers.
		2	Developing the freight Modal Split in favour of rail transport, maritime freight transport and inland water transport
		3	Developing the transport system (operation, organization and infrastructure development and maintenance) according to the principle of economic sustainability.
		4	Reducing the Climate change impact of the transport system
		5	Reducing the impact on the Environment of the transport system (Environmental sustainability)
		6	Improve the traffic safety in the Transport system
		7	Improve the interoperability of the transport system (PT, rail, road, maritime, inland water and air)
		8	Improve the integration of transport modes in Croatia (operation, ITS, VTMIS, P&R, etc.)
		9	To further develop the Croatian TEN-T (core and comprehensive) network
Specific objectives	Cross sectorial	1	To better harmonize the transport operations with neighbouring countries (BiH – Ploče Port, road and rail connections BiH, Slovenia, Serbia, Italy, Montenegro and Hungary)
		2	To complement the touristic sector development as the main economic factor in some parts of Croatia where relevant by adequate transport development especially in favour of PT and green mobility
		3	To improve accessibility to remote areas of Croatia (for example island, Southern Dalmatia…)
		4	To develop on the potentials of the main logistic centres (Rijeka maritime port, Ploče maritime port, Split maritime port, Vukovar inland port, Osijek inland port, Slavonski Brod inland port, Zagreb hub)
		5	Strengthening of Croatia as a logistic hub for the wider region with particular focus on Zagreb
		6	To improve the integration of the transport sector into the social and economic developments of the regions (Functional Regional Concepts)
		7	To address the specific situation in Croatia related to the seasonality of traffic
	Railway transport	1	To improve the rail freight corridors from Rijeka port towards the markets with the biggest potential for the port (Hungary, BiH, Slovakia, Italy, Southern Poland and Serbia)
		2	To better utilize the Croatian railway system in the main Croatian agglomerations (Zagreb, Rijeka, Split, Varaždin, Osijek) and within and between functional regions (subregions).
		3	To improve the LOS and environmental impact of rolling stock
		4	To improve the integration of the railway system into the local transport systems (safety and security of stations, interfaces with other transport modes, etc.)
		5	To improve the safety at level crossing with roads
		6	To improve the efficiency of the Croatian rail system (traffic management, operations etc.)
		7	To safeguard the maintenance of the infrastructure taking into account economic considerations

Table 9: Measures in relation to objectives in railway transport

Code	Measure	General objectives									Specific objectives													
											Cross sectorial							Railway transport						
		1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	1	2	3	4	5	6	7
RAILWAY TRANSPORT																								
Rail network elements																								
R.1	Zagreb - Slovenian border towards Ljubljana (TEN-T Core Network / TEN-T Mediterranean Corridor / Pan-European Corridor)		■	■	■	■	■	■	■	■	■	■		■	■	■	■	■	■	■	■	■	■	■
R.2	Zagreb - Karlovac (TEN-T Core Network / TEN-T Mediterranean Corridor / Pan-European Corridor RH2)		■	■	■	■	■	■	■	■	■	■		■	■	■	■	■		■	■	■	■	■
R.3	Karlovac+ to Rijeka (TEN-T Core Network / TEN-T Mediterranean Corridor / Pan-European Corridor RH2)		■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■		■	■	■	■	■

Code	Measure	General objectives									Specific objectives													
											Cross sectorial							Railway transport						
		1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	1	2	3	4	5	6	7
R.4	Railway network around railway node Rijeka																							
R.5	Zagreb - Križevci (TEN-T Core Network / TEN-T Mediterranean Corridor / Pan-European Corridor RH2)																							
R.6	Križevci -HU border towards Budapest (TEN-T Core Network / TEN-T Mediterranean Corridor / Pan-European Corridor RH2)																							
R.7	Zagreb - Novska (TEN-T Core Network/Pan-European Corridor RH1)																							
R.8	Novska - SRB border towards Belgrade (TEN-T Core Network/Pan-European Corridor RH1)																							
R.9	HU border - Osijek - BIH border (TEN-T comprehensive network / basic network / Pan-European Corridor RH3)																							
R.10	Regional connection Vinkovci - Vukovar (TEN-T core network / access to the Pan-European Corridor RH1)																							
R.11	Zagreb node																							
R.14	Zagreb main station																							
Rail network																								
R.15	ETCS L1, L2 on other lines, GSM-R																							
R.16	Electrification of other lines																							
R.17	Reconstruction of other lines, stations, stops and construction of new ones																							
R.18	Regional traffic other than Zagreb and Rijeka (Split, Varaždin, Osijek, etc.)																							
R.19	Improvements and new marshalling yards and logistic center																							
Rail operation/organization																								
R.26	Reorganization of Track access charge																							
R.30	Improvement of passenger rolling stock																							
R.31	Improvement of freight rolling stock																							
R.35	Liberalization of operations for passengers																							
R.36	Liberalization of operations for freight																							
R.38	Reorganization of the operations/time schedules																							

5.3. ROAD TRANSPORT

Table 10: List of objectives in road transport

General objectives		**1**	Developing the passenger Modal Split in favour of Public transport (PT) and 0 emission modes. This includes agglomeration PT and local regional context (trams, local buses, etc.), rail transport, maritime and inland water PT (boats), regional and long distance buses as well as pedestrians and bikers.
		2	Developing the freight Modal Split in favour of rail transport, maritime freight transport and inland water transport
		3	Developing the transport system (operation, organization and infrastructure development and maintenance) according to the principle of economic sustainability.
		4	Reducing the Climate change impact of the transport system
		5	Reducing the impact on the Environment of the transport system (Environmental sustainability)
		6	Improve the traffic safety in the Transport system
		7	Improve the interoperability of the transport system (PT, rail, road, maritime, inland water and air)
		8	Improve the integration of transport modes in Croatia (operation, ITS, VTMIS, P&R, etc.)
		9	To further develop the Croatian TEN-T (core and comprehensive) network
Specific objectives	**Cross sectorial**	**1**	To better harmonize the transport operations with neighbouring countries (BiH – Ploče Port, road and rail connections BiH, Slovenia, Serbia, Italy, Montenegro and Hungary
		2	To complement the touristic sector development as the main economic factor in some parts of Croatia where relevant by adequate transport development especially in favour of PT and green mobility
		3	To improve accessibility to remote areas of Croatia (for example island, Southern Dalmatia…)
		4	To develop on the potentials of the main logistic centres (Rijeka maritime port, Ploče maritime port, Split maritime port, Vukovar inland port, Osijek inland port, Slavonski Brod inland port, Zagreb hub)
		5	Strengthening of Croatia as a logistic hub for the wider region with particular focus on Zagreb
		6	To improve the integration of the transport sector into the social and economic developments of the regions (Functional Regional Concepts)
		7	To address the specific situation in Croatia related to the seasonality of traffic
	Road transport	**1**	To improve the safety of the road system
		2	To better utilize the Croatian road system for PT (Local, regional and national bus systems)
		3	To reduce the environmental impact the oldest parts of the Croatian motorway network
		4	To optimize and harmonize the different tolling systems in Croatia
		5	To improve the technical requirements for road design addressing more economic technical solutions, safety standards, green mobility and the integration of 0 emission modes
		6	To increase the road accessibility of areas, where the existing infrastructure reached the capacity limits and alternative modes (rail, maritime PT) are not economically justifiable (touristic centers in Adriatic Dalmatia) including the introduction of a sustainable traffic concept in favor of PT and 0 emission modes
		7	To increase the connectivity to neighboring countries in order to reach a higher level of cooperation and territorial integration
		8	To increase the accessibility of areas in Croatia, where the capacity limits have been reached, and no alternative road infrastructure is existing (parallel motorways ect.) – Zagreb towards Bielovar and Varaždin towards Koprivnica and Krapina
		9	To reduce congestion in heavily burdened agglomerations taking into account the specific requirements of protection of National Heritage

Table 11: Measures in relation to objectives in road transport

Code	**Measure**	**General objectives**									**Specific objectives**															
											Cross sectorial							**Road transport**								
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
ROAD TRANSPORT																										
Road network elements																										
Ro.1	Gradiška bridge connection																									
Ro.2	A5 Osijek - Hungarian border Pecs (TEN-T Comprehensive Network /																									

Code	Measure	General objectives									Specific objectives														
											Cross sectorial							Road transport								
		1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	1	2	3	4	5	6	7	8	9
	Pan-European Corridor Vc)																									
Ro.3	A5 from A3 to Bosnia and Herzegovinaborder (TEN-T Comprehensive Network / Pan-European Corridor Vc)																									
Ro.4	A7 Križišće to Žuta Lokva ((TEN-T Comprehensive Network /Adriatic-Ionian corridor)																									
Ro.5	A11 Lekenik - Sisak																									
Ro.6	DC 10 Vrbovec - Križevci - Koprivnica - Hungarian border towards Kaposvar																									
Ro.7	DC 12 Vrbovec 2 interchange - Ivanja Reka - Vrbovec - Bjelovar - Virovitica - Hungarian border towards Barcsu																									
Ro.8	Zagreb main network reorganization																									
Ro.9	D2 from SLO border to SRB border																									
Ro.10	Rijeka network reorganization																									
Ro.11	Dubrovnik - ME border																									
Ro.13	Increase of capacity - dedicated PT lane Zagreb bypass																									
Ro.15	Split network reorganization																									
Ro.16	Preparation for accessibility of Dubrovnik when Croatia joins Schengen (Pelješac bridge)																									
Ro.17	Reconsideration of tolling system in Croatia																									
Road network																										
Ro.19	Public roads and realignment																									
Ro.20	Develop a resting station concept for the high level road network																									
Ro.21	Traffic management, monitoring, traffic counting and information system																									
Ro.22	Interchange development plan																									
Road operation/organization																										
Ro.36	Recategorization of the road network																									
Ro.35	Enforcement																									

5.4. AIR TRANSPORT

Table 12: List of objectives in air transport

General objectives		1	Developing the passenger Modal Split in favour of Public transport (PT) and 0 emission modes. This includes agglomeration PT and local regional context (trams, local buses, etc.), rail transport, maritime and inland water PT (boats), regional and long distance buses as well as pedestrians and bikers.
		2	Developing the freight Modal Split in favour of rail transport, maritime freight transport and inland water transport
		3	Developing the transport system (operation, organization and infrastructure development and maintenance) according to the principle of economic sustainability.
		4	Reducing the Climate change impact of the transport system
		5	Reducing the impact on the Environment of the transport system (Environmental sustainability)
		6	Improve the traffic safety in the Transport system
		7	Improve the interoperability of the transport system (PT, rail, road, maritime, inland water and air)
		8	Improve the integration of transport modes in Croatia (operation, ITS, VTMIS, P&R, etc.)
		9	To further develop the Croatian TEN-T (core and comprehensive) network
Specific objectives	Cross sectorial	1	To better harmonize the transport operations with neighbouring countries (BiH – Ploče Port, road and rail connections BiH, Slovenia, Serbia, Italy, Montenegro and Hungary
		2	To complement the touristic sector development as the main economic factor in some parts of Croatia where relevant by adequate transport development especially in favour of PT and green mobility
		3	To improve accessibility to remote areas of Croatia (for example island, Southern Dalmatia…)
		4	To develop on the potentials of the main logistic centres (Rijeka maritime port, Ploče maritime port, Split maritime port, Vukovar inland port, Osijek inland port, Slavonski Brod inland port, Zagreb hub)
		5	Strengthening of Croatia as a logistic hub for the wider region with particular focus on Zagreb
		6	To improve the integration of the transport sector into the social and economic developments of the regions (Functional Regional Concepts)
		7	To address the specific situation in Croatia related to the seasonality of traffic
	Air transport	1	To support the development of Zagreb airport in order to safeguard the international accessibility of the Croatian capital
		2	To improve the operations and the operational reliability of Dubrovnik airport in order to safeguard the accessibility of Southern Dalmatia
		3	To improve the accessibility of the airports in general and in relation to PT in specific
		4	To improve the safety standards on the airports and in air traffic
		5	To improve the compatibility with Schengen requirements where applicable

Table 13: Measures in relation to objectives in air transport

Code	Measure	General objectives									Specific objectives											
											Cross sectorial							Air transport				
		1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	1	2	3	4	5
AIR TRANSPORT																						
Airports																						
A.1	Dubrovnik airport development (TEN-T comprehensive network)			■		■	■	■	■	■		■	■				■		■	■	■	■
A.2	Pula airport development (TEN-T comprehensive network)			■		■	■	■	■	■		■					■			■	■	■
A.3	Brač airport development			■		■	■	■	■			■	■				■			■	■	
A.4	Mali Lošinj airport development			■		■	■	■	■			■	■				■			■		
A.5	Osijek airport development (TEN-T comprehensive network)			■		■	■	■	■	■							■			■		■
A.6	Rijeka airport development (TEN-T comprehensive network)			■		■	■	■	■	■		■					■			■	■	■
A.7	Split airport development (TEN-T comprehensive network)			■		■	■	■	■	■		■					■			■		■
A.8	Zadar airport development			■		■	■	■	■	■		■					■			■		■

Code	Measure	General objectives									Specific objectives											
											Cross sectorial							Air transport				
		1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	1	2	3	4	5
	(TEN-T comprehensive network)																					
A.9	Franjo Tuđman airport development (TEN-T core network)																					
A.11	Airport safety																					
A.13	Closure or change of role/ownership of regional airports																					
Air traffic operation/organization																						
A.15	Improvement of the cooperation with the relevant regional authorities																					
A.16	Restructuring of Croatia Airlines																					
A.19	Cooperation with aeronautical industry																					
A.20	Air traffic management, Single European Sky, SESAR																					
A.21	Improving consumer satisfaction awareness																					
A.24	Review/update Airport Masterplans																					
A.25	Cooperation/agreements with other international airports																					

5.5. MARITIME TRANSPORT

Table 14: List of objectives in maritime transport

General objectives		**1**	Developing the passenger Modal Split in favour of Public transport (PT) and 0 emission modes. This includes agglomeration PT and local regional context (trams, local buses, etc.), rail transport, maritime and inland water PT (boats), regional and long distance buses as well as pedestrians and bikers.
		2	Developing the freight Modal Split in favour of rail transport, maritime freight transport and inland water transport
		3	Developing the transport system (operation, organization and infrastructure development and maintenance) according to the principle of economic sustainability.
		4	Reducing the Climate change impact of the transport system
		5	Reducing the impact on the Environment of the transport system (Environmental sustainability)
		6	Improve the traffic safety in the Transport system
		7	Improve the interoperability of the transport system (PT, rail, road, maritime, inland water and air)
		8	Improve the integration of transport modes in Croatia (operation, ITS, VTMIS, P&R, etc.)
		9	To further develop the Croatian TEN-T (core and comprehensive) network
Specific objectives	**Cross sectorial**	**1**	To better harmonize the transport operations with neighbouring countries (BiH – Ploče Port, road and rail connections BiH, Slovenia, Serbia, Italy, Montenegro and Hungary
		2	To complement the touristic sector development as the main economic factor in some parts of Croatia where relevant by adequate transport development especially in favour of PT and green mobility
		3	To improve accessibility to remote areas of Croatia (for example island, Southern Dalmatia…)
		4	To develop on the potentials of the main logistic centres (Rijeka maritime port, Ploče maritime port, Split maritime port, Vukovar inland port, Osijek inland port, Slavonski Brod inland port, Zagreb hub)
		5	Strengthening of Croatia as a logistic hub for the wider region with particular focus on Zagreb
		6	To improve the integration of the transport sector into the social and economic developments of the regions (Functional Regional Concepts)
		7	To address the specific situation in Croatia related to the seasonality of traffic
	Maritime transport	**1**	To improve the development and competitiveness of Rijeka port as the main maritime port of Croatia
		2	To reduce the environmental impact of maritime transport (development of the fleet, environmental protection and measures to prevent and combat maritime facilities pollution)
		3	To improve the Modal Split of freight transport across the Adriatic sea or along the coastline in favour of maritime transport
		4	To improve the reliability of maritime (transport PT and supply chains) in case of difficult weather conditions
		5	To improve the level of economic efficiency of the maritime transport system
		6	To improve the safety of the maritime transport system
		7	Better integration of the ports into the local transport system (passenger/freight)

Table 15: Measures in relation to objectives in maritime transport

Code	Measure	General objectives									Specific objectives													
											Cross sectorial							Maritime trans.						
		1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	1	2	3	4	5	6	7
MARITIME TRANSPORT																								
Ports and navigability																								
M.1	Increase intermodality and accessibility	■	■	■	■	■	■	■	■	■	■			■	■			■				■		■
M.2	Implementation of the "Motorways of the sea" projects		■	■				■	■	■	■			■				■						
M.4	Bunkering facilities for gas powered and ecoships				■	■													■					
M.6	Improve the accessibility of islands, port development	■		■					■				■			■	■			■	■	■	■	■

Code	Measure	General objectives									Specific objectives													
											Cross sectorial							Maritime trans.						
		1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	1	2	3	4	5	6	7
M.7	Other ports development (e.g. Korčula, Pula…)																							
M.8	Specialise Rijeka port (container, liquid cargo transport and LNG terminal)																							
M.9	Specialise Ploče port (container and bulk cargo)																							
M.10	Specialise Dubrovnik port (cruising vessels)																							
M.11	Specialise Split port (Ro-Ro, passenger and cruising)																							
M.12	Specialise Zadar port (Ro-Ro, passenger and cruising)																							
M.13	Specialise Šibenik port (small capacity cruising and super-yachts)																							
M.14	Development of special purpose ports (shipbuilding ports, nautical ports, military ports, industrial ports, fishing ports, sport ports)																							
M.16	Establish economic development of unused and abandoned former industrial, military or similar facilities																							
Maritime operation/organization																								
M.17	Cooperation with shipping industry																							
M.18	Strategical Maritime definition																							
M.20	Improvement of operational plan (ship routing, etc.)																							
M.21	Traffic management and IT system, VTMIS, e-Navigation																							
M.28	Modernisation of the vessels (safety, energy efficiency and environment)																							
M.29	Cooperation/agreements with other international ports																							

5.6. INLAND NAVIGATION

Table 16: List of objectives in inland navigation

General objectives		1	Developing the passenger Modal Split in favour of Public transport (PT) and 0 emission modes. This includes agglomeration PT and local regional context (trams, local buses, etc.), rail transport, maritime and inland water PT (boats), regional and long distance buses as well as pedestrians and bikers.
		2	Developing the freight Modal Split in favour of rail transport, maritime freight transport and inland water transport
		3	Developing the transport system (operation, organization and infrastructure development and maintenance) according to the principle of economic sustainability.
		4	Reducing the Climate change impact of the transport system
		5	Reducing the impact on the Environment of the transport system (Environmental sustainability)
		6	Improve the traffic safety in the Transport system
		7	Improve the interoperability of the transport system (PT, rail, road, maritime, inland water and air)
		8	Improve the integration of transport modes in Croatia (operation, ITS, VTMIS P&R, etc.)
		9	To further develop the Croatian TEN-T (core and comprehensive) network
Specific objectives	Cross sectorial	1	To better harmonize the transport operations with neighbouring countries (BiH – Ploče Port, road and rail connections BiH, Slovenia, Serbia, Italy, Montenegro and Hungary
		2	To complement the touristic sector development as the main economic factor in some parts of Croatia where relevant by adequate transport development especially in favour of PT and green mobility
		3	To improve accessibility to remote areas of Croatia (for example island, Southern Dalmatia…)
		4	To develop on the potentials of the main logistic centres (Rijeka maritime port, Ploče maritime port, Split maritime port, Vukovar inland port, Osijek inland port, Slavonski Brod inland port, Zagreb hub)
		5	Strengthening of Croatia as a logistic hub for the wider region with particular focus on Zagreb
		6	To improve the integration of the transport sector into the social and economic developments of the regions (Functional Regional Concepts)
		7	To address the specific situation in Croatia related to the seasonality of traffic
	Inland navigation	1	To improve the competitiveness of Vukovar and Osijek as the main inland freight ports
		2	To cooperate with BiH related to the development of Slavonski Brod freight port
		3	To use the potential of inland navigation for tourism and local PT
		4	To adjust the navigability requirements to the traffic needs and to safeguard the necessary level of navigability
		5	To improve the operational and organizational conditions of the inland transport sector (economic sustainability)

Table 17: Measures in inland navigation

Code	Measure	General objectives									Specific objectives											
											Cross sectorial							Inland navig.				
		1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	1	2	3	4	5
INLAND NAVIGATION																						
Ports and navigability																						
I.1	Upgrading Danube and Drava until Osijek			■		■				■								■			■	
I.2	Upgrading Sava			■		■				■									■			
I.3	Vukovar port development (TEN-T core Network)		■	■		■			■	■				■				■				
I.4	Osijek port development (TEN-T comprehensive network)		■	■		■			■	■				■				■				
I.5	Slavonski Brod port development (TEN-T core network)																		■			
I.6	Sisak port development (TEN-T comprehensive network)																			■		

Code	Measure	General objectives									Specific objectives											
											Cross sectorial							Inland navig.				
		1	2	3	4	5	6	7	8	9	1	2	3	4	5	6	7	1	2	3	4	5
I.11	Dangerous goods terminal and waste management facilities																					
Inland navigability operation/organization																						
I.16	Cooperation with Croatian shipping industry																					
I.18	Support to water transport companies																					
I.20	Increase the fleet of safety and environmental protection vessels																					
I.21	Cooperation/agreements with other international ports																					

6. ENVIRONMENTAL PROTECTION MEASURES

6.1. SOIL

If the intervention is planned in the area of moderate and high risk of erosion, it is necessary to use agrotechnical mitigation measures in accordance with the Ordinance on agrotechnical measures.

6.2. WATERS

1. During construction of railways, concrete slats should be used to a greater extent, ie avoid wooden thresholds that need to be chemically treated before use.
2. During the design and construction of railway lines and roads, the route of the roadway should be defined in such a way as to minimally affect the changes of existing river and lake basins in order to reduce the impact on their hydromorphological state. When constructing roadways in vulnerable, sensitive or protected areas, at the level of the project, conduct an analysis of potential pollution of the surrounding water bodies and prescribe appropriate protection measures.
3. In the expansion of airports, ensure the construction of a wastewater drainage system as well as wastewater treatment facilities of the appropriate category.
4. All line and point operations should be designed in such a way as to avoid areas of special water protection - sanitary protection zones.
5. Each newly constructed port, prior to the construction of the main project or before the start of the portuse, if the main project is not required, must have a maritime study accepted and certified by the Port Authority pursuant to Article 5 of the Regulation on Conditions to Meet the Ports (Official Gazette 110/04).
6. In planned ports, it is necessary to organize solid waste collection and to provide adequate infrastructure for wastewater collection from ships.
7. New maritime and river ports are planned at locations where the morphological state of water bodies is rated as very good, ie in locations where there are no existing hydromorphological pressures.

6.3. BIODIVERSITY

1. The development of railway traffic on the Karlovac-Rijeka section is based on a variant solution that passes south of the Zlobin settlement in the Primorsko-goranska County with the redemination of the existing railway line.
2. Motorways, as well as other roads with a planned traffic density of more than 5000 vehicles per day, shall be designed in such a way as to enable the establishment of adequate permeability for wild species in the following phases of their realization, taking into account existing traffic infrastructure.
3. Traffic infrastructure in areas evaluated as nonfragmented is primarily planned in habitats that are under anthropogenic influence through the use of the shortest possible stock through unphragmented areas. Planning the transport infrastructure in such a way as to enable the implementation of green infrastructure.
4. Planing the improving of maritime transportin in such a way as to avoid the areas of distribution of Tursiops truncatus (good dolphins) and fish hatches in the Adriatic.
5. The new eastern port on the Danube in Vukovar is planned outside the borders of the Special Reserve of Vukovar River Danube vegetation.
6. The section of the road that is planned within the boundaries of the Cetina - Lower Flow Landscape, and is covered by the measure Ro. 15 Reorganize the Split Network, should be performed in a way to avoid distorting the features of this protected area.
7. Traffic corridor envisaged by measures R.11 Zagreb node and Ro.8 The reorganization of the main Zagreb network in which several types of parallel bus traffic infrastructure are planned to mitigate the cumulative impacts should be carried out in cooperation with all the transport sectors involved as well as the bodies competent for professional nature protection activities and bodies responsible for forest management in the given area, in order to allow for adequate permeability for wild species through parallel roads with minimum disturbance of forest habitats.

6.4. CULTURAL AND HISTORICAL HERITAGE

Protection of archaeological heritage

1. Prior to undertaking a project in space resulting from spatially-located measures, it is necessary to carry out field archeological examination and, if necessary, test archeological investigations at positions of known and recorded archeological sites, which will determine the scope of protective archeological research, documentation and conservation of finds and sites. Field archeological examination is to be carried out at the positions of potential archeological sites with indicative names, toponyms and places where evident changes in relief were made by human activity in history.
2. If protective archeological research results in significant findings that need to be conserved and presented, it is needed to foreseen the possibility of relocating the route of infrastructure and other planned buildings to the positions of such sites.

Protection of cultural historical units, historical structures and buildings

3. The protection measure system includes the research and documentation of endangered cultural heritage with maximum conservation to mitigate the negative impact on the spatial and visual integrity of the architectural heritage.

Protecting the Historical Cultural Landscape

4. Measures to protect the historical cultural landscape are to be carried out during the project development phase by designing a landscaping project.
5. A Landscape Sensitivity Study is required before the Landscape Design Project is created

6.5. AGRICULTURE

1. In the area of Pannonian Croatia, the implementation of measures that can generate the conversion and fragmentation of the land value of the prudential values P1 and P2 should be planned in such a way that, except in exceptional circumstances, it is obligatory to avoid taking land of the prudential value P1 and P2.
2. In the Dinarid area, the implementation of measures that can generate conversion and fragmentation of the land value of the prudential value P1 and P2 should be carried out beyond the land value of the prudential values P1 and P2.
3. Measures that can generate conversion and fragmentation of agricultural land should be planned in a way that utilizes existing infrastructure to a greater extent and avoids unnecessary duplication and fragmentation of agricultural land.

6.6. LANDSCAPE CHARACTERISTICS

1. The measures envisaged by the Strategy should be incorporated into the landscape through projects of Green Infrastructure or Landscape Design projects.

6.7. SOCIO – ECONOMIC FEATURES

1. When designing a roadway, it is important to take into account the predictive value of traffic increase, assess the impact and if necessary, take appropriate noise protection measures.

6.8. CLIMATE CHANGE

1. All infrastructure projects arising from the measures of the Strategy shall be planned with taking into account the potential climatic phenomena in the area of implementation of the measure. Project design needs to be implemented in accordance with non-formal guidelines: "Non-paper Guidelines for Project Managers: making vulnerable investments climate resilient" European Commission, Climate Policy Directorate-General.
2. The measures envisaged by the Strategy shall be implemented in accordance with the National Policy Framework for the Establishment of the Infrastructure and Development of Alternative Fuel Market (NOP 34/17) and the strategic documents and incentives of local and regional self- fuels contained in the said National Framework.

6.9. IMPLEMENTING MEASURES FOR REDUCTION OF NEGATIVE EFFECTS OF DEVELOPMENT OBJETIVES ON THE WHOLENESS OF THE ECOLOGICAL NETWORK

Spatially located measures

Road traffic

1. During the preparation of the Measure Ro.1 project, linking the bridge to Gradiska will adapt the construction time and planning of use with the objectives of

conservation of the ecological network area HR1000004 Donja Posavina and avoid the construction of the bridge with the period of the largest activity of the target fish species of the ecological network area HR2001311 Sava downstream from Hrušćica.

2. Measure Ro.4 A7 Križišće - Žuta Lokva consider the possibility of mitigating significantly negative impacts on the target species of the ecological network area HR2000200 Zagorska peć at Novi Vinodolski by implementing adequate mitigation measures for target bats (eg, routing species that accompany vegetation at a larger scale the height of structures that allow bats to cross over hop-over using closed-screen structures.
3. When determining the work area, it is necessary to disable any activity near the area of the ecological network HR2000131 Škabac cave and HR2001154 Orlovac cave.
4. When planning a part of the route passing through the area of the ecological network HR5000019 Gorski kotar and northern Lika, and passing a high-availability habitat for target species of large beasts (bear, wolf and ridge), adequate transit across roads by building green infrastructure elements should be provided.
5. During the implementation of the measure Ro.5 A11 Lekenik - Sisak on project level plan noise protection according to the ecological network HR1000003 Turopolje in cooperation with the expert - ornithologist and during the construction of the connecting roads over the river Kupa avoid avoidance of the priority target habitat types 91E0 * Aluvial forests *(Alno-Padion, Alnion Incanae, Salicion albae)* and 7220 * Sources of Cratoneurion - Pointed or ribbed formations dominated by moss from *Cratoneurion commutati*.
6. In the implementation of the measure Ro.6 DC 10 Vrbovec - Križevci - Koprivnica - State border with Hungary towards Kaposvar consider further mitigation measures such as the construction of opaque fence against noise on the road.
7. Route planned by Ro.7 DC 12 node Vrbovec 2 - Ivanja Reka - Vrbovec - Bjelovar - Virovitica - The Hungarian border with Hungary should be moved so it does not cross the area of the ecological network HR1000009 Ribnjaci uz Česmu.
8. With the part of the stock provided for by measure Ro.8. Reorganization of the main Zagreb network passing through the area of the ecological network HR1000003 Turopolje integrates the opaque fence against noise. In the part of the section passing through the area of the ecological network HR2000589 Stupnički lug to avoid damaging the surrounding trees of the target habitat type 9160 Sub-Atlantic and Central European oak and oak-gravel forests of Carpinion betuli.

9. The share provided for in Measure Ro.9. D2 from the state border with Slovenia to the state border with Serbia passing through the area of the ecological network HR2001500 The steep habitat at Bapske is to be moved or overtaken by viaduct to prevent the conversion of the target habitat type 6240 * Subpanonian steep grasses (*Festucion vallesiacae*).
10. During the implementation of part of the section under Measure Ro.15 Splitska reorganization: Split - Omiš attention should be pointed to the part passing through the area of the ecological network HR2001376 surrounding the area and adapt the time of construction of the target species of the target barehole - *Myotis blythii*. During the use of this part, the mitigation measures for bats (allow bats to cross over hop-over) should be provided.

Railway traffic

1. When improving the railways provided for by measures R1, R2, R3, R4, R5, R8, R9, R10 and R11, measures for mitigation of target species and particularly large beasts are planned.

Air traffic

1. By implementing Measure A.8. The development of the Zadar Airport by the expansion of the airport in the area of the ecological network HR1000024 Ravni kotari and HR2001361 Ravni kotari should be avoided.

Sea traffic

1. When constructing a new terminal foreseen in Measure M9 Specialization of the Port of Ploce (Container and Bulk Cargo), breaking into the habitat of the ecological network area HR1000031 Delta Neretva and HR5000031 Delta Neretva should be avoided.

Cumulative impacts

1. Due to the recognized negative cumulative impact on the area HR2001311 Sava downstream of Hrušćica, it is necessary to temporally separate the construction of bridges and works of reconstruction of river ports on Sava.
2. If R11 is planning to build new railway lines, it is necessary to align it with the measure R08 Reorganization of the main Zagreb network in a way that follows the

road infrastructure and does not occupy parts of the ecological network area (especially ecological network areas HR2000589 Stupnički lug).

Their monitoring is essential to determine the effectiveness of mitigation measures. Sometimes only minor changes are enough to significantly increase their functionality. Also, on the basis of data collected through monitoring, future projects and mitigation measures can be better planned. Monitoring should be anticipated during the planning of mitigation measures in the procedure for approving.

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