Republic of Croatia
MINISTRY OF THE SEA, TRANSPORT AND INFRASTRUCTURE

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

May 2017

The project is co-financed by the European Union from the European Regional Development Fund.

TABLE OF CONTENTS

1 INTRODUCTION

1.1 Background on development of a Croatian Comprehensive National Transport Plan

Republic of Croatia applied to become an EU Member State in March 2003 and in June 2004 officially received a candidate country status. The EU accession negotiations with Croatia started in October 2005. In June 2011, accession negotiations were closed. Republic of Croatia signed the accession Agreement with EU members in Brussels on 9 December 2011. In March 2012, Croatian Parliament ratified Accession Treaty. Republic of Croatia attained a status of the accession country in June 2004 and has benefited since then from various pre-accession instruments provided by the European Union, relevant to the transport sector, namely ISPA and IPA. Republic of Croatia became Member State on 1st July 2013.

The Regulation (EU) No 1303/2013 of the European Parliament and of the Council of 17 December 2013 lays down common provisions on the ESI Funds as ex-ante conditionality for the programming period of sectorial strategies for 2014 to 2020.

The Transport ex-ante conditionality is considered fulfilled when it achieves the following outcomes:

- The existence of a Comprehensive Transport Plan for investment
- The Plan complies with legal requirements for Strategic Environmental Assessment
- The Plan sets out the contribution to the Single European transport Area
- A realistic and mature pipeline of projects for which support from the Cohesion Fund and ERDF is envisaged
- Measures to ensure the capacity of intermediate bodies and beneficiaries.

In its guidance on ex-ante conditionality, the European Commission describes how the fulfilment of the ex-ante conditionality is based on an assessment of key processes and components. Where the ex-ante conditionality in transport are not fulfilled, an Action Plan may be required addressing the actions needed to fulfil the ex-ante conditionality at

the latest by the end of 2016. This situation may arise either where a Transport Plan is not reaching the required level of completeness, or some of the other EACs are not fulfilled.

The decision-making process to establish the fulfilment of the Ex Ante Conditionality, and the possible requirement for an Action Plan and further Assessment Round with reference to the Comprehensive Transport Plan, is set out below:

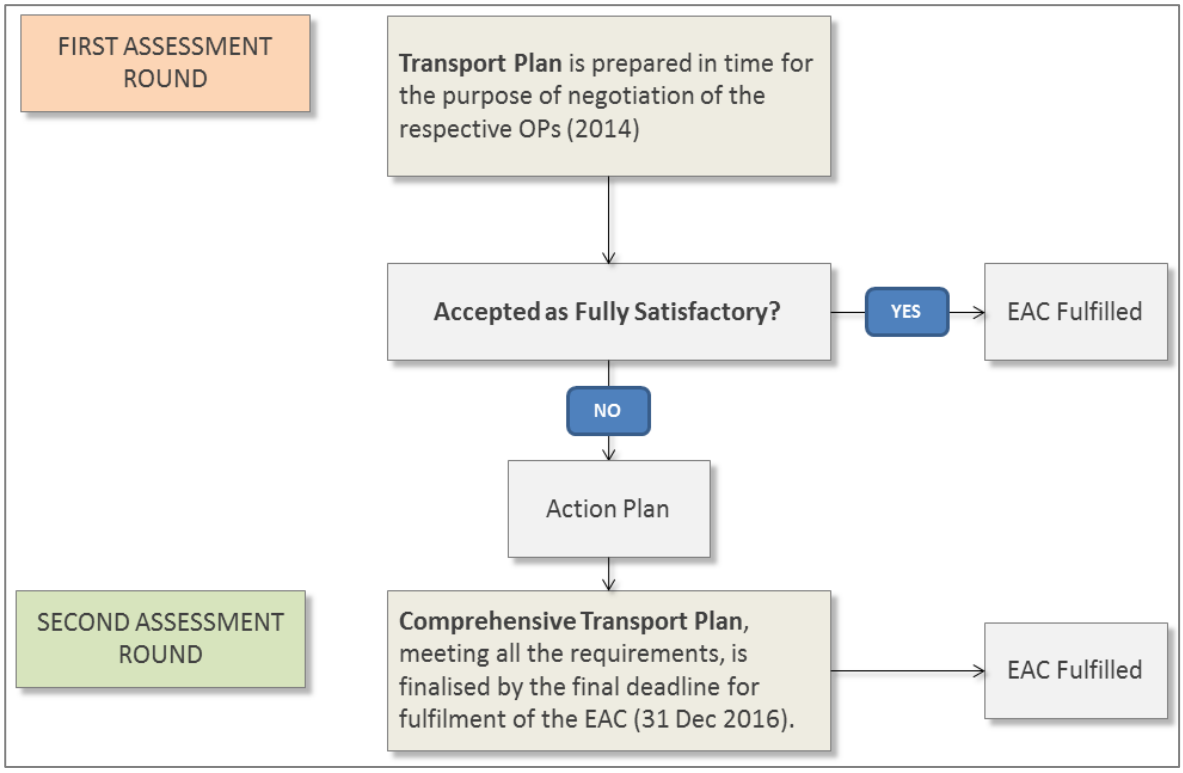


Figure 1: Establishing the Requirement for an Action Plan related to the Comprehensive Transport Plan (Source: JASPERS)

Transport infrastructure development in the Republic of Croatia is considered essential for economic and social development and promotion of inter-regional exchange. It is an instrument of regional development, facilitating the flow of goods, as well as the access of people to employment, health, education and recreation. The authority responsible for the development of the National Transport Development Strategy is the Ministry of the Sea, Transport and Infrastructure (MSTI). The Ministry has already taken the actions to fulfill the ex-ante conditions by creating a Traffic Development Strategy of the Republic of Croatia for the period from 2014 to 2030, in following text TDS (2014). TDS (2014) was adopted by the Croatian Government on October 30th 2014 (Official Gazette No. 131/14).

TDS follows a robust methodology, in line with EU and JASPERS[1] guidelines and recommendations.

In order to develop the current TDS (2014), MSTI organized 6 sector subcommittees for developing concepts of sector strategies for rail, road, maritime, inland waterways, air transport and for the first time on the level of national strategic transport planning, sector for urban, suburban and regional mobility. The result was the drafting the concepts of sector transport strategies that was completed in July 2013. The process of merging the sector transport strategies into a single and comprehensive Transport Development Strategy document started in August 2013 by using the functional regional and sector approach. The functional regional approach implies the division of the Republic of Croatia in functional regions based on real mobility interactions, regardless of the county or national borders; in some cases the functional regions partially overlap with other functional regions. The sector approach implies the analysis of the key transport sectors i.e. rail, roads, inland waterways, maritime and transport, regarding national and international mobility. Finally, the outcomes of the analysis of the functional regional approach and the sector analyses are used to identify the multimodal objectives and measures to achieve these objectives which are identified for each transport sector.

In September 2013, parallel to the process of developing the TDS (2014), the SEA process was launched so both processes were conducted in parallel and with constant communication between the two processes. This has been undertaken throughout the whole process and has been formalised through the SEAs assessment of the TDS objectives and measures.

The final drafts of the Transport Development Strategy and the SEA report were prepared in June 2014 and were consulted with the public from 26th June to 27th July 2014, with a public hearing being held on 1st July 2014.

[1] JASPERS – Joint Assistance to support projects in European regions, www. jaspers-europa-info.org

The SEA procedure conducted for the Transport Development Strategy of the Republic of Croatia was approved by the Ministry of Environment and Nature protection on 29th October 2014.

The first assessment round was completed on 30th October 2014 by adoption of the TDS by the Government of the Republic of Croatia, providing input for the programming exercise for the 2014-2020 EU Programming Period.

During this process, and as presented in the Action Plan, gaps in collected data were identified, and a proper traffic model was missing

This document represents second phase of TDS for the period from 2014 to 2030 and can be considered like a Full Transport development Strategy of the Republic of Croatia taking into account the outcomes from the National transport model which means that with this document MSTI fulfilled the ex ante conditionality in transport sector

1.2 Objectives of the Transport Development Strategy (2017)

Transport Development Strategy of the Republic of Croatia for the period 2017 to 2030, in the following text TDS (2017), shall assess and define the future measures (infrastructure, operation and organization) in the transport sector related to international and national transport in all transport segments independent from the funding source.

The TDS (2017) shall provide the framework for the development of interventions and define the interfaces to other strategies or assessments (Functional Regional Concepts-FRC, Master Plans, sectorial strategies, etc.)

The TDS (2017) shall take into account the European strategies and requirements (TEN-T, ERTMS, TSI, environmental protection, climate protection etc. – general objectives) and be based on a thorough analysis of the Croatian situation (specific objectives for Croatia)

The TDS (2017) shall identify the need for further data collection/generation and define the consecutive steps to be taken for the future revision of the TDS.

1.3 Revision of the TDS (2017) Ex-Ante conditionality

With the finalization of the National Traffic Model (NTM – supported from the Transport OP 2007 to 2013), additional data are available which allow to update the TDS (2014)

adopted by the National Government in October 2014. The TDS (2017) will take into account the findings of the previously mentioned documents respectively models and complement it by the information provided in feasibility studies and other sectorial strategies.

1.4 Methodology for the development of the TDS (2017)

The TDS (2017) shall be based on a thorough analysis of the transport sector as well as the key drivers for transport development in Croatia (key findings). From the previous assessments done on a strategic level or project level, a number of hypothesis have been identified, which in case they have been confirmed by data or analysis shall be turned into key findings, in case they have not been confirmed by data or the analysis they shall either be dismissed or stay on the level of hypothesis for further investigation.

The key findings shall be translated into objectives, which consequently lead to measures in the area of investment, operation and organization.

2 ANALYSIS

2.1 General aspects of transport

2.1.1 Hypothesis

"The population in Croatia has been decreasing over the last 20 years".

Source

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

Key findings

- The population of Croatia declined between 1991 and 2001 from 4.8 Mio inhabitants to approximately 4.4 Mio inhabitants. Since 2001 it almost stagnated with a slight decline to 4.2 Mio inhabitants in 2015.

Comment

The basic determinants of the population dynamics are: population growth, natural movement and migration, geographical mobility of the population.

Comparing the basic demographic indicators with other EU countries, in the period 2008 – 2012. Croatia had a negative natural growth, a negative balance of net migration and an overall population decline. As a result of all of these negative indicators Croatia is in a group of only five EU countries that had both a natural decline and a negative migration balance in the period 2008–2012. As a result, one may conclude that not even a moderate increase in fertility will stop the Croatian population from decreasing further in the next few decades.

According to the last census in 2011, 4,284,889 people lived in Croatia's territory. The number of inhabitants decreased by 152,571 persons (index 96.56) from the prior census in 2001.

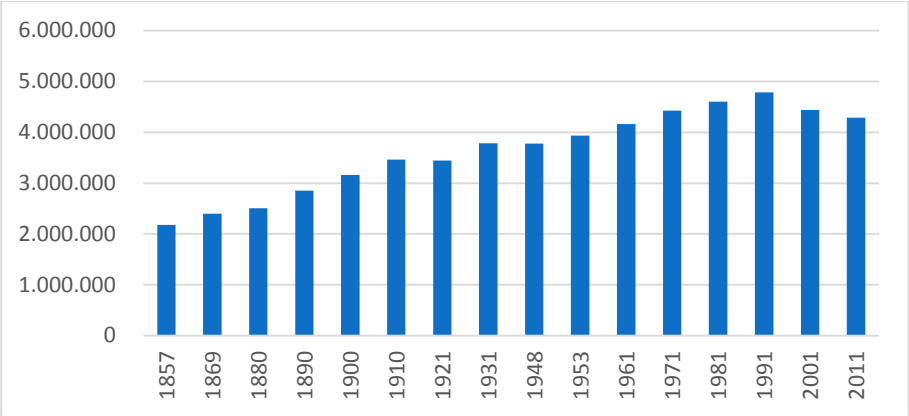


Figure 2: Population in Republic of Croatia (source: Croatian Bureau of Statistics)

The birth rate in Croatia has been so low over the last few decades that a population decline is inevitable even without immigration.

The analysis of the natural population growth in Croatia in 2013 shows a negative growth of -10,447 persons, with 39,939 live births and 50,386 deaths.

It is very likely that the population will decrease to less than 4,000,000 by 2030.

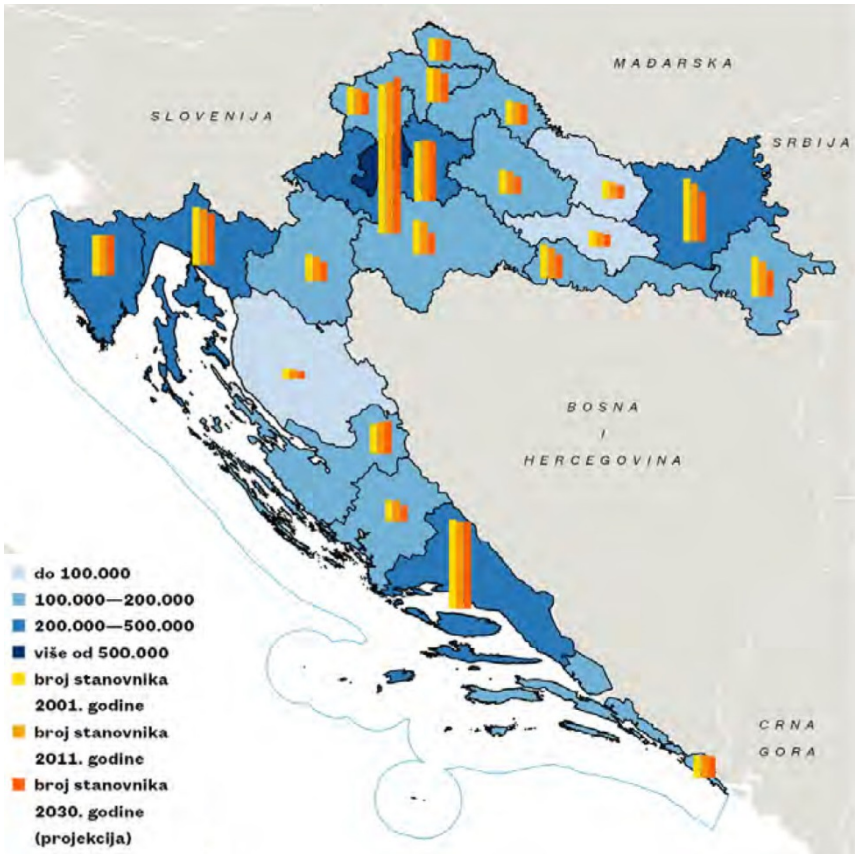


Figure 3: Changes in the population in the period 2001 - 2011 and projections to 2030 (source: Spatial Development Strategy of the Republic of Croatia)

The probability of the projections becoming realized is very high, and the optimistic variant is that it will remain at the 2013 level, but only in case of significant immigration – more than 350,000 immigrants than emigrants during that period, or a less positive net migration with a significant increase in fertility. Both alternatives are highly unlikely, and the reduction of the population is most likely.

Negative demographic forecasts directly affect the development of mobility, i.e. the smaller the population size, the less need for mobility; therefore, demographic forecasts should be taken into account in the further development of the transport system.

2.1.2 Hypothesis

"The population development is different for specific regions in Croatia"

Source

Croatian Bureau of Statistics (Census 2011); Technical base for the development of the Spatial Development Strategy, Faculty of Economics of Zagreb University, 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%.

Comment

The analysis of the population by counties shows that only four out of twenty-one counties have a population growth: the Zadarska County (index: 104.92), Zagrebačka County (index: 102.55), City of Zagreb (index: 101.40) and the Istria county (index:

100.83). The largest decline of residents was reported by Vukovarsko-srijemska county (index: 87.67).

The population declined in most counties from 1998, with an emphasized negative natural increase. From 1998 to 2013, only seven counties reported a positive balance of natural growth and net migration: all counties along the Adriatic coast, except for the Primorsko-goranska County, the City of Zagreb and the Zagrebačka county. In relative terms, the Zagrebačka and Zadarska counties had the largest increase in population, more than 10% of the total population. An overall depopulation, with over 10% less population, mostly affected the Ličko-senjska, Karlovačka, Bjelovarsko-bilogorska and Virovitičko-podravska counties. These are also economically least developed counties in which the natural growth has been negative for a number of years.

Table 1: Population in the Republic of Croatia by counties (source: Croatian Bureau of Statistics)

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**

The analysis of the natural population growth in 2013 shows that the growth rate is -10,447 persons, with 39,939 live births and 50,386 deaths. It was the year in which no county on the Croatian territory reported a positive natural growth. The Sisačko-

moslavačka County had the highest negative natural increase (-1,116), followed by the Osječko-baranjska County (-1,039) and Primorsko-goranska County (-1,018). The smallest negative natural growth was reported by the Međimurska County (-26) and Dubrovačko-neretvanska County (-62).

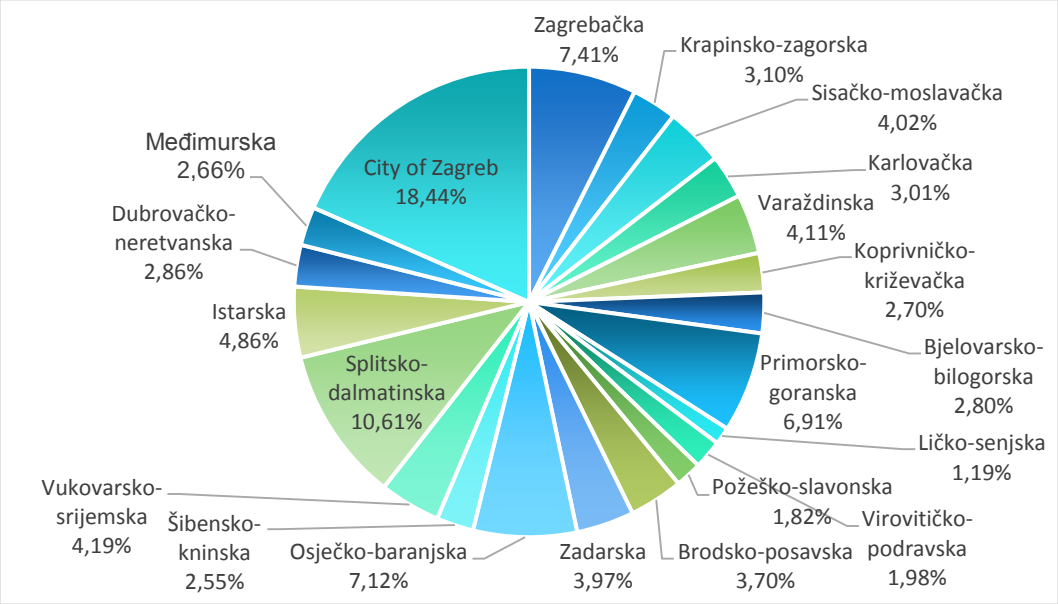


Figure 4: Population in the Republic of Croatia by counties (source: Croatian Bureau of Statistics)

In a large number of counties migrations have a greater impact on the number and structure of population than the difference between the birth rate and mortality. Thus, the negative natural growth in Croatia from 1998 to 2013 was almost compensated by a positive net migration. In that period ten counties and the City of Zagreb had a positive balance of the total migration. In the Zagrebačka and Zadarska counties, the positive net migration accounted for almost 15% of the total population from 1998. At the same time, as a result of the negative balance of the total migration, the Vukovarsko-srijemska and Požeško-slavonska counties lost about 5% of their respective population from the initial period.

Zagrebačka, Istarska and Šibensko-kninska county, despite a natural decline, were not experienced overall population decline thanks to migration.

Population growth zones in some counties are mainly driven by migration, which will further increase in the future, especially if the zones achieve a population increase.

An above-average share of immigration is found in the City of Zagreb (46.7%) and the Zagrebačka County (40.8%), which have the highest proportion of immigrants in their

population, and the lowest share of immigrants in the population is found in the Međimurska (12.9%), Krapinsko-zagorska (13.7%) and Varaždinska (14.8%) counties.

According to the results of general mobility from NTM, trip rates do not rise linearly with the increase in the population size. More precisely, settlements with less than 500 residents had the lowest trip rate (2.1), followed by a group of settlements with between 501 and 5 000 residents (about 2.4). In the largest three groups of settlements (more than 5,000 residents) trip rates were similar (2.6–2.7), but the traveling time in the largest settlements is the longest (48 minutes a day). In this category type settlements are distinguished based on their administrative role. As the name suggests, local administrative centres are the seats of local government. This often entails that they have a better communal and social infrastructure compared to the peripheral settlements, which have no administrative role. Respondents from local administrative centres took on average more trips (2.55 against 2.27) and spent more time travelling (43 minutes against 39 minutes) than respondents from peripheral settlements.

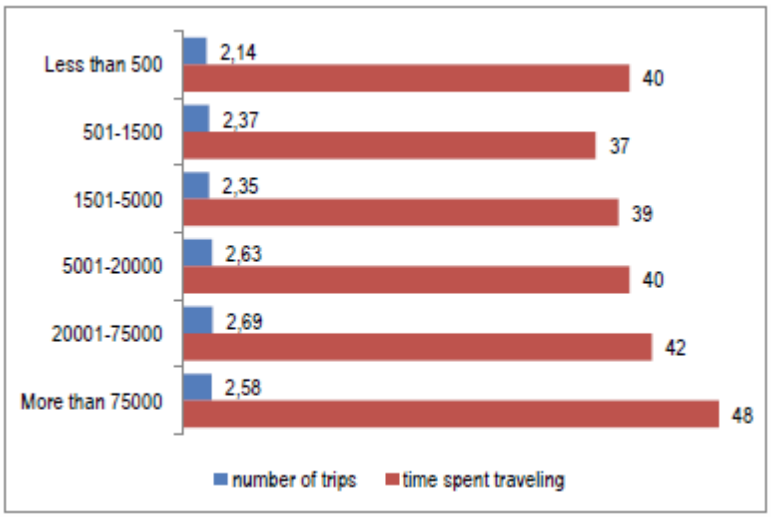


Figure 5: Trip rates and time spent travelling by size of settlement (NTM)

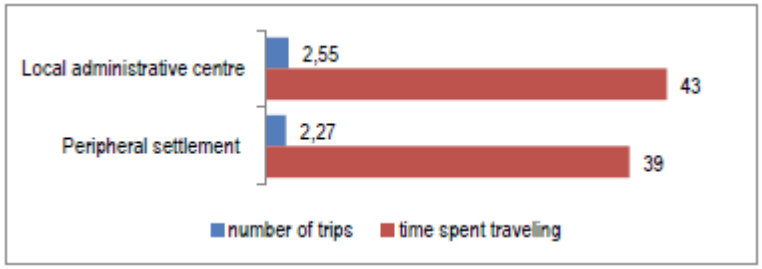


Figure 6: Trip rates and time spent travelling by type of settlement (NTM)

According to the 2011 census there are less than 1% weekly migrants between counties, and they are not relevant to the conclusions about the transport.

In conclusion, one may say that, if nothing is done to make life more attractive in counties with decreasing population, the tendency will most probably remain.

2.1.3 Hypothesis

"The average age of the population is increasing"

Source

Spatial Development Strategy of the Republic of Croatia (adopted by the Croatian Government in September 2015)

Key findings

- The average age of population increased from 39.3 years in 2001 to 41.7 years in 2011, and to 42.6 years in 2015.
- The highest average age of population is and will be in the Ličko-senjska County, the Karlovačka County and the Šibensko-kninska County.

Comment

The aging index, the ratio of elderly (65+) and young people (0–14), is one of the best indicators of aging because it is most sensitive to fluctuations or changes in the age structure of a population.

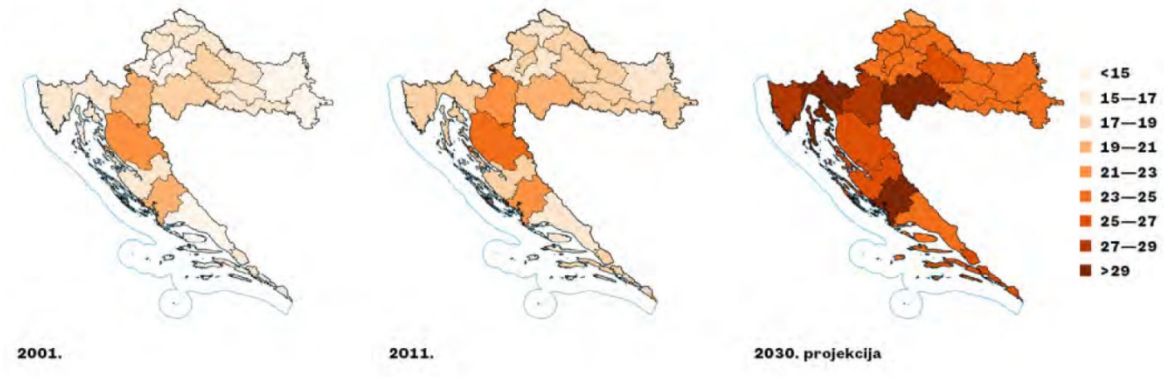


Figure 7: Share of elderly people (65+) by counties (source: Spatial Development Strategy of the Republic of Croatia)

Demographic aging of the population in Croatia has been present for a long time and tends to increase. There are fewer and fewer young people, and the number of elderly is growing.

The longer life expectancy in Croatia is based on the fact that, from 2001 to 2014, the number of oldest (80+ years) almost doubled, from 98,802 to 189,923 inhabitants.

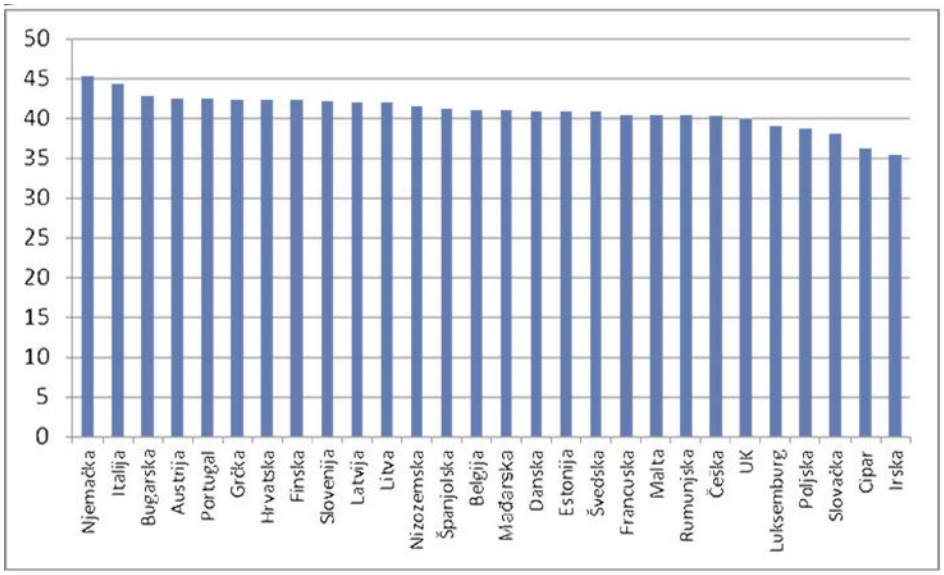


Figure 8: The median age of the population in the EU and Croatia in 2013 (source: Technical base for the development of the Spatial Development Strategy, Faculty of Economics of Zagreb University, September 2014)

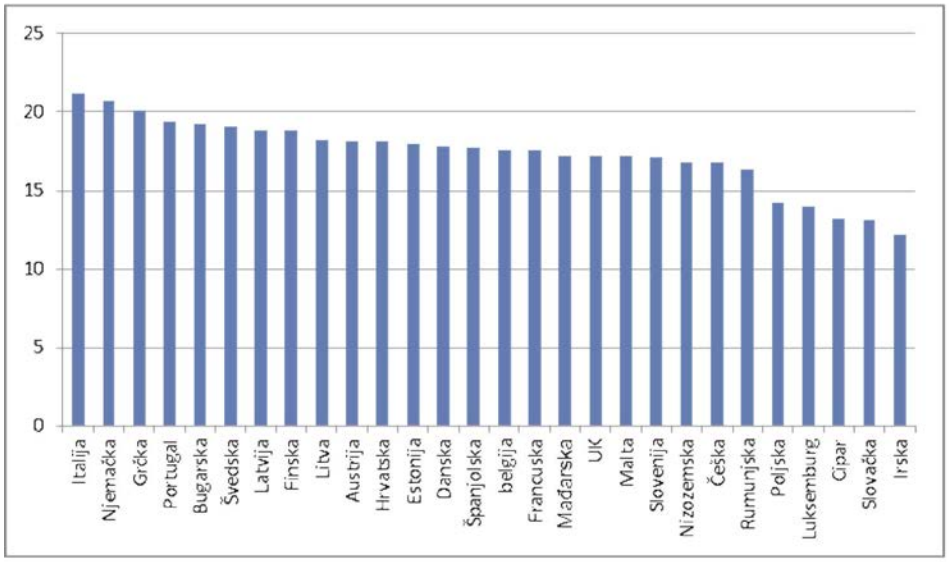


Figure 9: Share of elderly people (65+) in the EU and Croatia in 2013 (%) (source: Technical base for the development of the Spatial Development Strategy, Faculty of Economics of Zagreb University, September 2014)

According to the demographic indicators of aging, the Croatian population is in a group of 10 to 15 oldest populations in the world. According to the last census (2011), there are elderly people, or people of a high age, with an ageing index of 115.0% on the territory of Croatia.

At the regional level, there are three Croatian counties with a share of elderly population (65+) of over 20%: Ličko-senjska, Karlovačka and Šibensko-kninska. Međimurska, Zagrebačka and Splitsko-dalmatinska counties have the lowest share of elderly population.

The Primorsko-goranska, Istria and Karlovačka counties have the smallest share of children younger than 15 years in their total population. This is because of a lower fertility rate, migration of young people to the big cities and an above-average lifespan in these counties. The largest share of children in the total population is found in the Brodsko-posavska and Vukovarsko-srijemska counties, as they have higher fertility rates and a lower life expectancy.

The accelerating aging rate in Croatia is indicated by the fact that, according to the 2001 census, most of the counties, 14 of them, had more young people than elderlies. Only a decade later, in 2011, the Zagrebačka and Međimurska counties were the only ones with fewer elderly than young people in the population. On the other hand, the Primorsko-goranska, Šibensko-kninska and Karlovačka counties had 50% or more older than young people in their population, in particular the Ličko-senjska county, with more than 80% of older people in its population.

According to EUROSTAT projections, the median age of the population is projected to increase by 2.4 years in the period 2013–2040. Figure 10 describes population structure by age groups in Croatia in period 2013-2040.

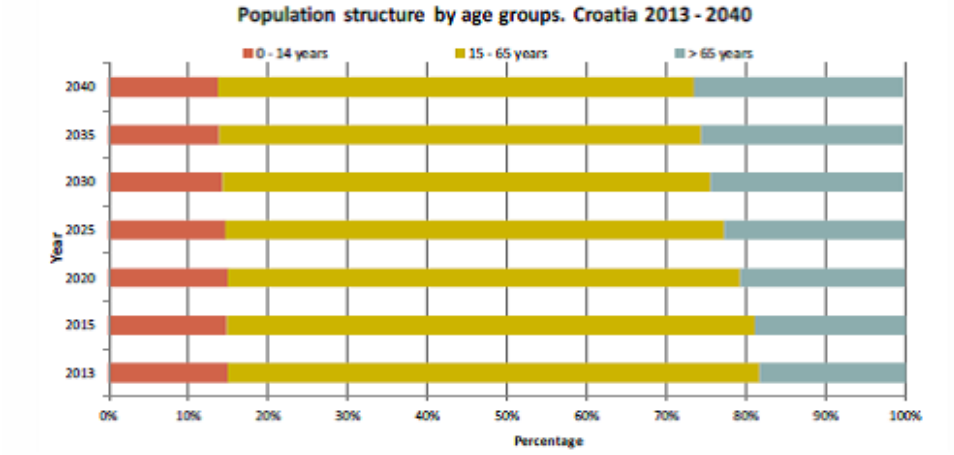


Figure 10: Projections of population structure by age groups. Croatia (source: EUROSTAT)

According to demographic indicators, the increasing trend of population ageing has an obvious impact on the mobility patterns and needs of the population, e.g. the number of work active people will reduce and then the number of trips to work will decrease, while leisure and health-related trips will increase.

2.1.4 Hypothesis

"The economic development of the specific regions is not the same"

Sources

Spatial Development Strategy of the Republic of Croatia

Key findings

- The development index value is the highest in the following counties: City of Zagreb (index: above 180), Zagrebačka, Primorsko-goranska, Dubrovačko-neretvanska and Istria counties (index: 120–180).
- The lowest development index values are in the Virovitičko-podravska, Vukovarsko-srijemska and Brodsko-posavska counties.
- Concentrated urbanization resulted in an unequal regional development and deepened the differences between urban and rural areas.
- Significantly weaker economic development of minor regional centres resulted in a depopulation of huge areas in Croatia.
- Concentration of economic (transport, energy, communication system, community activities) and non-economic (education, health, science, culture,

social protection and administration) infrastructure in several major cities has also resulted in a concentration of the labour force with a higher education level.

Comment

Population indices and demographic trends directly affect the regional development indices. Northwest Croatia has the highest regional index and GDP, while Slavonia and other continental regions have significantly lower indices. Indices are again higher in Istria and other coastal regions due to tourism and the related development investments.

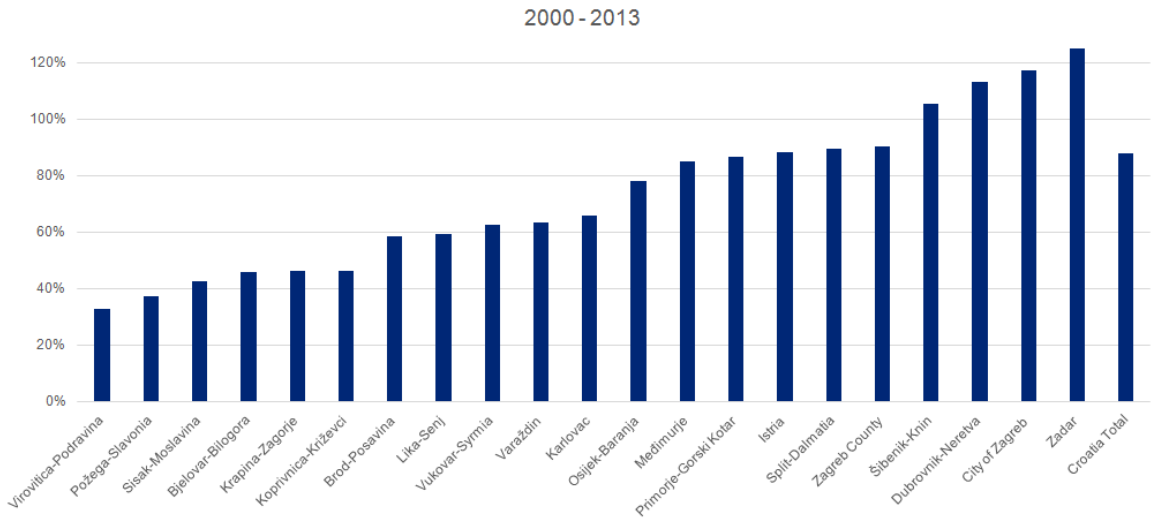


Figure 11: Counties of Croatia by GDP growth from 2000 to 2013 (source: Wikipedia)

Figures 11 and 12 show the counties of Croatia, analysed by the GDP growth rate and the actual GDP amounts (in millions of HRK) in the period 2010-2013, respectively. A huge gap between the fastest growing counties like costal Dalmatian counties and the City of Zagreb, on one side, and the poorest counties of continental Croatia: Virovitičko-podravska, Požeško-slavonska or Sisačko-Moslavačka county, on the other.

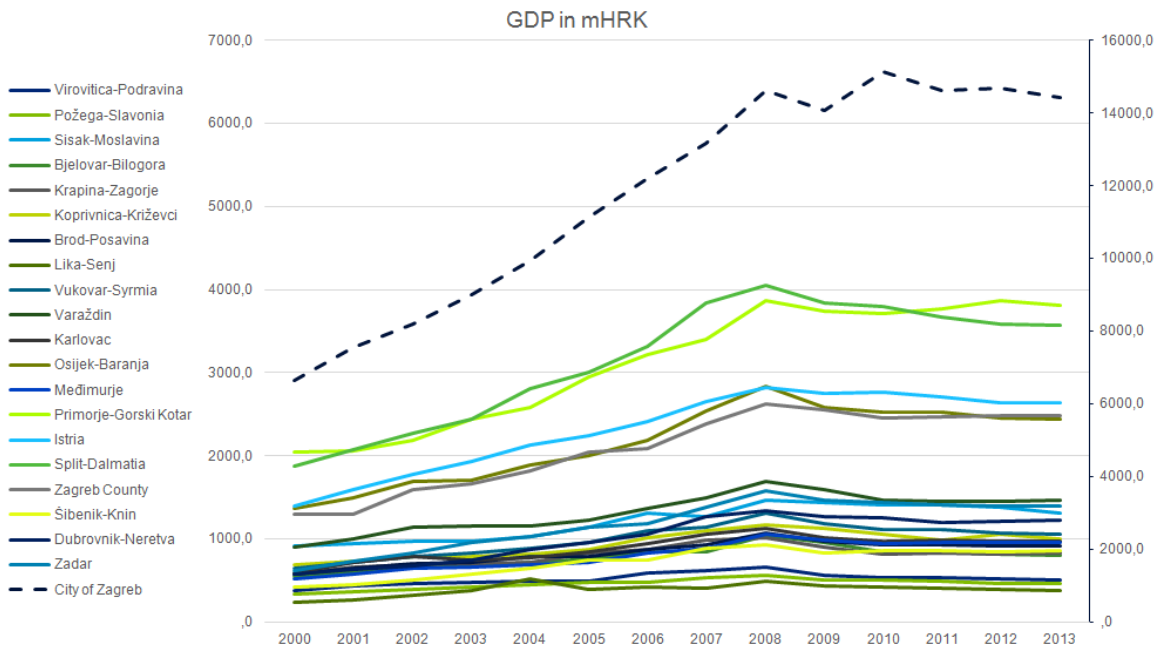


Figure 12: Counties of Croatia by GDP, in million Euro (source: Wikipedia)

The unequal economic development is due to the different economic situation of the continental and costal parts in relation to the City of Zagreb. Depopulation, poor job offerings and a lack of positive migration have hit hard the counties in the former parts. The coastal region sees a growth in tourism from year to year, and huge investments are being made in order to keep the tourist season as long as possible. The population density of 78 inhabitants per km^2 is quite under the EU 27 average, which amounts to about 115 inhabitants per km^2. Northwest Croatia is the region with the largest population density of 191 inhabitants per km^2. Regions with less favourable demographic trends have a significantly lower 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 increased over the last years. From 160 cars/1,000 inhabitants in 1991, it reached 275 cars/1,000 inhabitants in 2001

and 360 cars/1,000 inhabitants in 2008. In the most recent years, since 2008, a slight decrease in the motorization rate has been observed due to the global economic crisis (e.g. in 2012 it decreased to 339 cars/1,000 inhabitants) and 381 cars/1,000 inhabitants in 2015.

- The counties with a higher motorization rate (2015) are Istarska (487 cars/1,000 inhabitants), Primorsko-goranska (430 cars/1,000 inhabitants) and Dubrovačko-neretvanska with 391 cars/1,000 inhabitants. The counties with a lower motorization rate are Vukovarsko-srijemska (275 cars/1,000 inhabitants), Osječko-baranjska (291 cars/1,000 inhabitants), Brodsko-posavska (283 cars/1,000 inhabitants and Virovitičko-podravska (302 cars/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/1,000 inhabitants in 2011., and the City of Zagreb had a motorization rate of 408 cars/1,000 inhabitants in 2011.

Comment

As happened generally 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 implied an increase in the daily mobility needs of the population. Recently, due to the global economic crisis, the increasing tendency in the motorization rate changed to a slight decrease. The numbers from 2014 show again a positive tendency. Partially cars have been de-registered during the economic crises; partially the used car import from other European countries is significantly growing during the recent years.

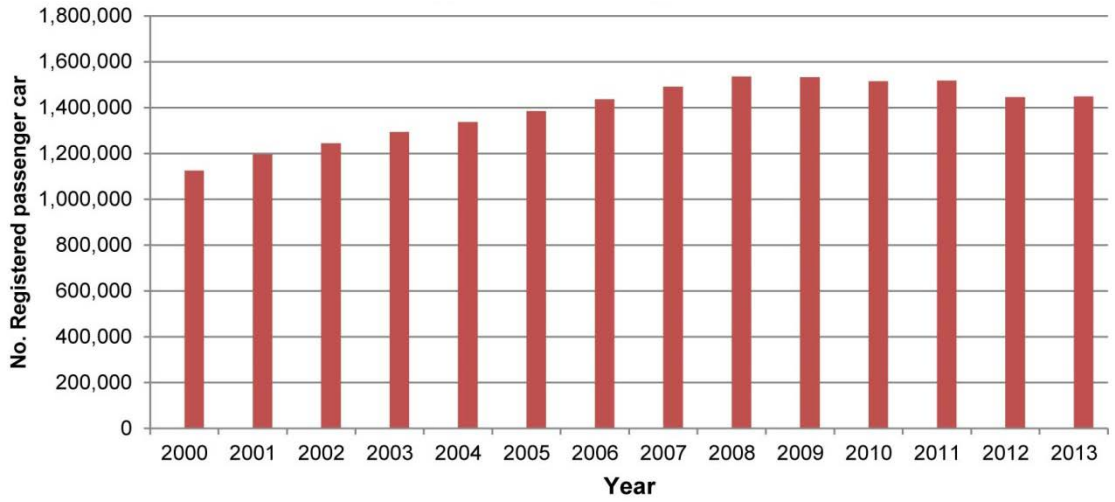


Figure 13: Evolution of registered passenger cars in Croatia (source: NTM)

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 Croatia amounts to < 400 pc/1,000 inhabitants, currently below the European average.

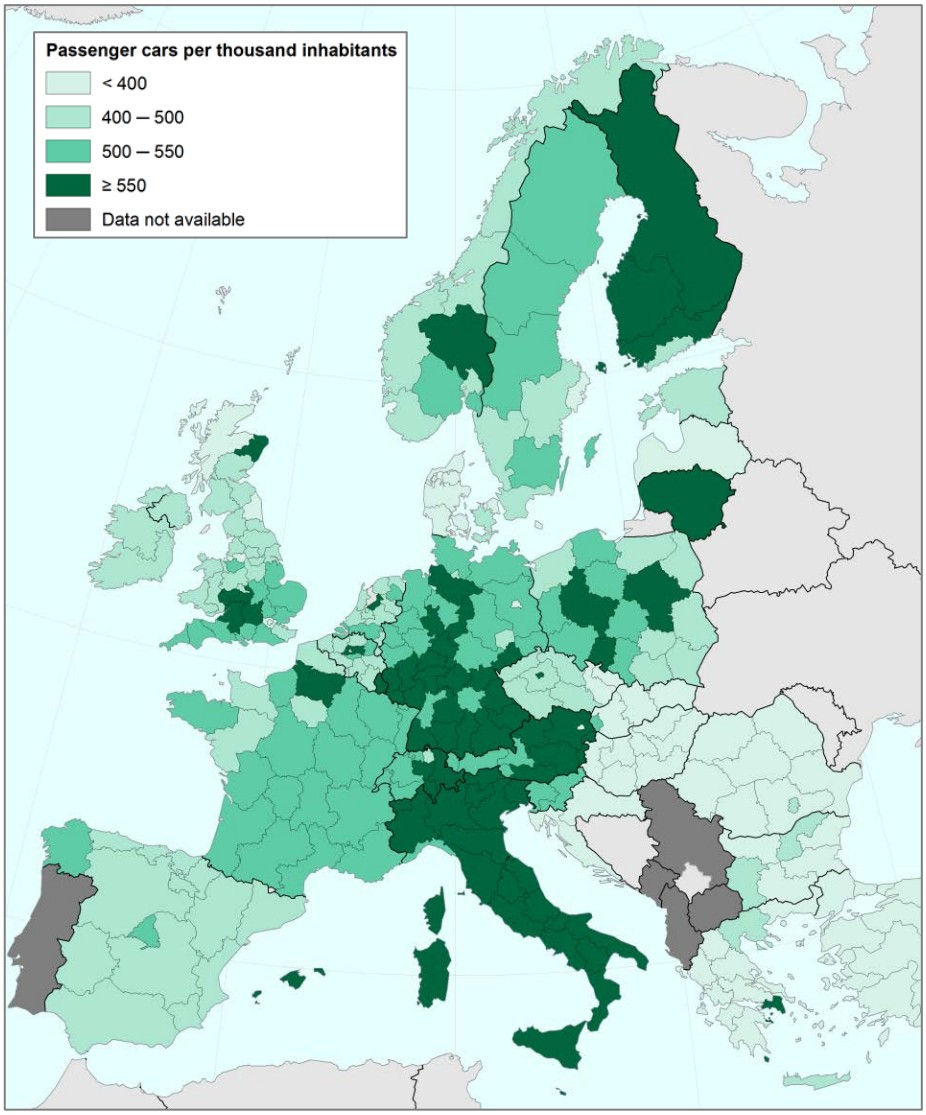


Figure 14: Number of passenger cars per thousand inhabitants by NUTS2 region. 2013 (source: EUROSTAT)

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.

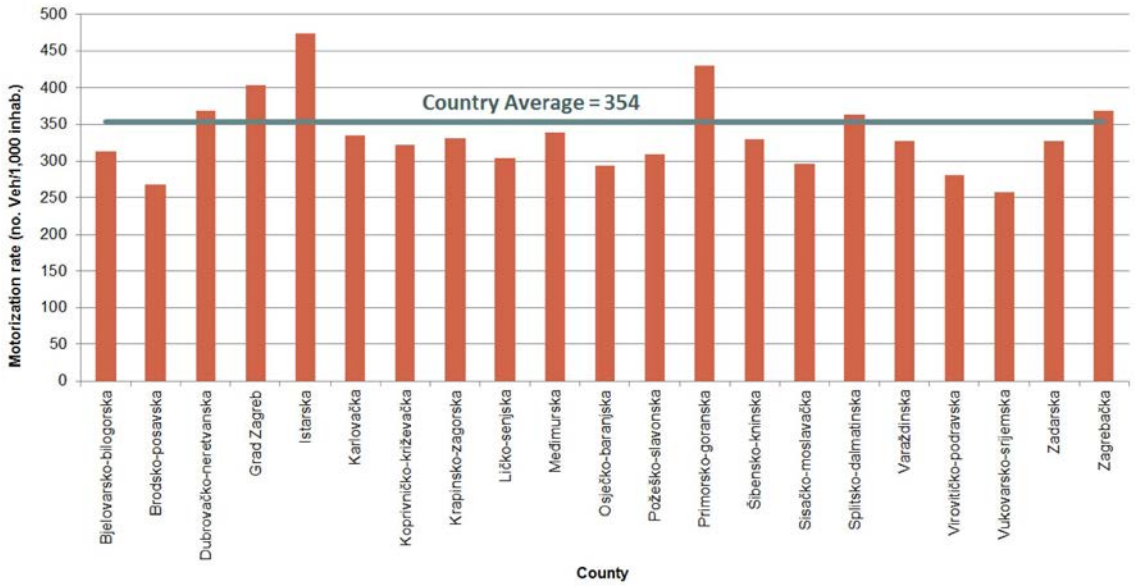


Figure 15: Motorisation rate at County level. 2011 (source: NTM)

2.1.6 Hypothesis

"The traffic numbers in 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 figures 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.

Comment

The Republic of Croatia is highly oriented to tourism. Overall, the share of tourism in country's economy in 2015 was over 18%. More than 92% of all accommodation capacities are located in the Adriatic region. Only the Istrian peninsula has more than one-fourth of all accommodation capacities in Croatia.

Table 2: Accommodation capacity in Croatia in 2015 (source: Tourism in figures 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**

Looking at the total number of tourist arrivals, Croatia has every year an increasing number of foreign tourists, while the number of domestic tourists has stagnated. According to the official statistics of the Ministry of Tourism, more than 14.3 million tourists, of which 12.6 million foreign and 1.6 million domestic tourists, visited Croatia in 2015. In the same year, foreign tourists made a little less than 66 million overnight stays, which is an average of 5.2 nights per tourist, while domestic tourists made 5.7 million overnight stays, an average of 3.5 nights per tourist.

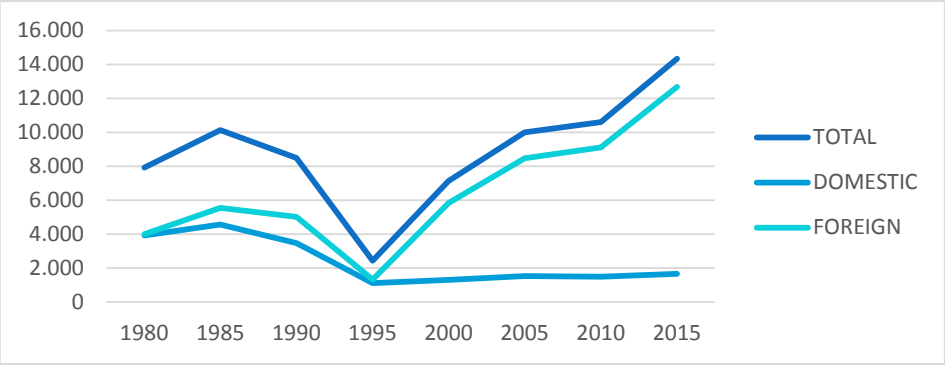


Figure 16: Tourist arrivals (Source: Tourism in figures 2015)

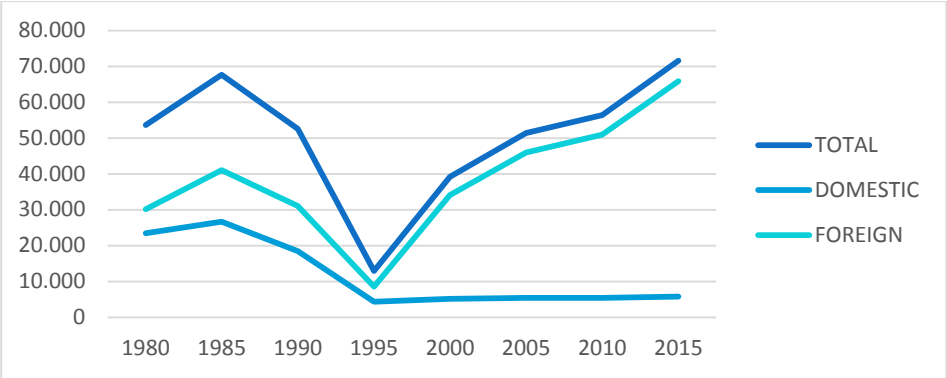


Figure 17: Tourist overnights (Source: Tourism in figures 2015)

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 at the country level during high season is 20% higher than the off-season demand. Given that, during the season, educational institutions are not working and that more than 92% of all accommodation capacities are in the Adriatic region, the season demand in the Adriatic region is 3.1 times higher than the off-season demand. The season traffic demand results in a 2 times higher traffic demand on the main touristic routes, especially on the highways that lead to the Adriatic coast and on the primary roads in the Adriatic Region.

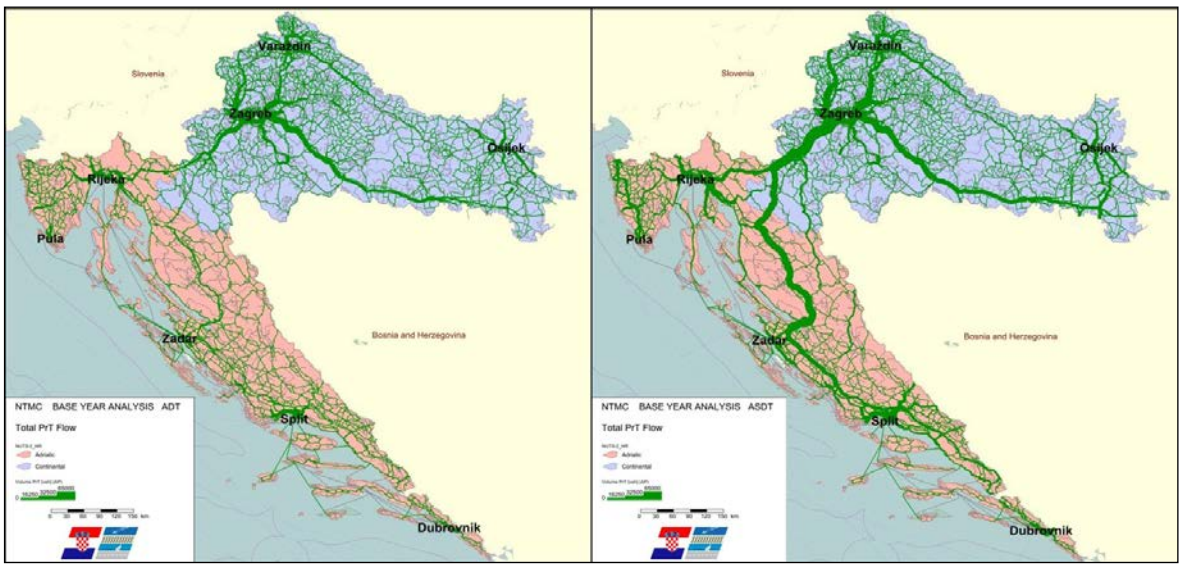


Figure 18: Road traffic – Annual Average Daily Flow for whole Year (ADT) and for seasonal traffic (ASDT) (Source: NTM)

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 private cars in Croatia increased from 10.47 years in 2010 to 12.52 years in 2015

Comment

Recently, due to the global economic crisis, the increasing tendency in the motorization rate changed to a slight decrease. Partially cars have been de-registered during the economic crises; partially the used car import from other European countries is significantly growing during the recent years.

Table 3: Average age of private cars (Source: Centre of vehicles in Croatia)

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

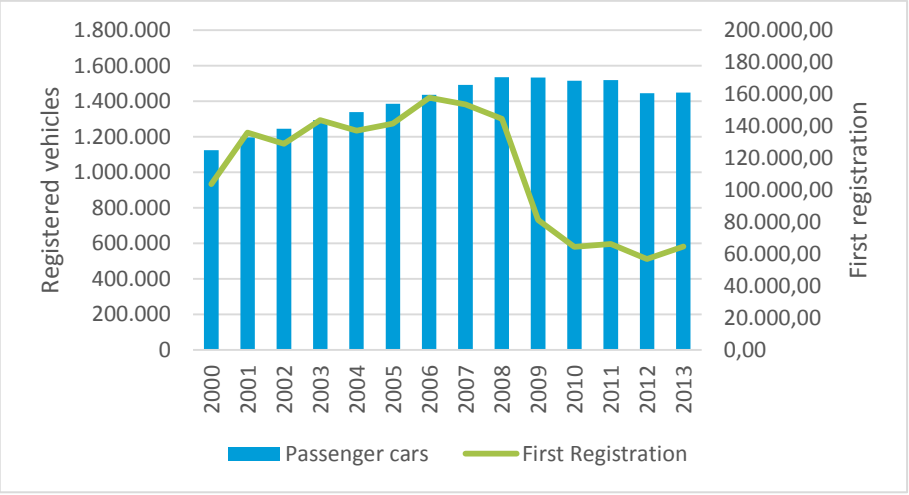


Figure 19: Passenger cars – first registration (Source: NTM)

The diagram in Figure 19 shows the difference in the share of registered cars and new registered cars, which leads to the conclusion that in the last decade, the number of new registered cars has significantly decreased compared with the number of registered cars.

Croatia's joining to the EU started a trend of importing used cars from EU countries with an average vehicle age of 10 years.

2.1.8 Hypothesis

"The better harmonization of Spatial Planning and Strategic Transport development has a big potential for reducing the impact of the transport operation on the environment"

Source

Physical Planning Strategy of the Republic of Croatia (1997); Spatial Development Strategy of the Republic of Croatia – Final Draft (2015); Transport Development Strategy of the Republic of Croatia 2014-2030

Key findings

- Physical Planning Strategy of the Republic of Croatia was adopted in 1997 and amended in 2013, with the Ministry of Construction and Physical Planning as the responsible body.
- Spatial Development Strategy of the Republic of Croatia - The Final Draft was prepared in 2015 under the responsibility of the Ministry of Construction and Physical Planning (adopted by the Government, a public debate is completed, the approval by the Parliament is pending).
- Transport Development Strategy of the Republic of Croatia 2014 - 2030 was prepared in June 2014, under the responsibility of the former Ministry of Maritime Affairs, Transport and Infrastructure.
- Settings, objectives and measures established by the Spatial Development Strategy of the Republic of Croatia and Transport Development Strategy of the Republic of Croatia 2014-2030 are the basis for the spatial planning of smaller spatial units, i.e. for the development of master plans of functional regions and "new generation" spatial plans.

Comment

Compatibility and coherence in the strategic decision-making process are fundamental and important tools for achieving global and specific objectives, such as sustainable development, environmental protection and the development of transport infrastructure in the Republic of Croatia and its regions. Therefore, it is extremely important to consider all the above mentioned strategic documents in order to define a sectoral action plan that will contribute to the national development in a consistent and coordinated manner.

According to the Physical Planning Strategy of the Republic of Croatia, which was adopted in 1997 and amended in 2013, the territory of Croatia can be assessed as having all the elements necessary for the integration into the EU's development systems. Croatia's geographical location is particularly favourable for the development of traffic routes connecting Western and Central Europe with Southeast Europe and the Middle East. However, the current level of development is not in accordance with resources (the situation in the country's economy affects domestic traffic as well as traffic from other countries).

Spatial Development Strategy of the Republic of Croatia – The Final Draft was prepared under the responsibility of the Ministry of Construction and Physical Planning in 2015 and adopted by the Croatian Government. The Spatial Development Strategy will be the basis for the future development of planning system, protection, and physical planning and it is based on:

- the value of the Croatian territory, which is stemming from the mosaic of spatial basis and spatial identity shaped by the natural, cultural, social and landscape values, heritage in the construction, and spatial design;
- the achievements of previous planning models and the implementation of spatial development: the tradition of urban and regional planning, as demonstrated by the Croatian territory and zoning system based on the orientation of the Physical Planning Strategy of the Republic of Croatia from the 1997;
- an international context, particularly the one accepted by the Republic of Croatia in the pre-accession period, along with its status as the 28th Member State of the European Union (EU).

The „Transport Development Strategy of the Republic of Croatia 2014 - 2030" was developed in June 2014 with the following main strategic set-up: The strategic planning is the basis for the development of the transport sector and a tool serving the country's high-level economic and social policy goals. Therefore, in terms of strategic planning, the traffic is considered as a basic system that will meet the mobility needs of Croatian citizens, and at the same time as an effective and important means of promoting economic development, social and territorial cohesion by ensuring the greatest benefit in the service of society.

These two Strategies were prepared in different periods, due to the procedure for adopting the Spatial Development Strategy of the Republic of Croatia – The Final Draft by the Parliament, and because of the revision of the Transport Development Strategy of the Republic of Croatia 2014 – 2030, it is necessary to reconcile them by interconnecting the main objectives.

Spatial planning in the Republic of Croatia is based on the Physical Planning Strategy of the Republic of Croatia from 1997. This Strategy is the basis for the structuring of following spatial plans at the national level:

- Spatial plan of areas with specific characteristics,
- Urban plans at the national level.

Lower-level spatial plans, such as County Physical Plans, are prepared based on the Croatian internal spatial distribution.

The harmonization of the strategies at the national and regional levels is a necessity that will contribute to the sustainable development of the entire country and each individual region. Settings, objectives, and measures established by the Spatial Development Strategy of the Republic of Croatia and Transport Development Strategy of the Republic of Croatia 2014 - 2030 are the basis for the physical planning of smaller spatial units, i.e. for the development of master plans of functional regions and "new generation" spatial plans. All these spatial and master plans should be created in accordance with the possibilities of their realization and implementation.

Master plans of functional regions should provide measures how to reduce regional development disparities and how to strengthen the development potential of a region, in

order to increase the overall competitiveness of the country, while taking account of the current and future needs. Therefore, it is extremely important to consider all strategic documents to define a sectoral action plan in a consistent and coordinated manner.

Consequently, one can concluded that, in preparing the spatial plans at all levels, it is necessary to observe the preferences of the national strategy.

The City of Dubrovnik, as a globally recognized tourist destination, is competitive and attractive to investors and, a good example of compliance with the Tourism Development Strategy of the Republic of Croatia until 2020. On the other hand, the harmonization of the physical plans of Dubrovnik, the Dubrovačko-neretvanska County and the Republic of Croatia, requires substantial mutual adjustment of the plans with each other, as well as their alignment with national strategy.

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

Comment

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. The most common approach to define functional regions is using data about

population commuting to work and school because the pattern of the daily commute is a good approximation 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

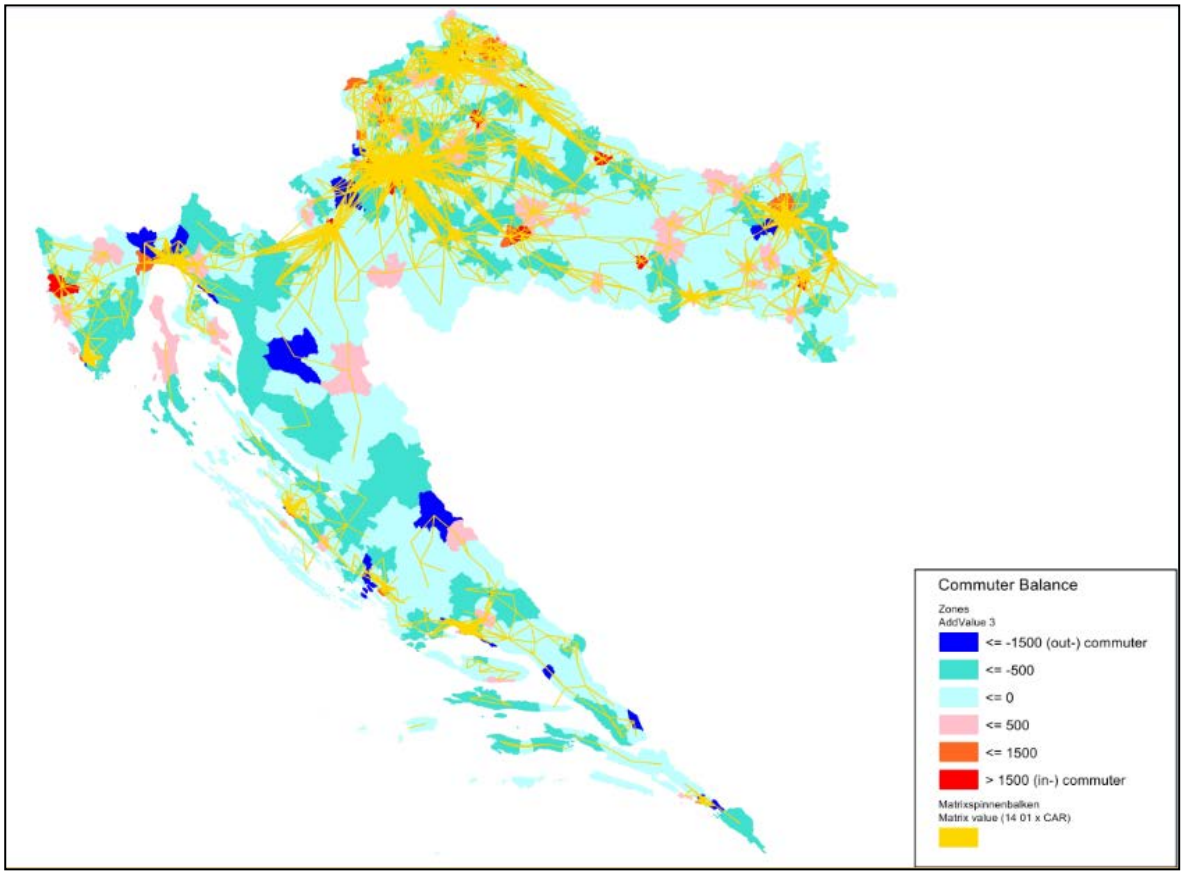


Figure 20: Display of Commuter Flows for the definition of Functional Regions (Source: NTM)

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.

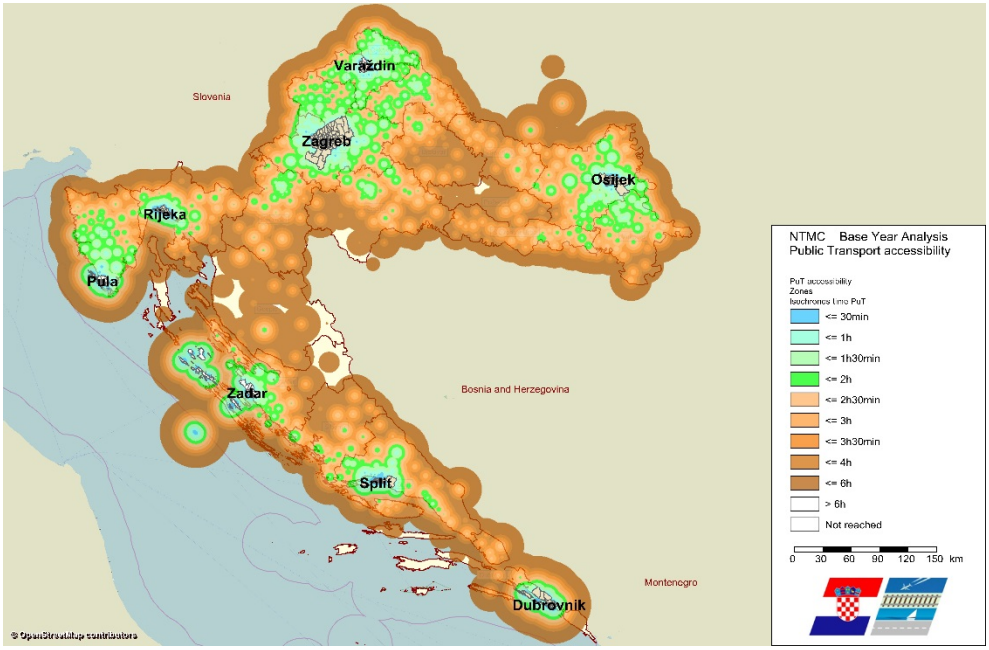


Figure 21: Accessibility of regional centres using public transport (Source: NTM)

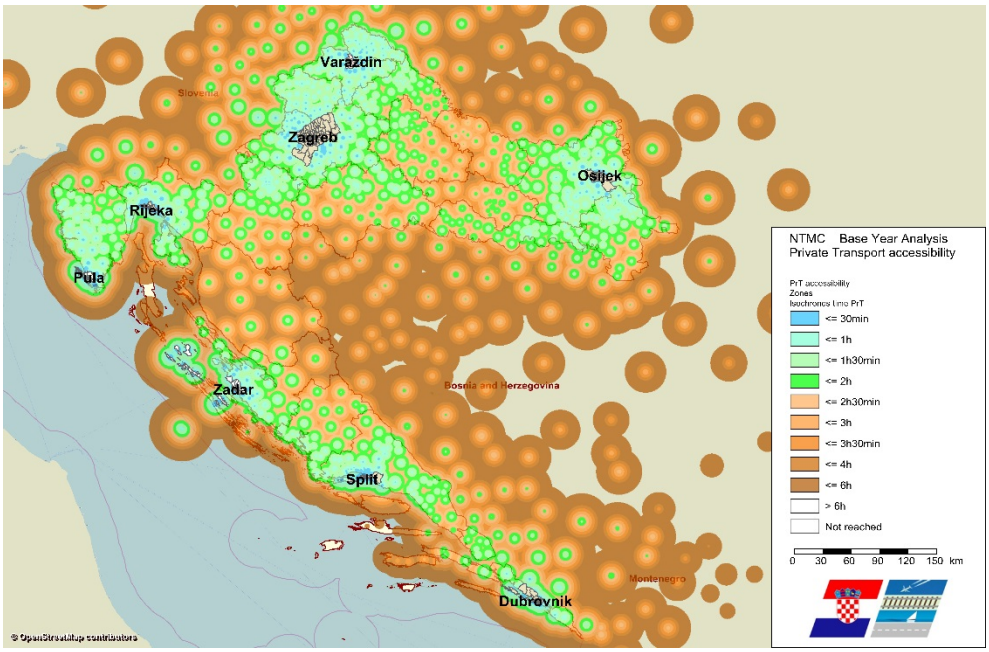


Figure 22: Accessibility of regional centres using private transport (Source: NTM)

Central-Croatia

Given its geographic position, Central-Croatia plays a prominent role in the transport network 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, 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, Croatia's third largest city, 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.

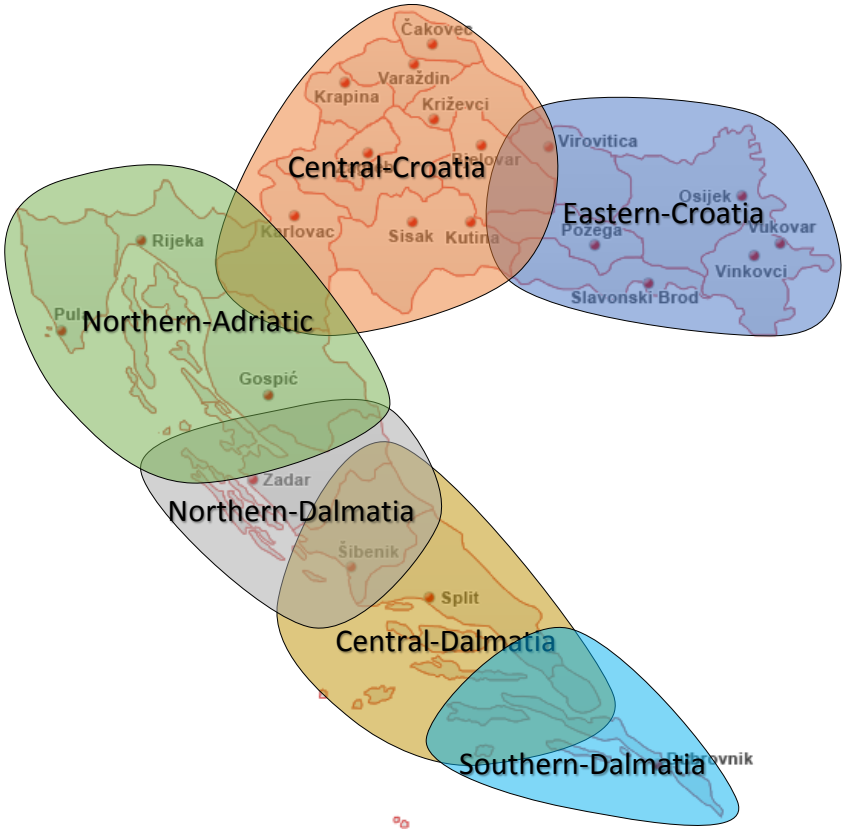


Figure 23: Functional regions in the Republic of Croatia

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 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

Comment

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.

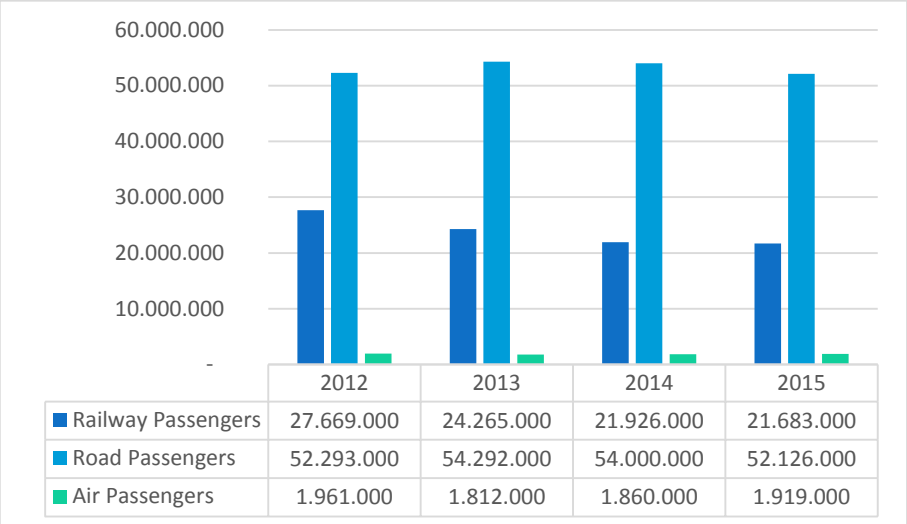
Regarding railway and urban/suburban transport, the big fluctuations in the recent years can be explained by modification in the method of counting passengers carried by ZET and HZPP. In 2011 the City of Zagreb stopped providing financial support for a joint ZET-HZPP ticket. The passengers carried by ZET (Zagreb PT) and HZPP (railway) are now counted separately, which resulted in a sharp decline in the number of railway passengers

carried in 2011. 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 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 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.



	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

Figure 24: Number of passengers carried in Croatia for period 2012-2015 (Source: CBS)

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.

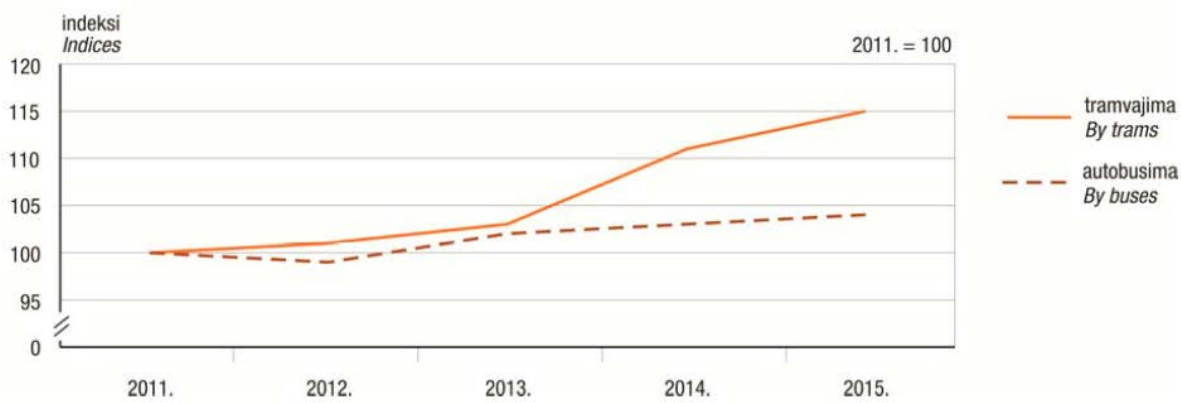


Figure 25: No. of passengers carried in urban and suburban PT (Source: CBS)

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.

Figure 26: No. of passengers carried in PTs for period 2011-2015

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.

In real terms, the number of passengers in all PT modes was increasing in the last 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

Spatial Development Strategy of Republic of Croatia; 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.

Comment

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 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 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 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.

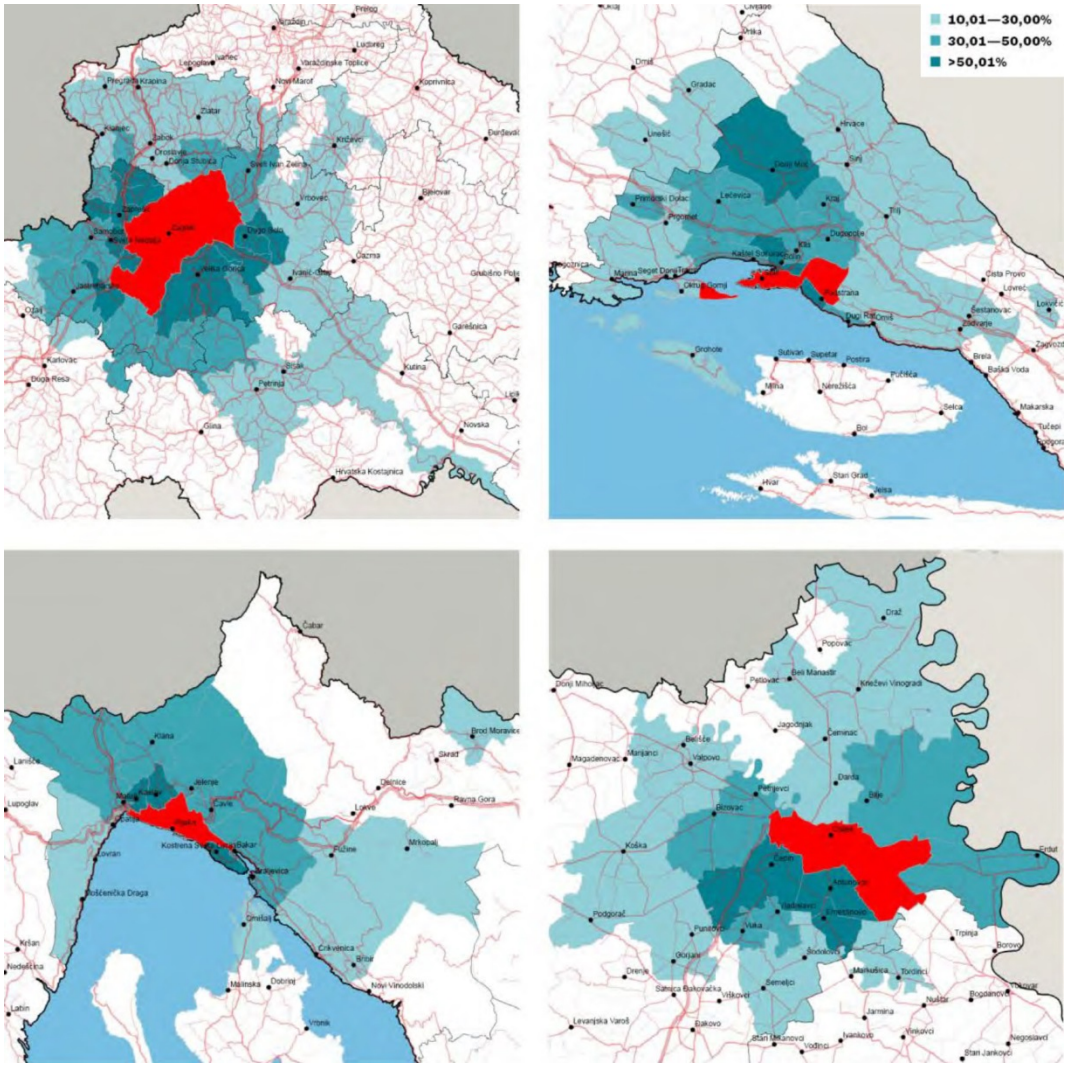


Figure 27: Daily migrants in Zagreb, Split, Rijeka and Osijek in relation to the total number of employees in local government (Source: Spatial Development Strategy of the Republic of Croatia)

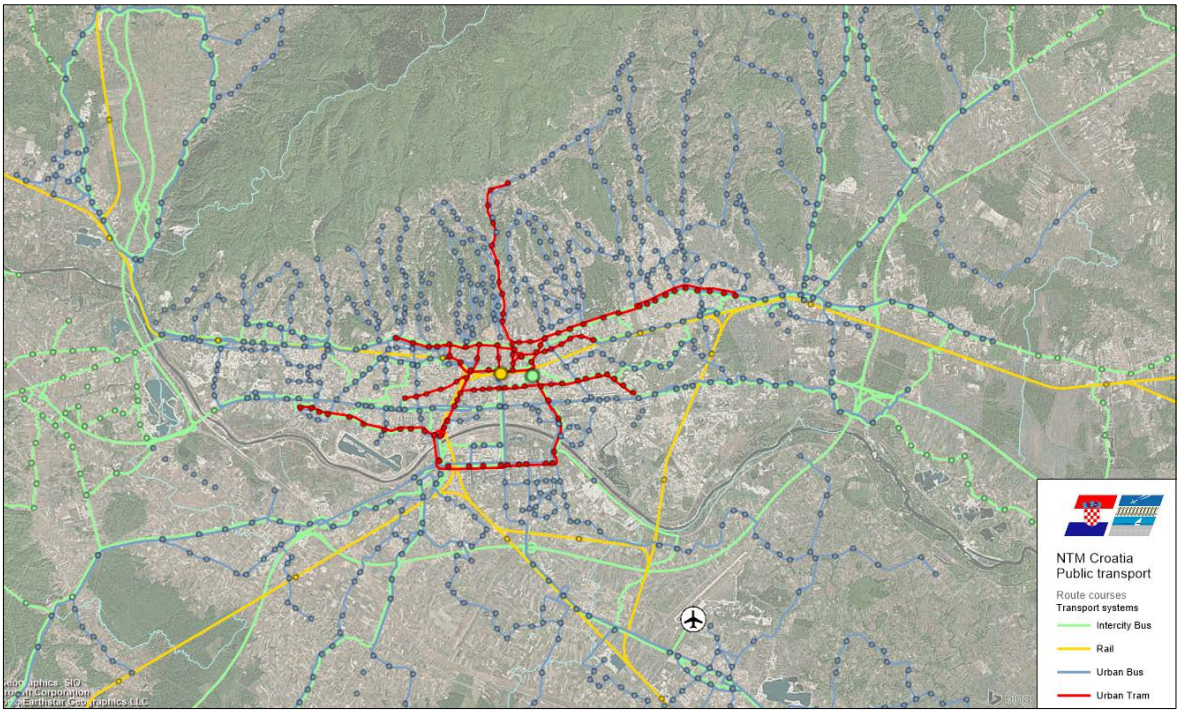


Figure 28: Tram and bus routes and stops in Zagreb (Source: NTM)

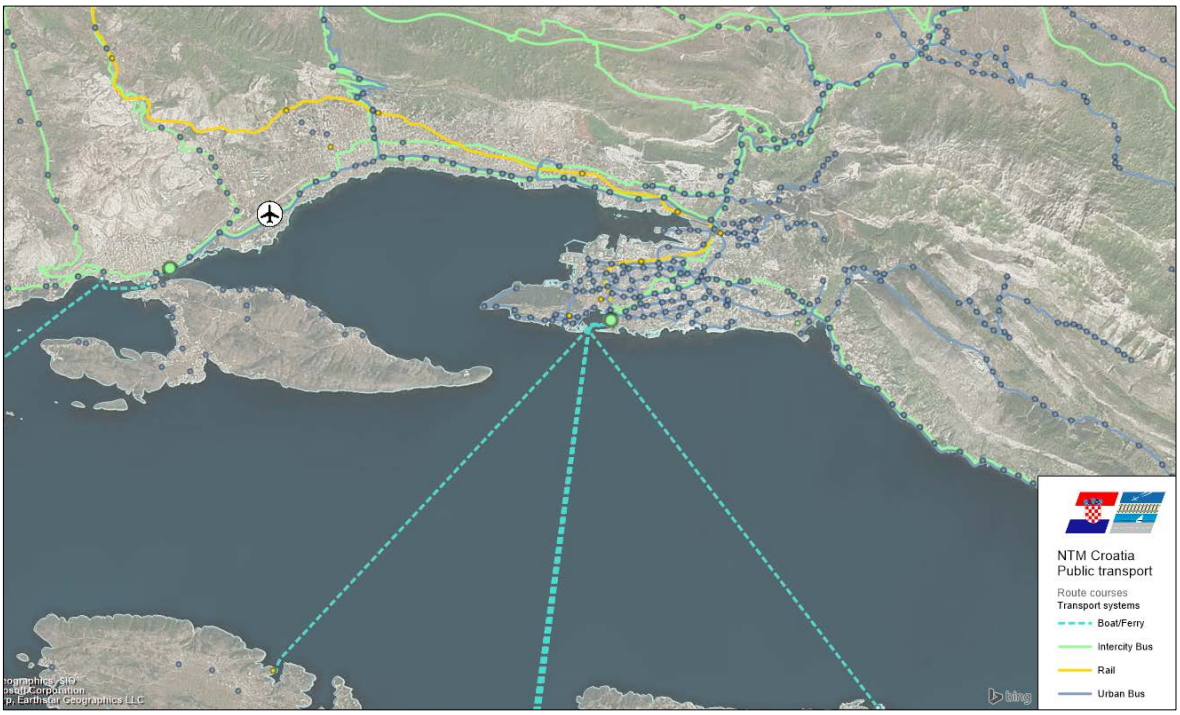


Figure 29: Bus routes and stops in Split (Source: NTM)

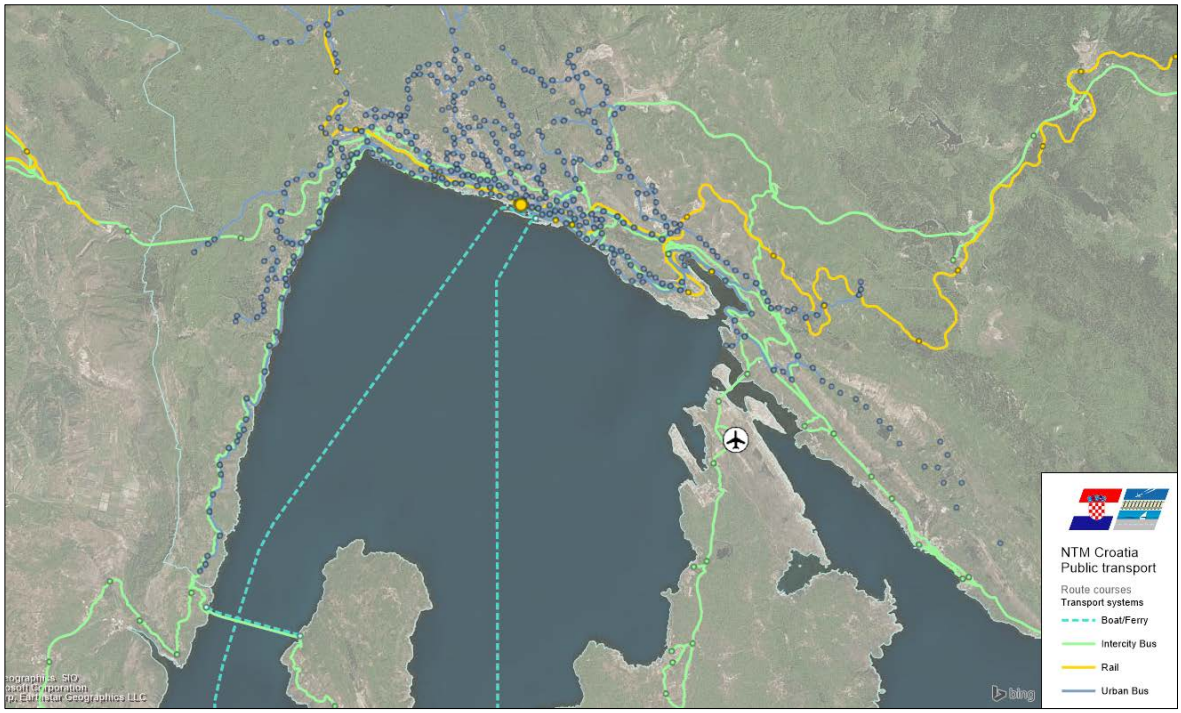


Figure 30: Bus routes and stops in Rijeka (Source: NTM)

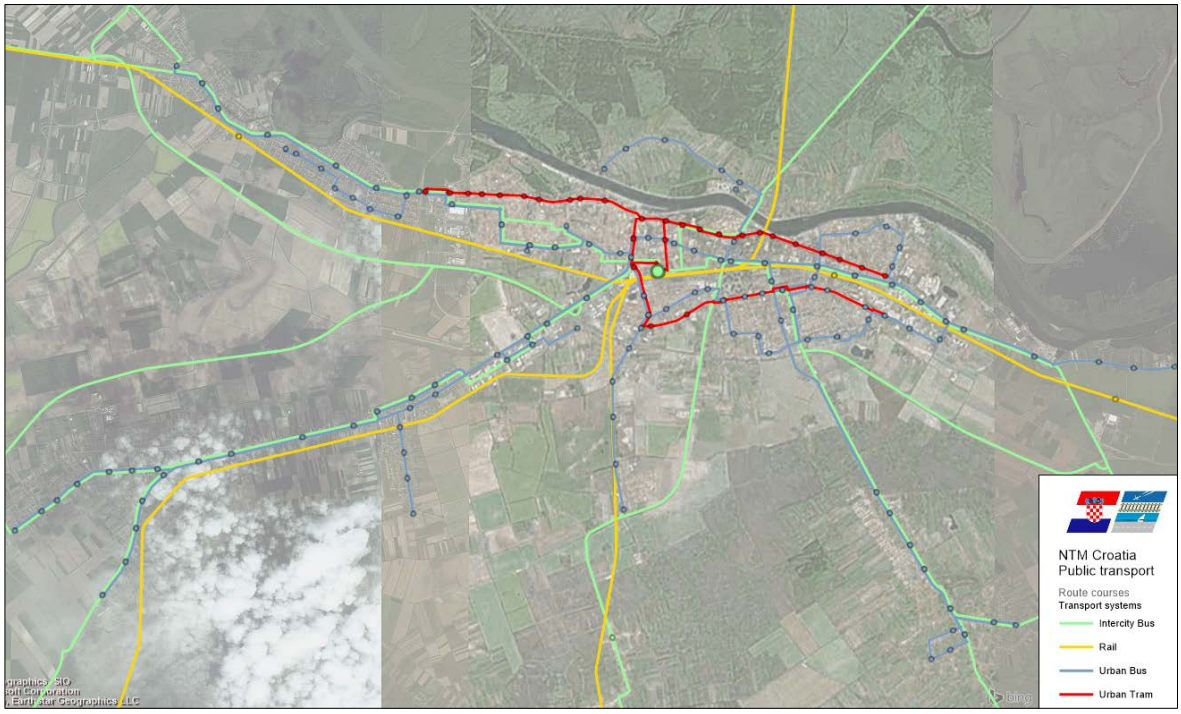


Figure 31: Tram and bus routes and stops in Osijek (Source: NTM)

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.

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

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

The concession contracts for buses last around 4 or 5 years but only 45% or 50% are currently on operation due to the low level of service offered.

The public transport system has a deficit balance. It is estimated that public transport cover only 20% of the total costs. The loss of the municipal owned operators is covered by the municipality budgets.

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.

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.

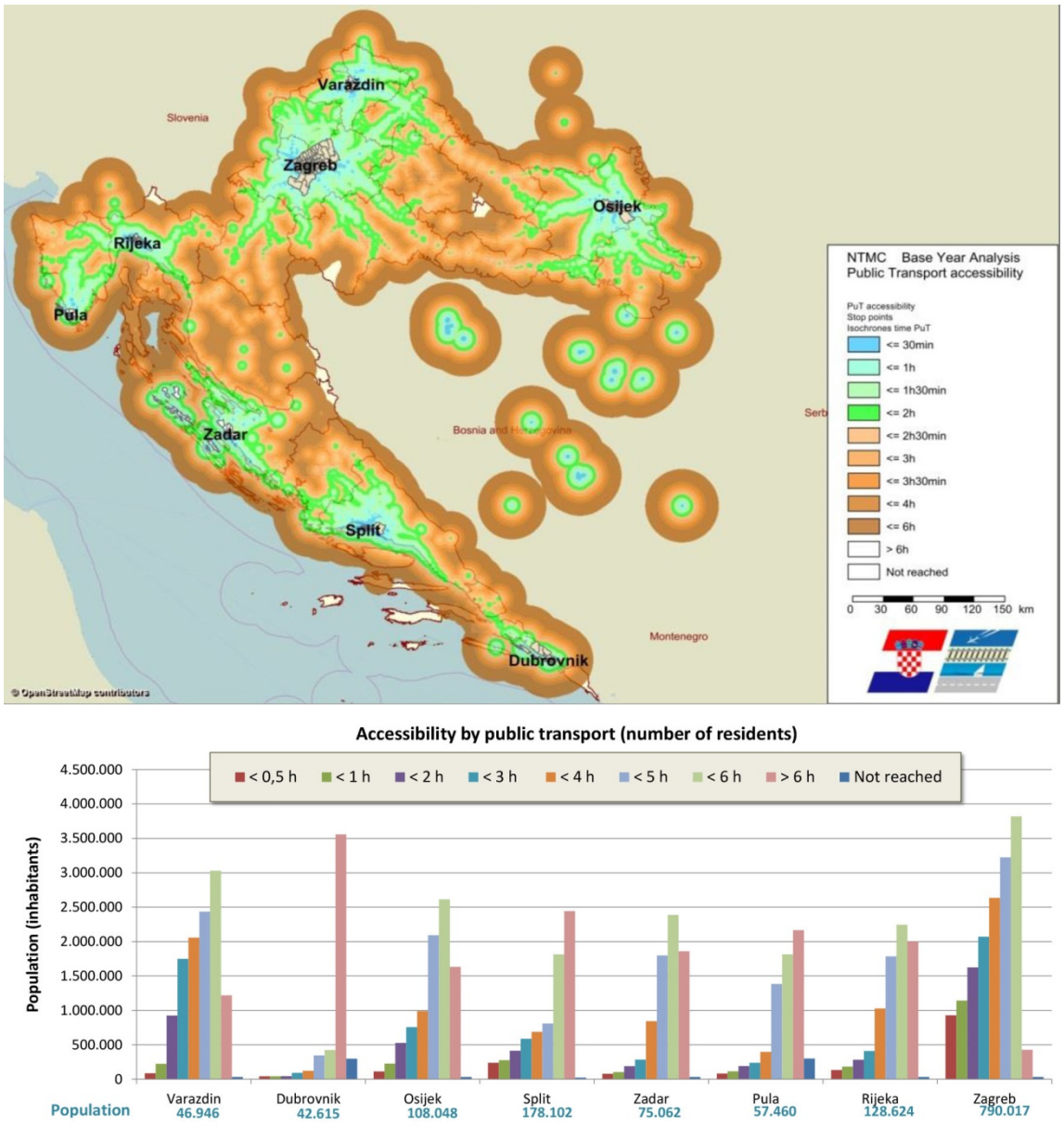


Figure 32: Public transport accessibility (Source: NTM)

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; 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.

Comment

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.

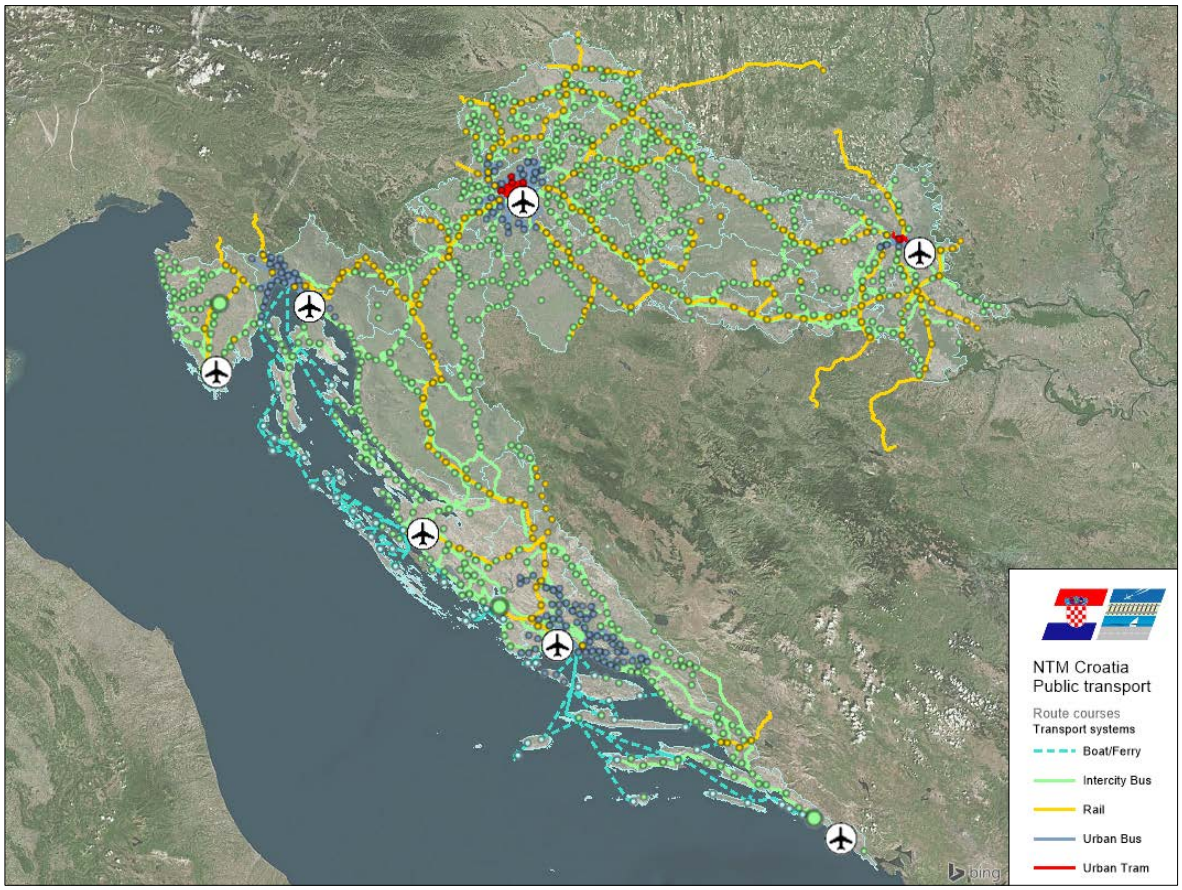


Figure 33: Public transport routes in Republic of Croatia (Source: NTM)

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.

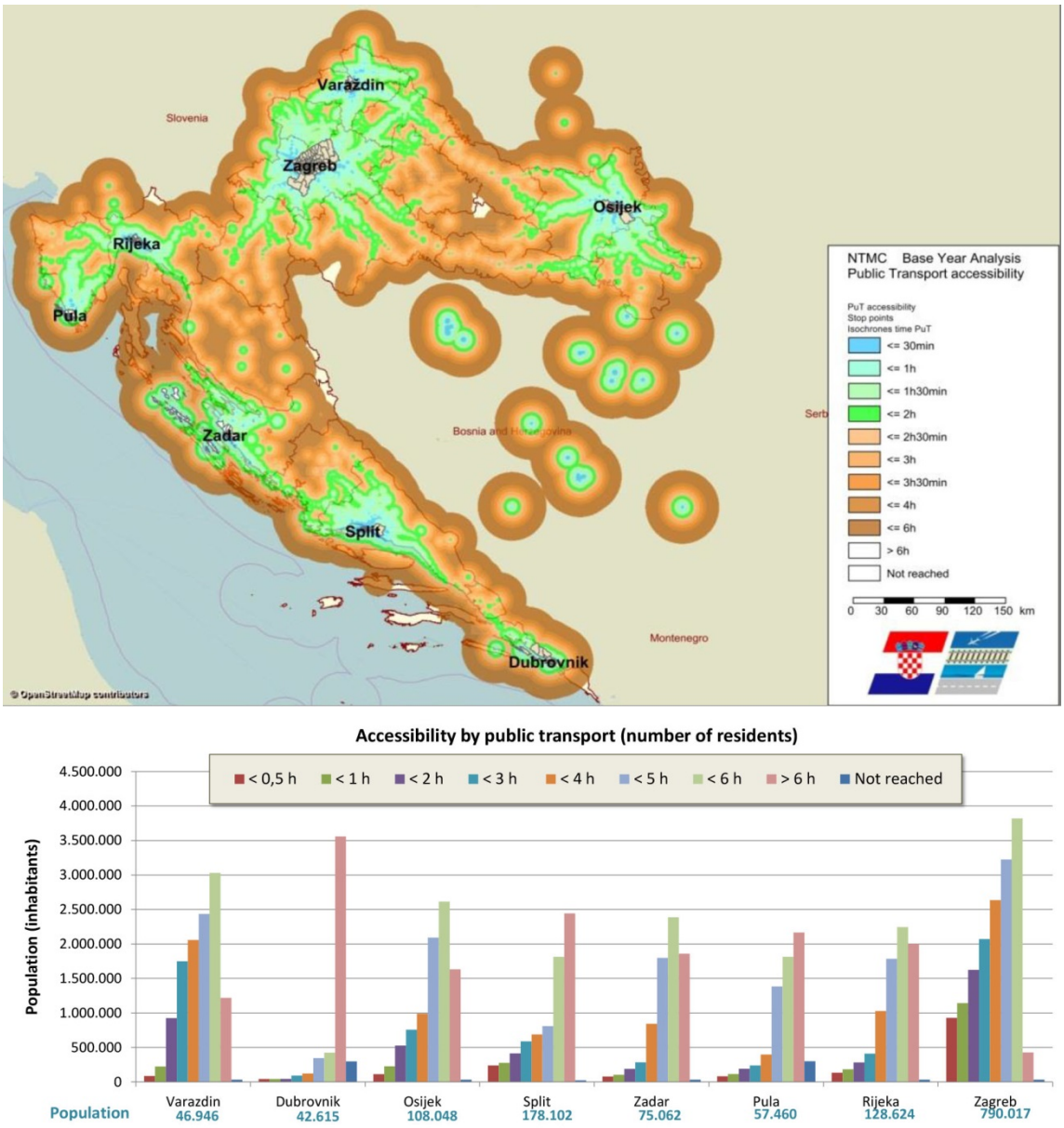


Figure 34: Public transport accessibility (Source: NTM)

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 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.

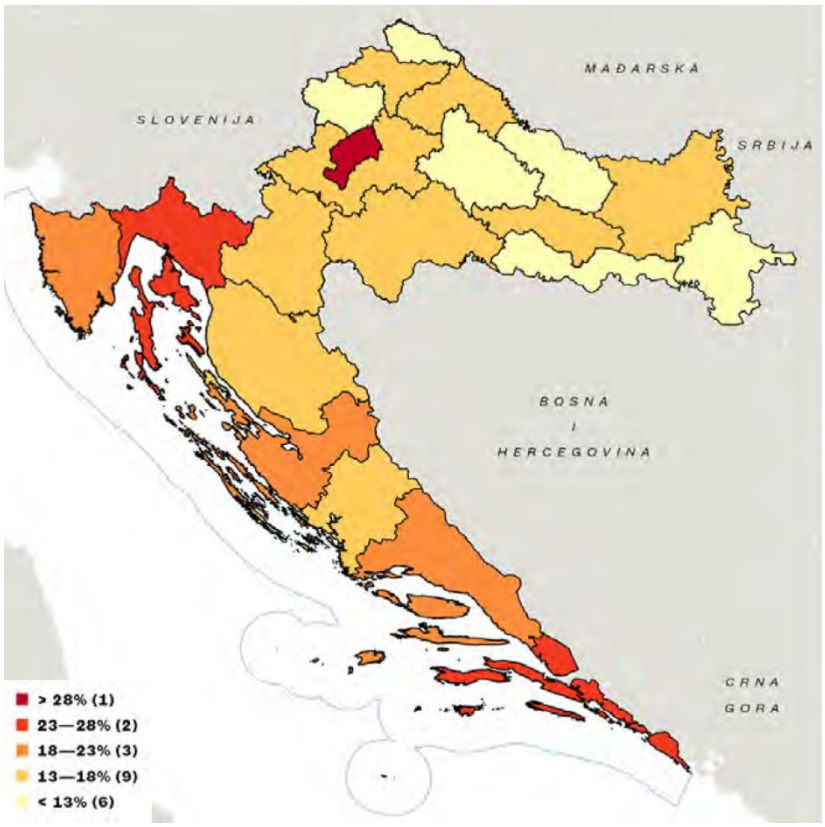


Figure 35: The share of highly educated working age population (Source: Spatial Development Strategy of the Republic of Croatia)

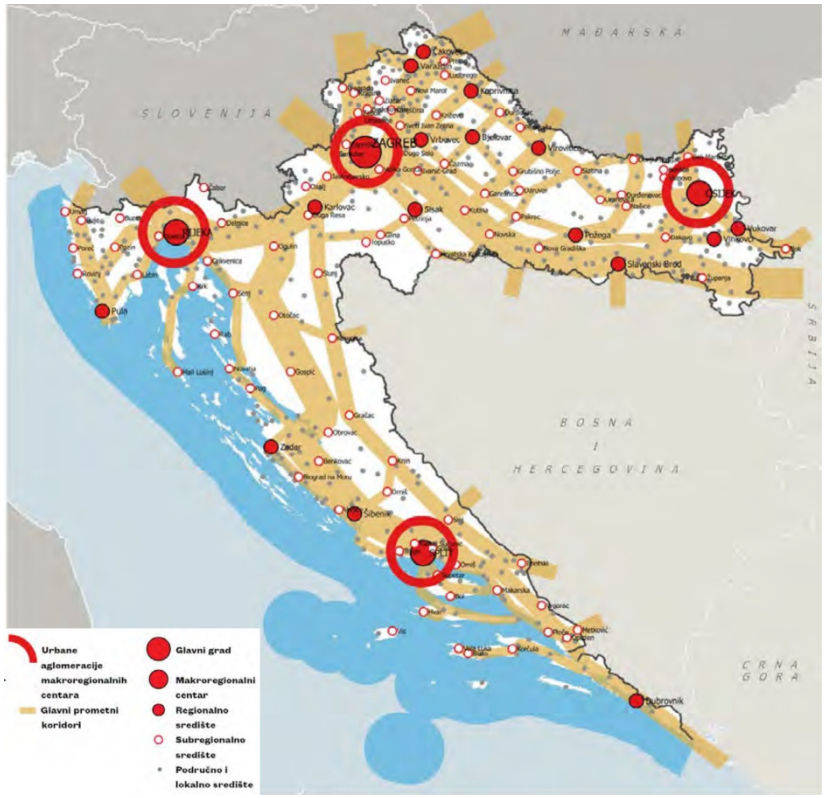


Figure 36: City region and spatial transport corridors (Source: Spatial Development Strategy of the Republic of Croatia)

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 Croatia with poor transport communication such as Ličko-senjska, Primorsko-goranska, Bjelovarsko-bilogorska, Virovitičko-podravska and Požeško-slavonska counties, Croatian 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 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. Domestic tourism such as weekend tourism and agro tourism also offer much potential.

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. It is an advanced, user-oriented form of public transport characterised by flexible routing and scheduling of small/medium vehicles operating in shared-ride mode between pick-up and drop-off locations according to passenger's needs. The same principle of on-demand PT service can be applied in Croatian areas with a low population density and low accessibility of PT.

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.

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 Croatia
- The ITS system on the motorway network is well developed, however the integration into the local and regional ITS system is lagging behind.

Comment

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

In recent years, public transport (PT) in Croatia reported a decrease in the number of passengers in all modes of transport. In the period from January to December 2012, passenger transport registered decrease of 20.1% compared to the same period of 2011. The decrease in railway transport was 45.5%, and 0.5% in road transport. Sea and coastal transport has decreased by 3.5%, while air transport has decreased by 5.7%.

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 CO2 emissions from transport and 69% of road accidents occur in cities. These issues are felt in the main urban nodes/metropolitan areas 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.

Croatian motorways are equipped with information and communication systems for data exchange. The Centres for maintenance and traffic control are responsible for traffic management. 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...

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…). Development of ITS in 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 Croatia
- The use of e-bike has a great potential for the development of bike system in cities with unfavourable morphology

Comment

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 (Source: European Cyclist Federation)

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

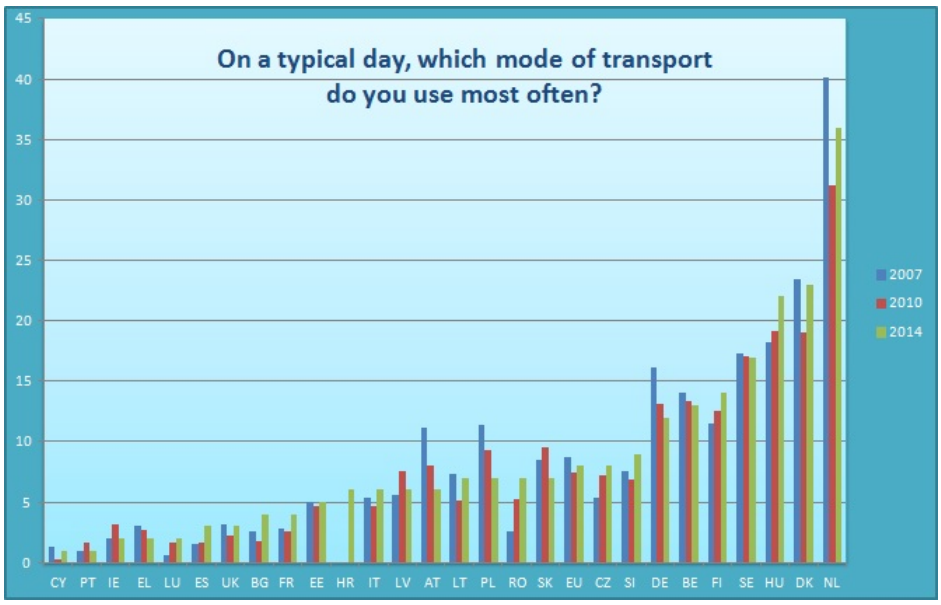


Figure 37: Cycling - a typical mode of transport in the EU countries (Source: European Cyclist Federation)

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 Bicycle accidents on Croatian Roads, 2005–2014). To increase the safety and attractiveness of bike rides it is a necessary to plan and construct bicycle infrastructure.

Table 7: Bicycle accidents on Croatian Roads 2005 to 2014 (Source: CBS)

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%

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 38: 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 (Source: European Cyclist Federation)

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)

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.

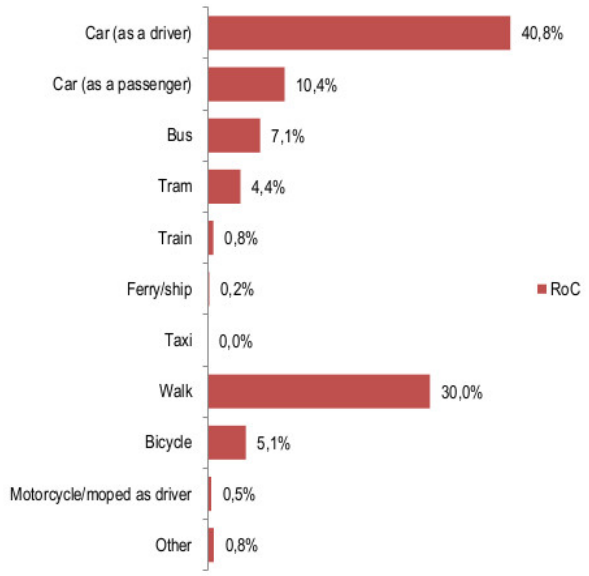


Figure 39: Proportion of all trips taken by different methods of transport, at the national level (Source: NTM)

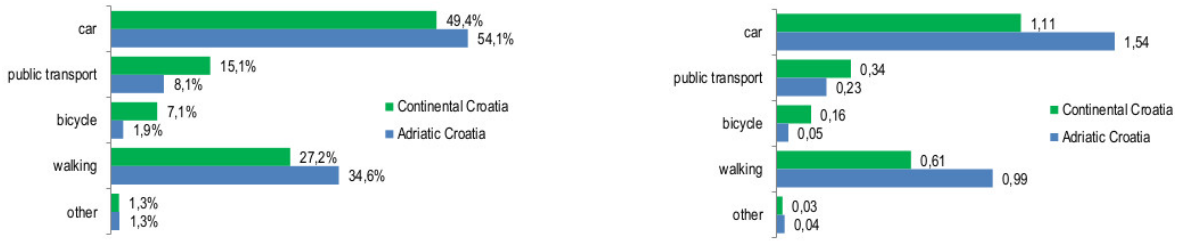


Figure 40: Proportion of all trip rates and trip rates by different methods of transport at the regional level (Source: NTM)

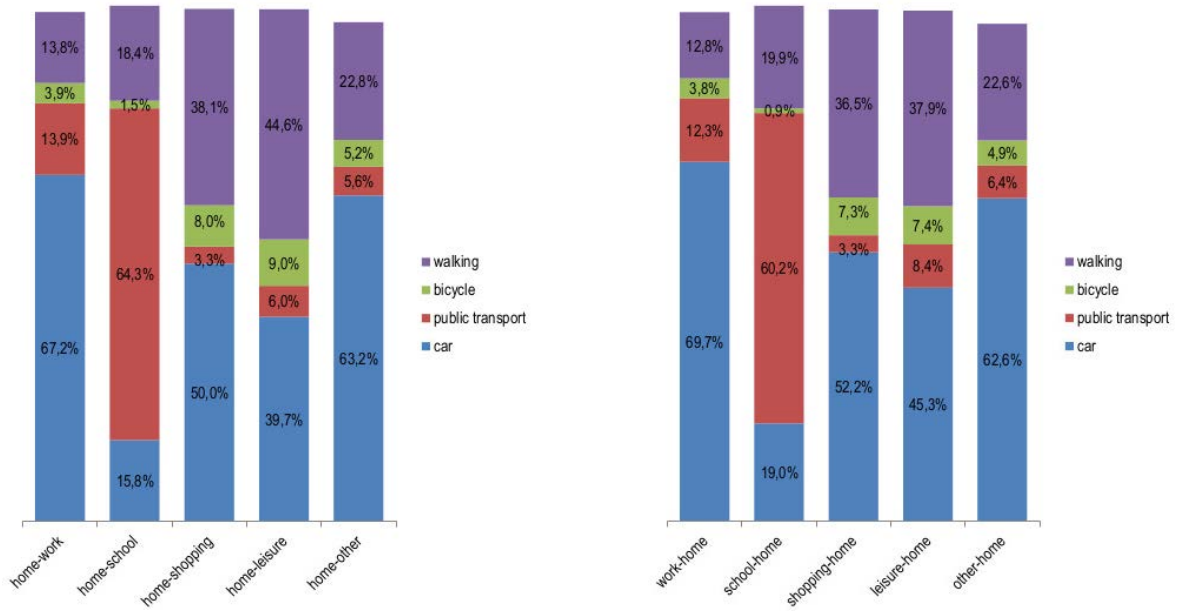


Figure 41: Trip purpose with home as the origin of trip by mode of transportation (Source: NTM)

The bicycle doesn't require a license plate, driver's license, helmet, nor insurance. Riders travel on a healthy and environmentally friendly machine 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

Comment

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.

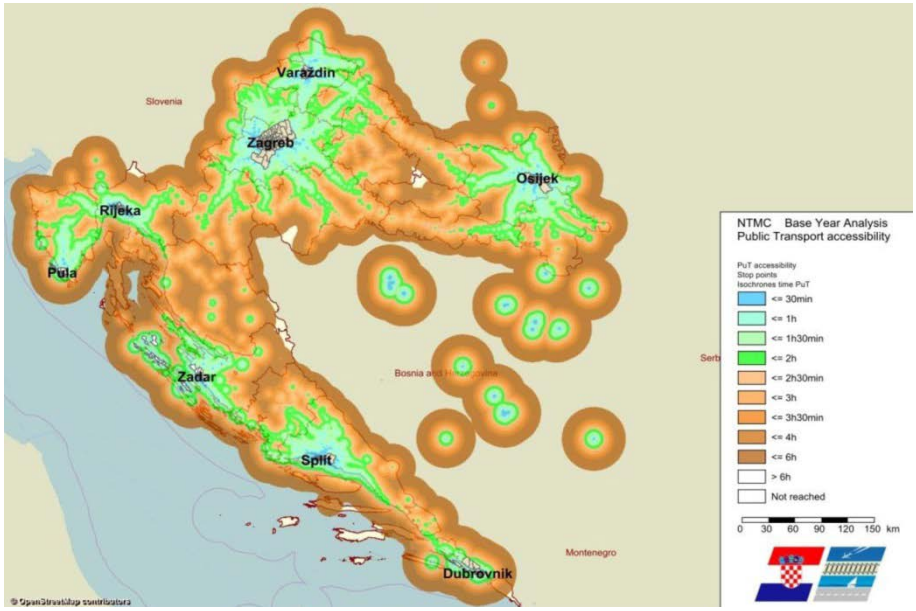


Figure 42: Accessibility by public transport (Source NTM)

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 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... 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.

Comment

Looking at the average age of rolling stock of four biggest cities and their PT systems in 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. In the period 2013–2015 the need for the renewal of the GPP Osijek rolling stock was repeatedly stressed, but has never been acted upon.

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

Comment

Pursuant to Article 3 of Regulation (EC 1370/2007 of the European Parliament and the Council of 23.10.2007 on public rail and road passenger transport) it is necessary that the competent authority compensates the public service operators for the net financial effect, positive or negative, on cost incurred and revenues generated in complying with the tarrif obligations established through general rules in a way that prevents overcompensation. 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

Comment

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.

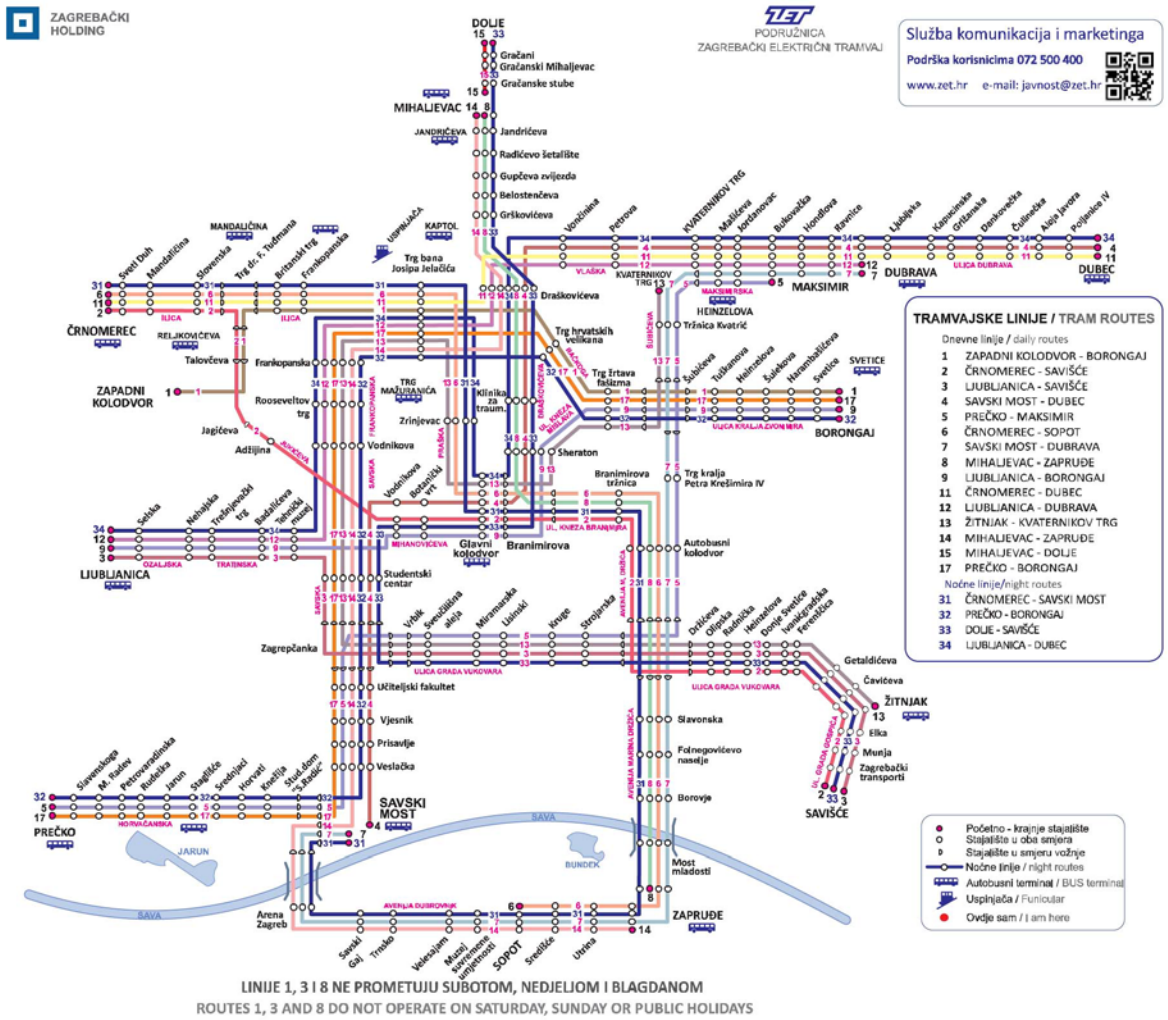


Figure 45: Zagreb tram lines (Source: ZET)

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.

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 NT2200. 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.

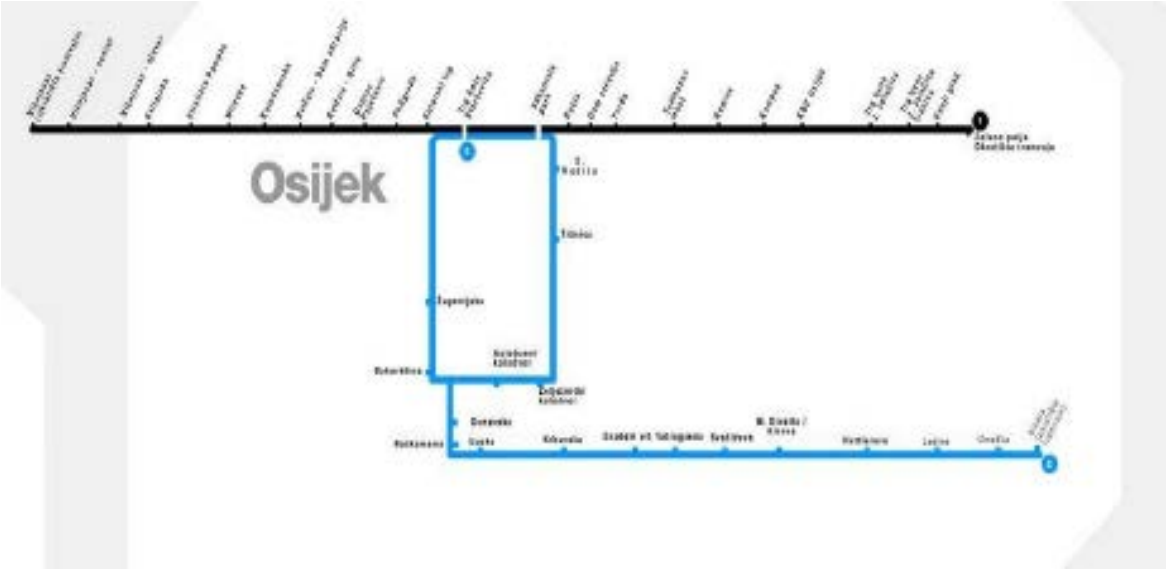


Figure 46: Osijek tram lines

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 35% of the tracks is in very poor condition and require thorough reconstruction, about 5% of the tracks is on the border of becoming in very poor condition, and 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 Ltd. 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

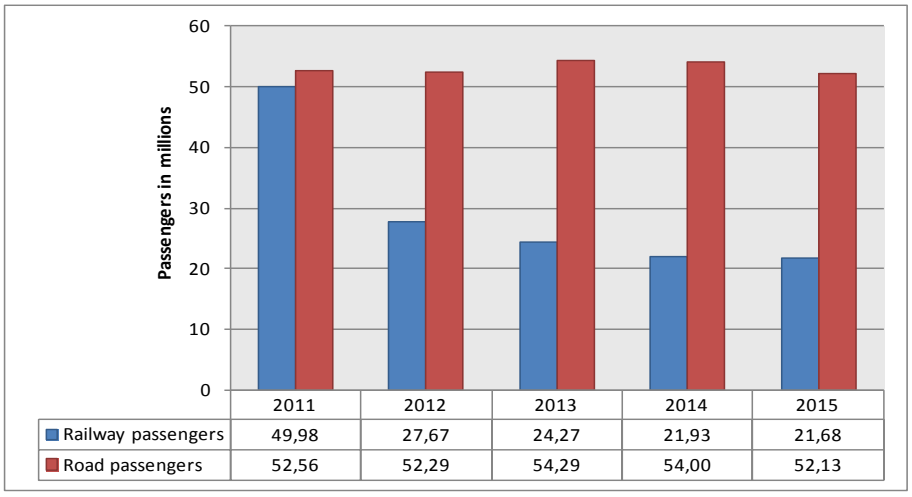
Croatian Bureau of Statistics (CBS)

Key findings

- Significant decline of railway passengers in Zagreb agglomeration in 2012 after stopping the integrated ticketing between HZ PP 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.

Comment

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.



	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

Figure 47: Number of passengers in Railway and Road transport (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 Croatia.

Comment

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 HZPP 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.

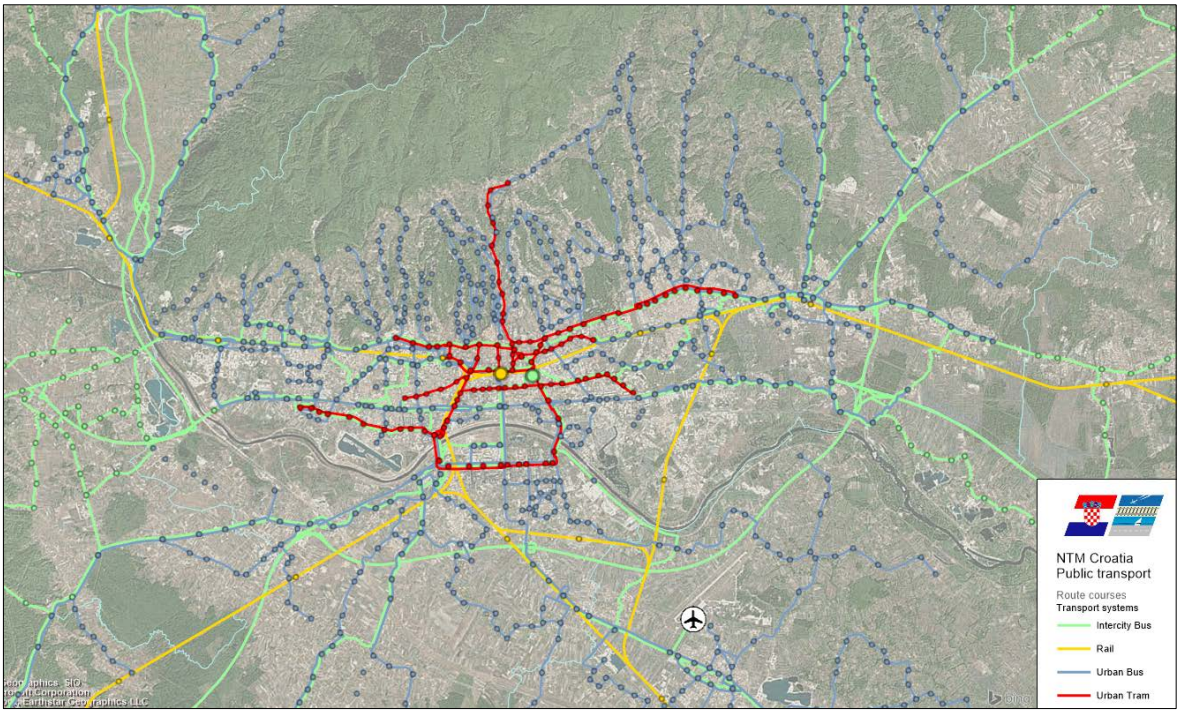


Figure 48: Zagreb Public transport, Red – tram lines, Blue – bus lines, Yellow – railway) (Source: NTM)

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

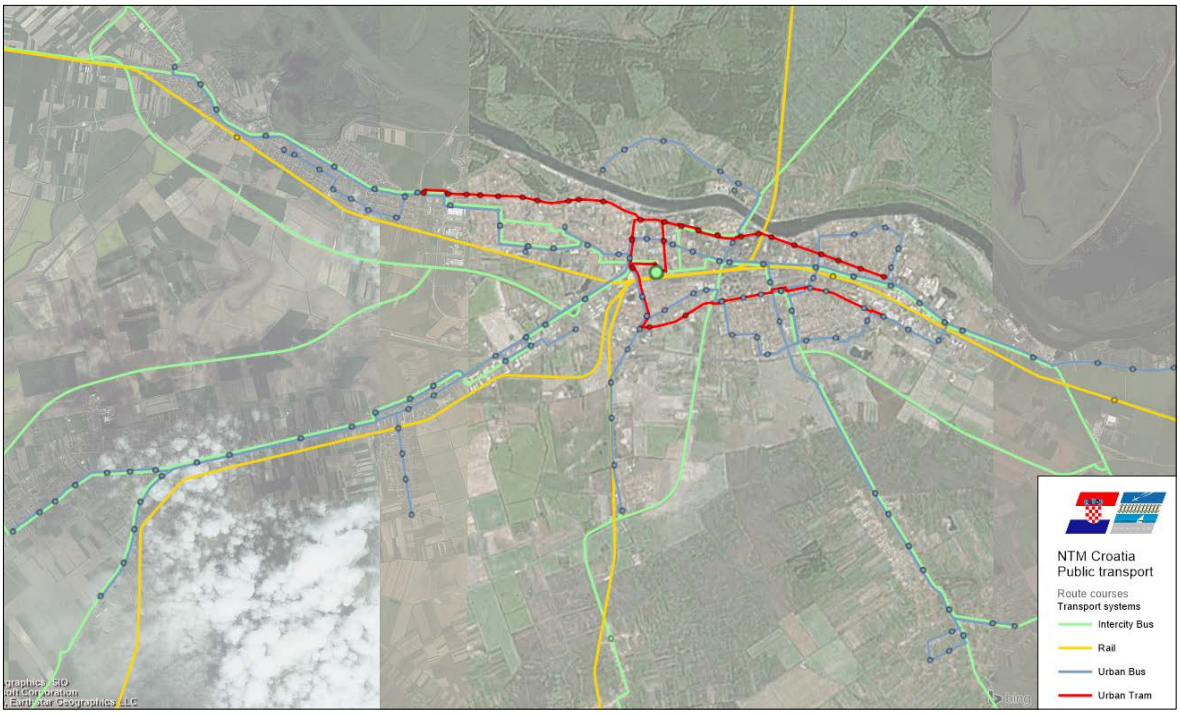


Figure 49: Osijek Public Transport, Red – tram lines, Blue – bus lines, Yellow – railway (Source: NTM)

Exchange of information and cooperation are encouraged in order to avoid competing "parallel" lines and provide to the citizens a better integrated public transport system.

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 transport of urban passengers started in late 1880s. Tram in Zagreb dates back to 1891, but its intense development as an electric tram started in 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 HZPP 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 methodology applied.

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, butapart 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 in case Zagreb will be developed as a freight hub.
- A logistic concept for the railway sector largely utilizing the Croatian network will be developed and the cooperation with the neighbouring countries (above all Hungary, BiH, Slovakia, Italy and Serbia which show the strongest freight loading and unloading volumes in relation to national rail cargo operators) will be optimized.

Comment

IC passenger transport between Zagreb and Rijeka and Split is very limited (apart from commuters between Zagreb and Karlovac, and around Rijeka – figure 50).

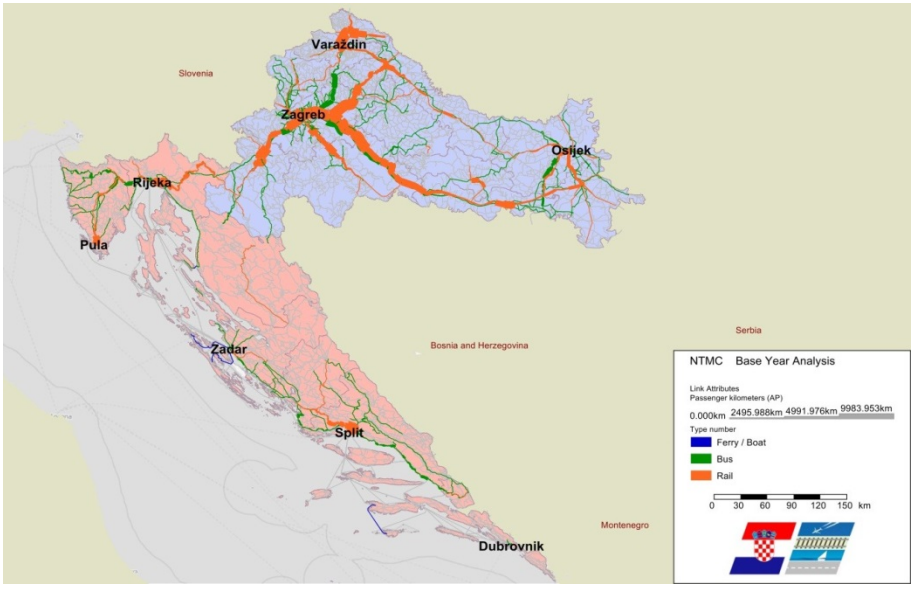


Figure 50: Average passenger transport volume between Zagreb and Rijeka (Source: NTM)

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.

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

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.

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

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 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 section from Ogulin to Sušak Pećine (Rijeka).

Direct rail connection from Rijeka towards Slovenia might jeopardize the development need of Zagreb-Rijeka corridor.

2.3.2 Hypothesis

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

Comment

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 signalling system (train traffic is flowing within a block interval). Average speeds on all lines are 60 to 140 km/h. There are 14 rail stations and 11 stops in the node area. Freight transport is organized in such a way to bypass Zagreb Main Station (Zagreb GK) in the very centre of the node via the existing Marshalling Yard, but it interacts a great deal with all levels of passenger traffic (urban, suburban, intercity) at 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 main station Zagreb GK.

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.

There are no coordinated timetables or single tickets for different modes of PT. Cost of joint HŽPP-ZET ticket without Zagreb City subventions is commercially unappealing. Generally, monthly ticket costs 609 kn, 279 kn for primary school students, and 309 kn for secondary school and university students, pensioners and social categories. 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 50 million in 2011 to 3 million passengers in 2013, table 15). Another contributing factor to the lower number of railway passengers carried is that the passengers carried by ZET (Zagreb PT) and HZPP (railway) are now counted separately.

Table 15: Passenger transport volume on GPP Zagreb City, 2005-2013

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

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 and Rijeka.

The Split suburban railway network was renewed in 2006. It consists of one line 17.8 km long serving nine stations, running from Split-Harbour to Kaštel Stari. An average train ride lasts for 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.

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 HŽ PP 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 (faster track superstructure degradation).
- Prior to rolling stock modernization it is necessary to create a study that will point out deficiencies in the existing fleet.

Comment

Average age of HŽPP and HŽ Cargo rolling stock is more than 30 years. The passenger fleet 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 (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 lifetime
- Modern security and access standards are not met on most rural stations

Comment

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.

Overall length of overhead contact line (catenary) on electrified lines is 1827 km. During the war in the 90ies 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 modern relay interlocking equipment

financed by the EU. 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.

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)

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.

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.

Comment

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.

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

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 70,000 passengers per year, which is still very low. International transport on corridor RH2 from Croatia to Hungary is much lower (around 3,000 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. Exemptions could be seasonal offers between Slovenia, Austria, Germany, Hungary and other origins with destination along the Croatian Coast line (night trains, trains with car transport facilities, etc.).

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; National program of HŽ Infrastructure 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.

Comment

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 Croatia, http://www.hzinfra.hr/vjub-opcenito; 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.

Comment

On 2,605 km of railway tracks in Croatia there are, in total, 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	602	228	330	34	10
Regional	399	252	133	14	-
Local	506	412	82	11	1
Tracks out of station	13	6	7	-	-
Total		898	552	61	11
Total number of rail-road crossings		1.450			
Total number of pedestrian crossings				70	
Total number of level crossings		1.520			

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 those 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 issue of visibility conditions (sight triangle). 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

Key findings

- The old rolling stock is deteriorating the infrastructure and therefore the noise levels during operations are high.
- The drainage system along the corridor is insufficient and/or out of service.

Comments

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 HZ Infrastructure Ltd, HZ Cargo Ltd. and HZPP Ltd.

Comments

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 in the favour of road transport (80 % of the cargo is transported by road and only 20 % of the freight is transported by rail).

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 HZPP 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 HZPP Ltd., considering technical, financial and users' requirements, the indications from Directive

2008/57/EC on the interoperability of the rail system respecting HR and EN Standards, laws, regulations, internal technical specifications and other applicable regulations.

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 not in compliance with EU Regulative 1370/2007
- Financial sustainability is a key factor for development of railway system in Croatia
- Currently, HŽ Cargo restructuring programme has been considered by European Union

Comment

Railway system in the Republic of Croatia create three mayor companies.

HŽ Infrastruktura d.o.o. (HŽI Limited Liability Company for Management, Maintenance and Building of Railway Infrastructure) services relating to access to the railway network are a derived demand which is the result of demand by HŽ Putnički prijevoz d.o.o. and HŽ Cargo d.o.o. (other two companies) as well as others who in turn, are dependent on by demand from travelling passengers and cargo transporters. 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).

Tablica 19: HŽI summary P&L ststement 2012-2015 (Source: Audited financial statements, annual report)

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

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 Croatian Government,
- implementation of revised track access charges system in line with EU legislation, etc.

HŽ Putnički prijevoz d.o.o. (HŽ Passenger Transport Limited Liability Company. HŽ PP) 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 580.9m. In order to ensure that operations by HŽ PP can be maintained, HŽ PP has a Public Service Obligation („PSO") contract with the Government 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 504.6 million. In June 2015, HŽ PP signed a seven year PSO contract to commence 2017.

Tablica 20: HŽPP summary financials 2012-2015 (Source: Audited financial statements in 2013, 2014 and 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	2195,3
Total shareholder's equity	152,7	209,2	28,4	30,6

Improved financial performance should be one of the key goals of HŽ PP in the near future. Liberalisation of the passenger train market planned not before 2019 will impact HŽ PP'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 HŽ PP services at least on potentially profitable routes or routes subject to PSO contracts.

HŽ Cargo (HŽ Cargo Limited Liability Company for Cargo Transport) is state owned company that provides rail freight transport services via domestic and international rail transport and combined transport. In addition, HŽ Cargo provides cargo reload on railway stations and other places. Disclosed revenues from government funding in FY 2015 were HRK 182,5mIn. 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.

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, HŽ Cargo restructuring programme has been considered by European Union.

Tablica 21: HŽ Cargo summary financials 2012-2015 (Source: Audited financial statements in 2013, 2014 and 2015.)

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

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 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 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 Croatia consists of 1,419.50 km of motorways, 6,913.40 km of state roads, 9,594.90 km of county roads and 8,939.10 km of local roads
- 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 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

Comment

Pan-European transport corridors Vb, Vc, X and Xa 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).

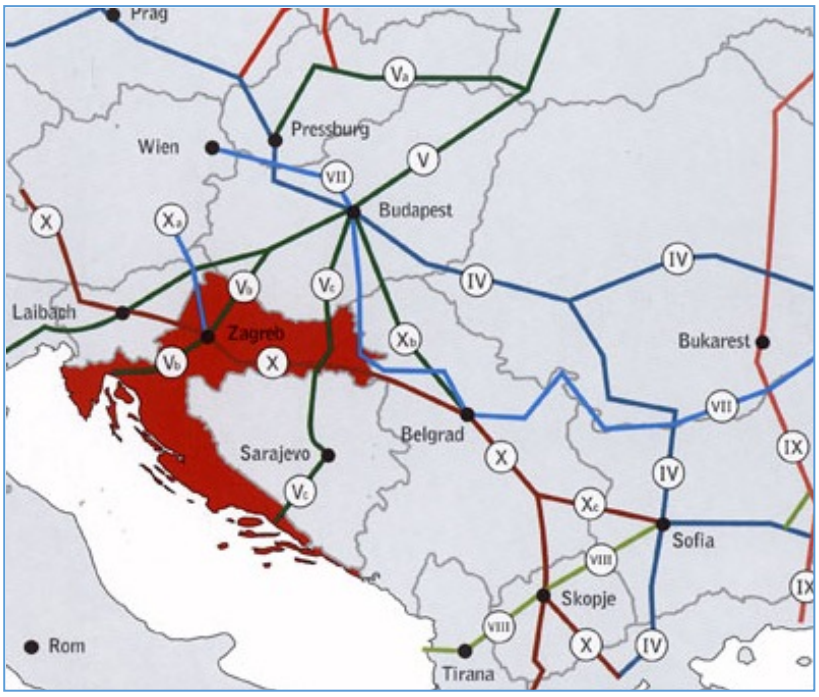


Figure 52: Map of International road corridors (Source: Transport Development Strategy Annex 1)

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

- A2 motorway is a part of TEN-T comprehensive network – Pan European corridor Xa,
- A4, A1 (Zagreb- Bosiljevo 2) and A6 (Bosiljevo 2-Rijeka) are part of TEN-T Mediterranean Corridor – Pan European corridor Vb,
- A5 and A10 are part of TEN-T comprehensive network – Pan European corridor Vc,
- A3 motorway 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 ,there are some small sections left , for example in the functional region Southern Dalmatia the demand on the midterm is covered by the developments in the Airport of Dubrovnik and Pelješac project including related road developments.

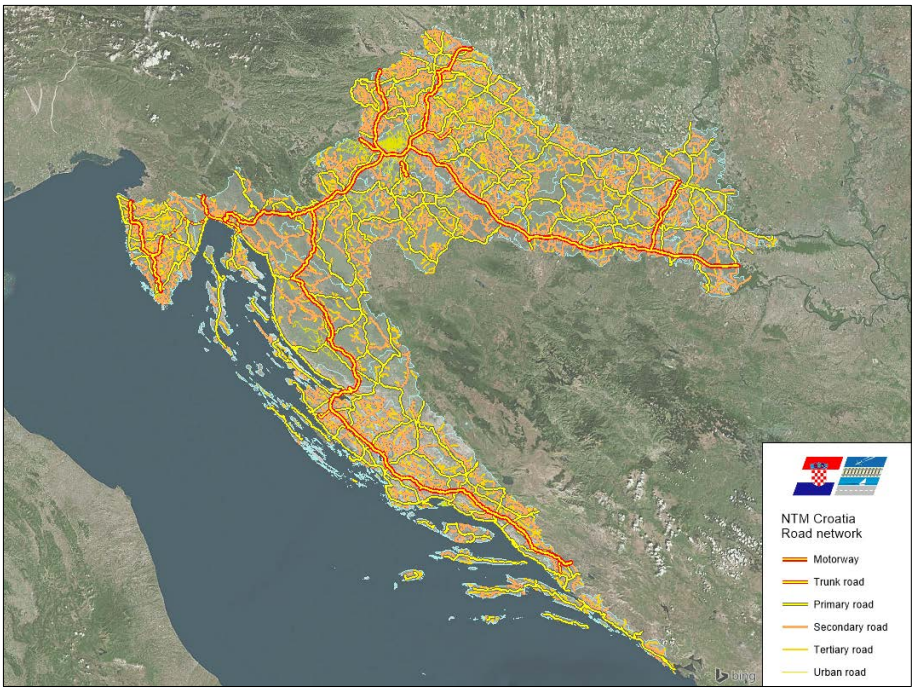


Figure 53: Croatian Road Network (Source: NTM)

Croatia's road network is 26,866.90 km long and comprises 1,419.50 km of motorways, 6,913.40 km of state roads, 9,594.90 km of county roads and 8,939.10 km of local roads.

If we look at the integration of the Croatian road network in the international traffic, one may conclude that the basic road network in 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 (Source: HUKA, National Reports on Motorways 2015)

Company	Total network 2014	Total network 2015	Total network plan for 2016
HAC	901.43	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	1,289.43	1,313.83	1,313.83

*** revised km according to km of network in service**

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. 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 Bielovar and from Varazdin towards Koprivnica (Podravska magistrala) show significant capacity utilization.

Comment

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.

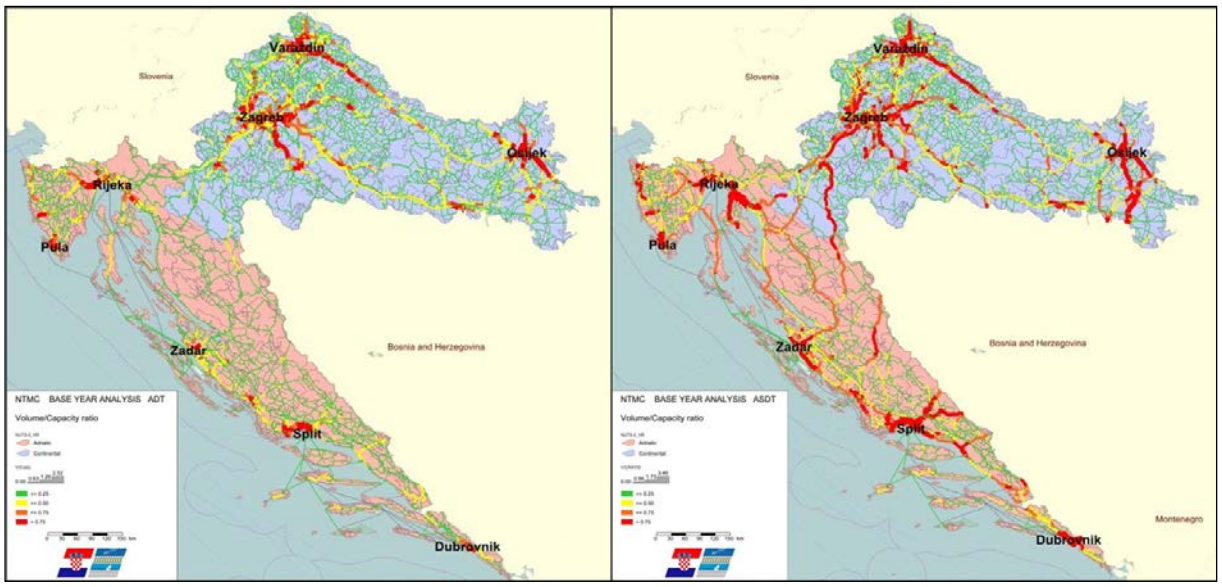


Figure 54: Road Traffic – Volume/Capacity Ratio for Annual Average (ADT) and for seasonal traffic (ASDT) (Source: NTM)

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 (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.

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%.

Comment

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.

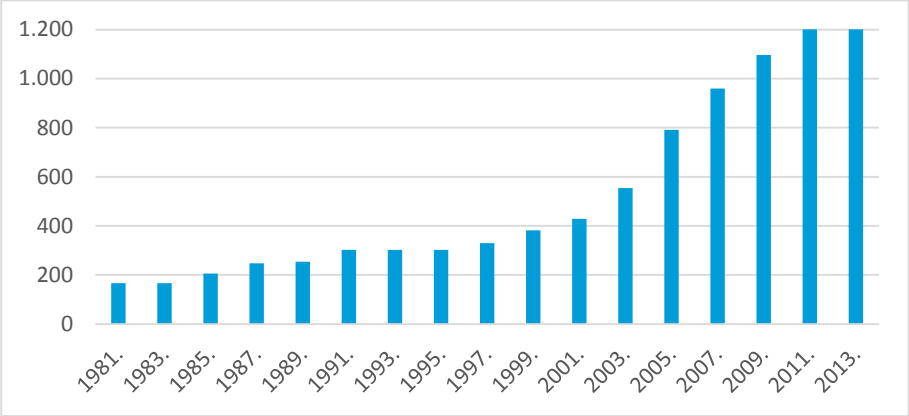


Figure 55: Length of the motorways network in Croatia, 1981-2013 (Source: CBS)

The analysis of the actual demand expressed in volumes or number of vehicles per time interval is in relation to the provided supply or 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.

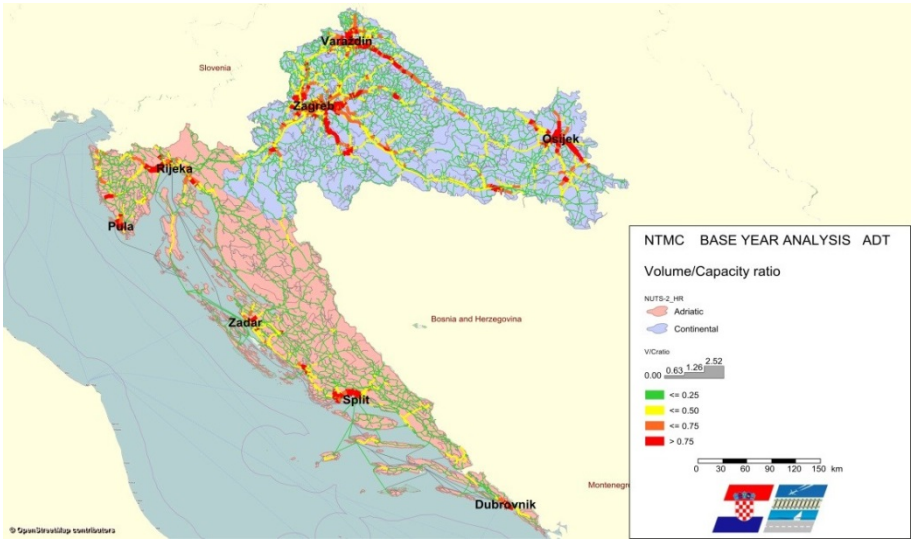


Figure 56: Volume / capacity ratio on the Croatian Road network for ADT (Source: NTM)

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.

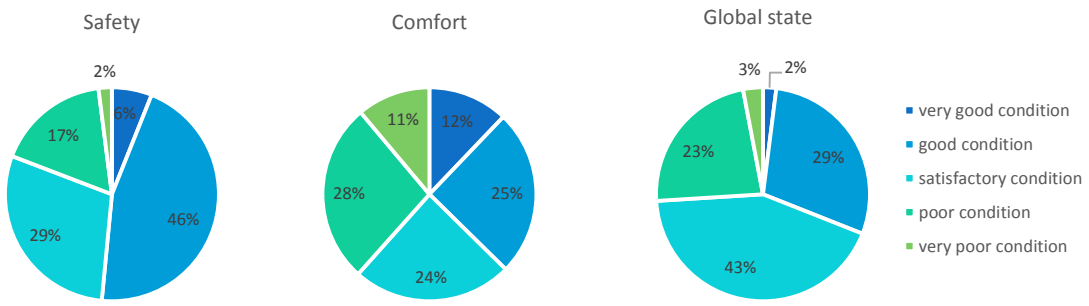


Figure 57: State-road pavement condition, 2012 (Source: The Public Road Network Construction and Maintenance Programme for the Period 2013–2016, (OG no. 1/2014))

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

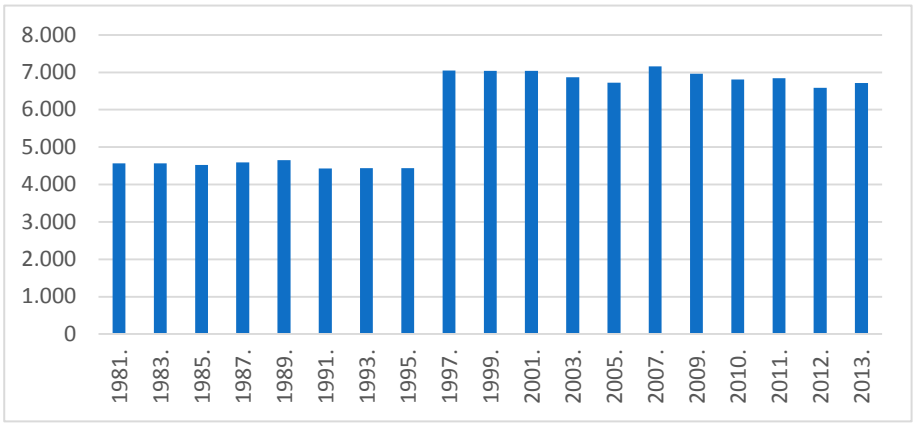


Figure 58: Length of State roads network in Croatia from 1981 to 2013 (Source: CBS)

The State Road Network Construction and Maintenance Programme for the Period 2013–2016 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 2009–2012 and 2013–2016 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, two-thirds of the investments are planned for state roads, county roads and local roads.

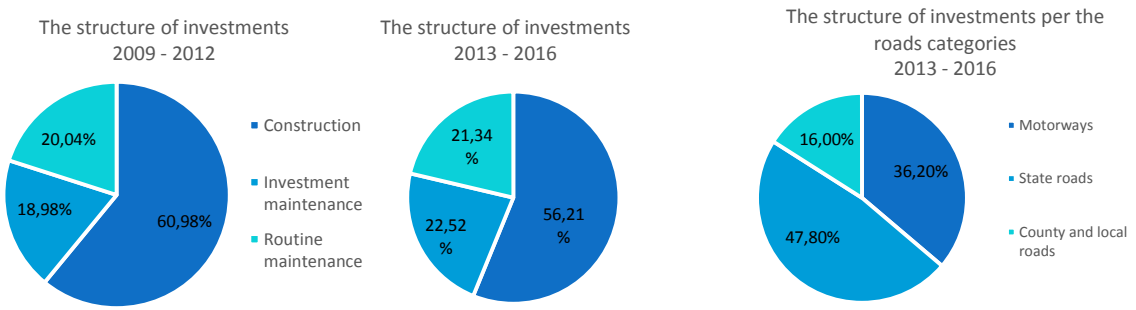


Figure 59: Review of investment in road infrastructure (Source: The State Road Network Construction and Maintenance Programme for the Period 2013–2016)

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 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.

Comment

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:

- Directive 2008/96 on the safety management 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 (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; 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

Comment

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 km/h 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.

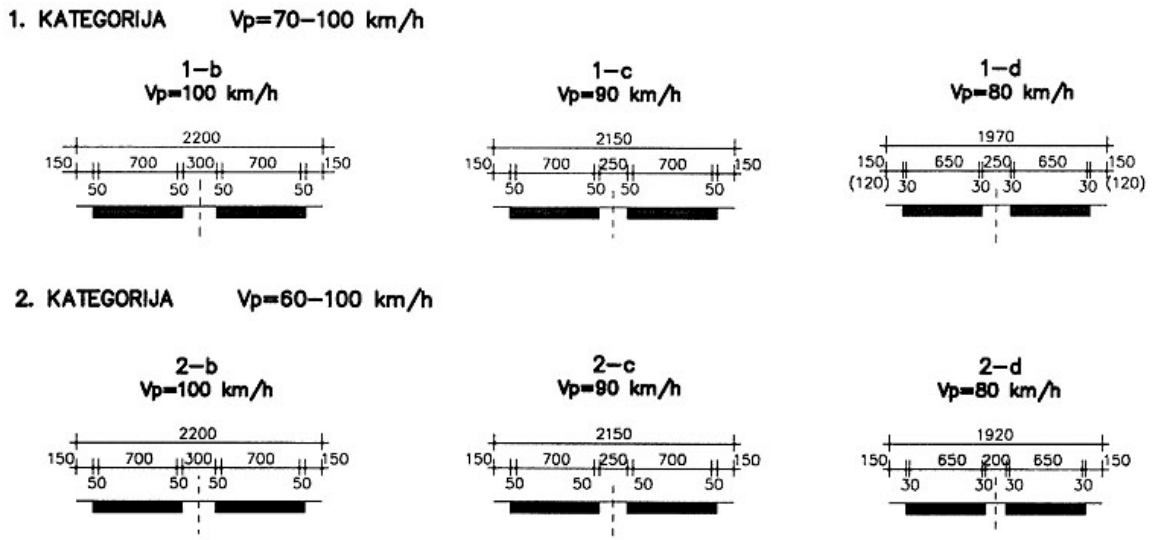


Figure 60: Overview of cross-section dimensions (Source: Rulebook on essential road safety requirements for public roads outside urban areas and their elements regarding road safety (OG no. 110/01))

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 62, depending on whether the intersection is located within or outside an urban area.

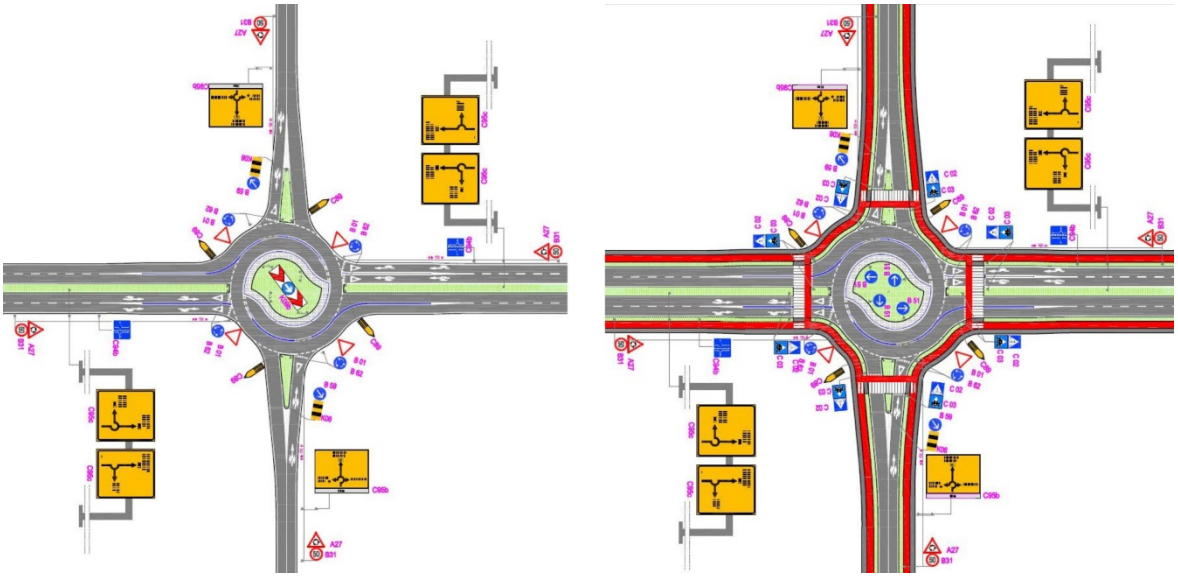


Figure 61: Overview of a turbo roundabout outside and within urban areas (Source: Guidelines for the design of roundabouts with the spiral flow the circular carriageway on State roads, 2014)

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 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

Comment

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 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, Croatia has an increasing number of foreign tourists from year to year, while the number of domestic tourists stagnates.

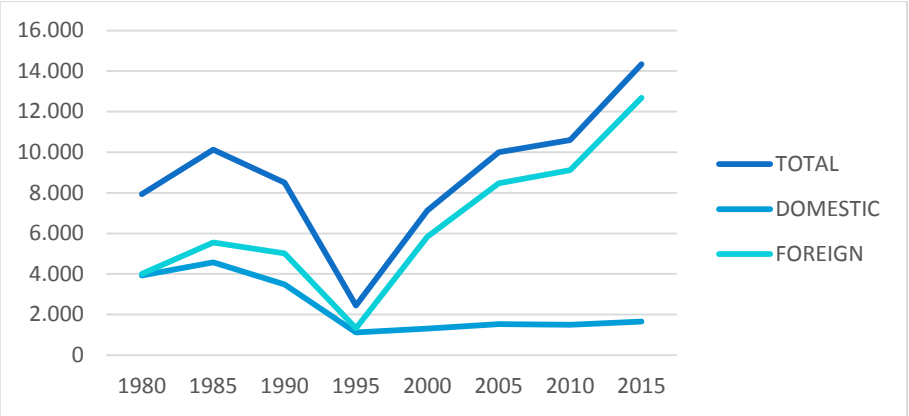


Figure 62: Tourist arrivals (Source: Tourism in figures 2015)

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.

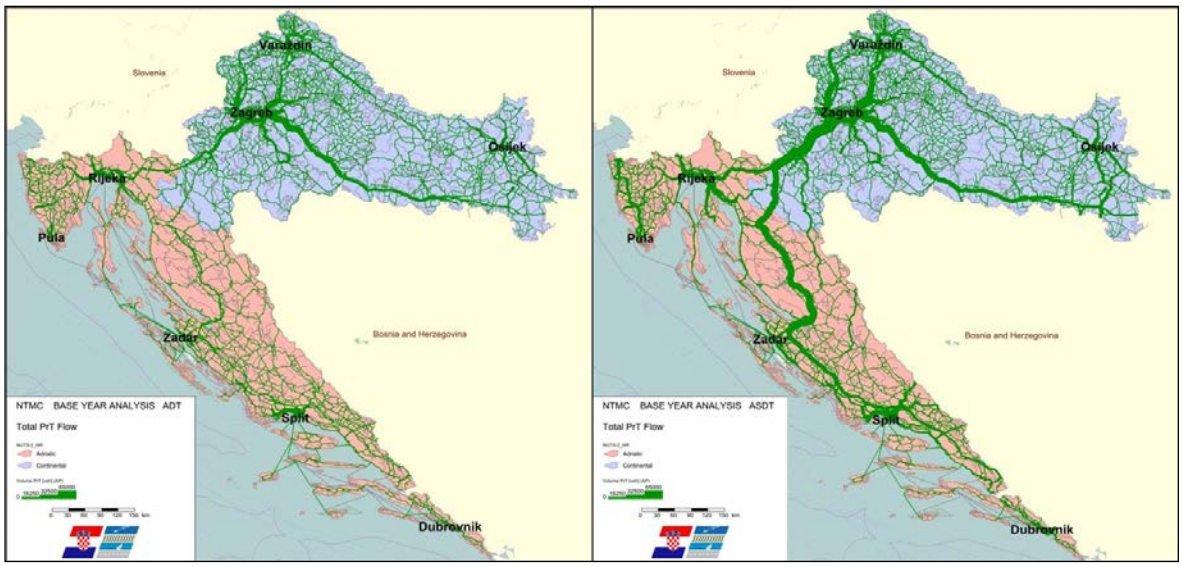


Figure 63: Road traffic – Annual Average Daily Flow for whole Year (ADT) and for seasonal traffic (ASDT) (Source: NTM)

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.

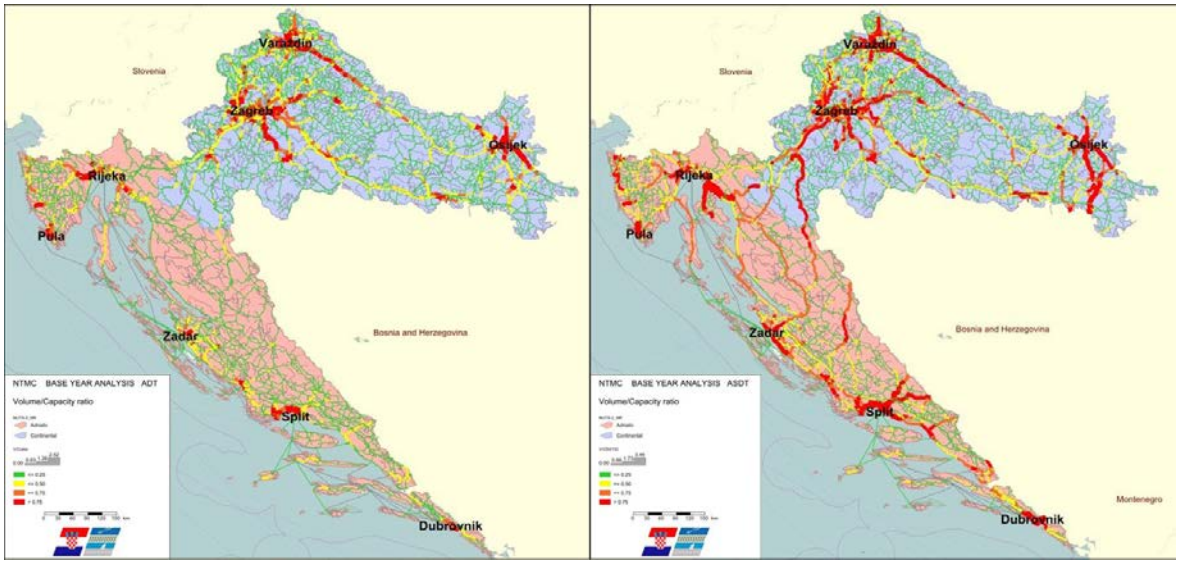


Figure 64: Volume/Capacity ratio – For off-season and season traffic (Source: NTM)

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. 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) 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.

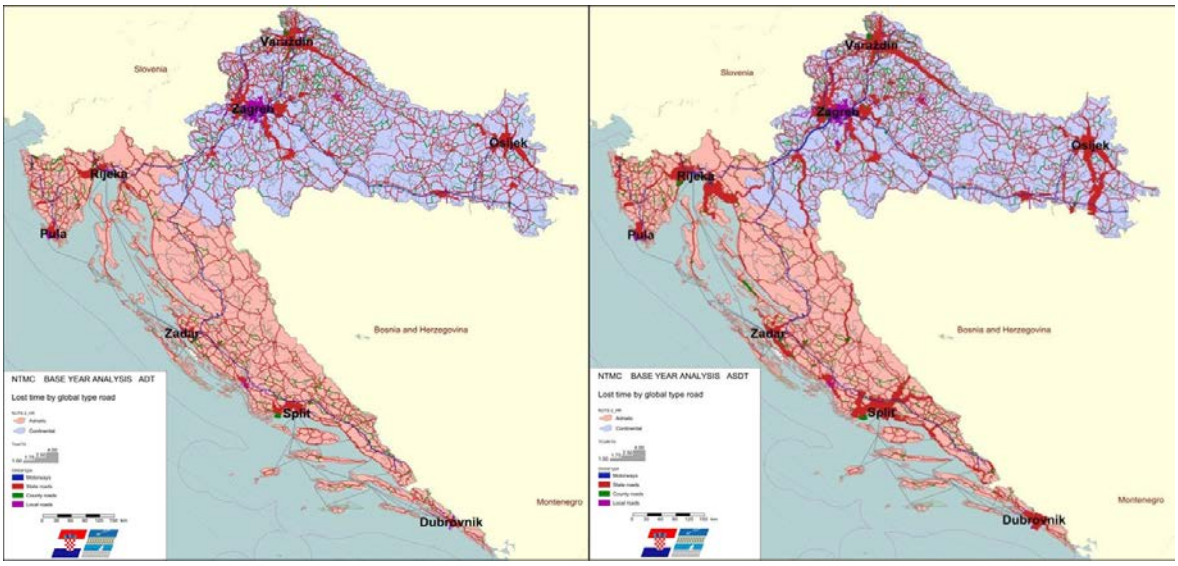


Figure 65: Lost time (actual travel time/target time) – For off-season and season traffic (Source: NTM)

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 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, D28 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 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 Croatia are: cash, credit and debit card, ETC, SMART card, INA card
- There is no unique ETC or SMART card between concessionaires
- in Republic of Croatia has not been established EETS - EUROPEAN ELECTRONIC TOLL SERVICE

Comment

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

Društvo	Autoceste
HRVATSKE AUTOCESTE d.o.o.	A1 A3 A4 A5 A10 A11
AUTOCESTA RIJEKA-ZAGREB d.d.	A1 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 (HRK and EUR), 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 ARZ 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.

At HAC toll stations the toll can be paid either in cash (in HRK or EUR), 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 “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 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 toll collection system and become Bina-Istra subscribers (for frequent users), or to register their cards for ETC devices (for non-frequent users).

At 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 financial setup of the Croatian road systems (Croatian Roads and Croatian Motorways) is not sustainable"

Source

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

Key findings

- HAC expenses substantially exceed annual revenues. Revenues are generated from tolling activities and imposed fuel tax representing state support (according to Public Roads Act).
- 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 state support (i.e. imposed fuel tax relating to Public Good) 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.

- HC debt is also included in the calculation of the public debt of the Republic of Croatia.

Comment

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 Public 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 31.12.2015., total financial liabilities 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.

HC revenue streams are mostly generated from excise duties. The Company presents financial statements similar to HAC i.e. according to IFRS and Public 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.

The deficit is covered by taking on additional debt. In 2015, HC took over new debt in the amount of 1.67 bn HRK and used 1 bn HRK to repay existing debt. Without additional bank funding, HC would experience severe financial and liquidity pressures. Therefore, current operating model should be altered to reflect viable and independent financing in the future.

2.4.9 Hypothesis

"The road safety in 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

Comment

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, 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.

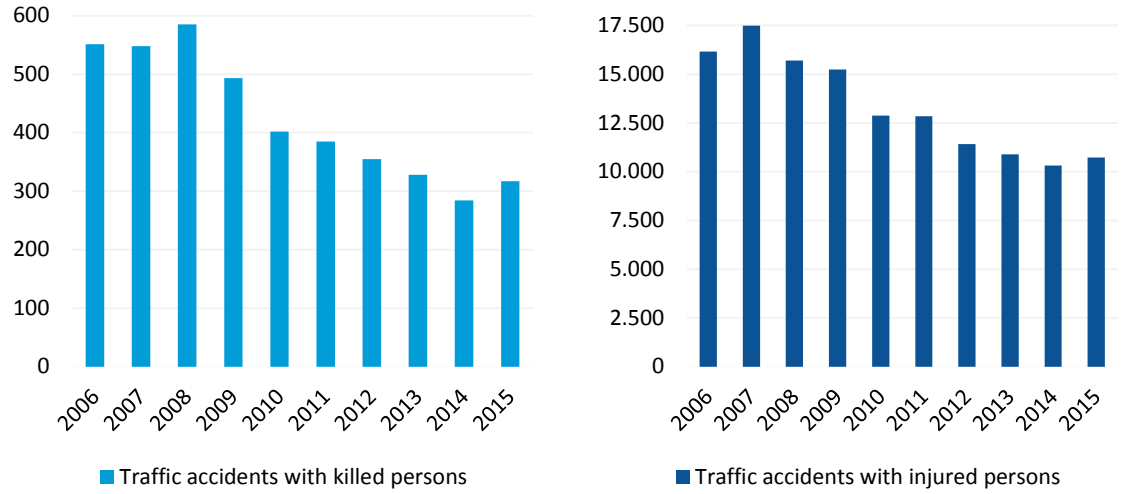


Figure 66: Traffic accidents with killed and injured in the period 2006-2015 (Source: Ministry of Interior)

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 (Source: HUKA)

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

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: Black spots on Croatian roads (Source: Hrvatske ceste d.o.o., Maintenance Department, Section for inspection and safety of traffic and facilities, Zagreb June 2013)

County	partly repaired	to be completely repaired	total sites for repair
Zagreb County	3	6	9
Splitsko-dalmatinska County	12	13	25
Primorsko-goranska County	8	4	12
Osječko-baranjska County	4	1	5
Istarska County	3	12	15
Dubrovačko-neretvanska County	1	1	2
Karlovačka County	-	1	1
Sisačko-moslavačka County	1	1	2
Šibensko-kninska County	2	1	3
Vukovarsko-srijemska County	-	1	1
Zadarska County	4	5	9
Bjelovarsko-bilogorska County	2	2	4
Brodsko-posavska County	-	3	3
Koprivničko-križevačka County	3		3
Krapinsko-zagorska County	-	6	6
Ličko-senjska County	-	1	1
Međimurska County	-	4	4
Požeško-slavonska County	1	3	4
Varaždinska County	-	1	1
Virovitičko-podravska County	2	1	3
Republic of Croatia	46	67	113

One of the important goals of the infrastructure improvement is the detection and reconstruction of hot spots. Table 25 shows accident black spots on Croatian roads by counties.

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, the situation with state and local roads is not satisfactory, and there are IT systems that are not fully developed.

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 Croatia is above the European average. In 2014 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).

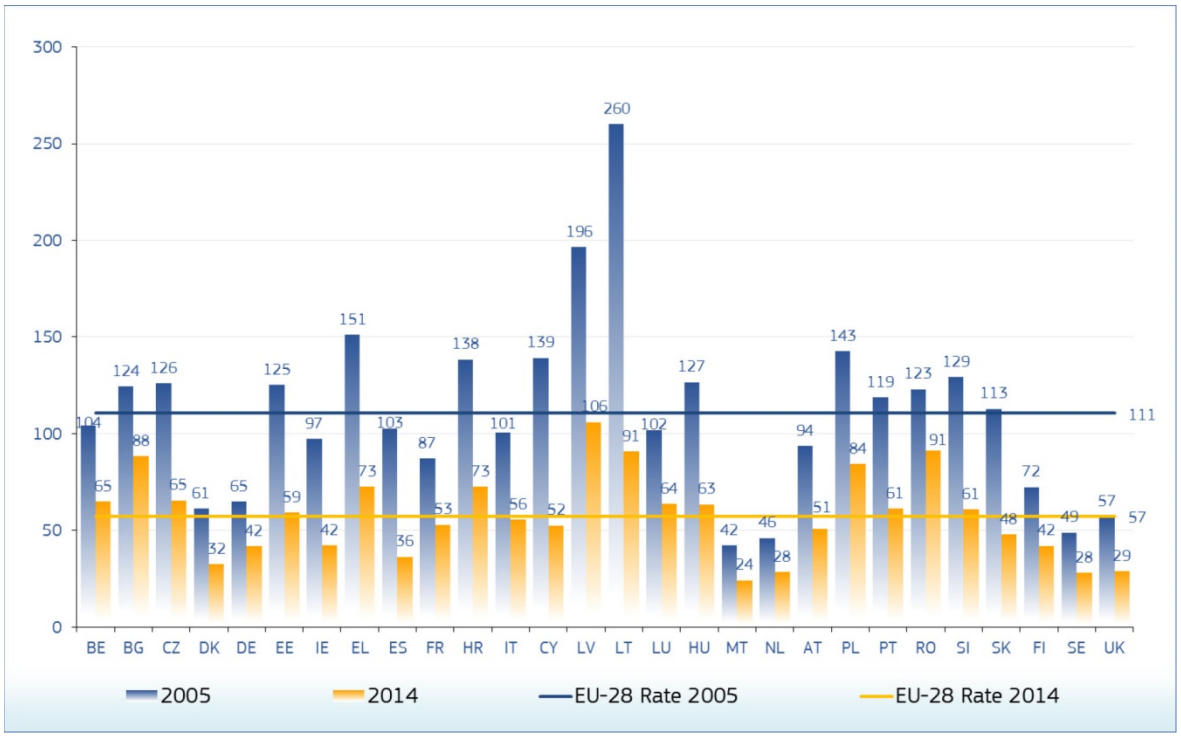


Figure 67: Fatalities per million inhabitants in the EU, 2014 compared to 2005 (Source: European Road Safety Observatory, Annual Accident Report 2016)

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

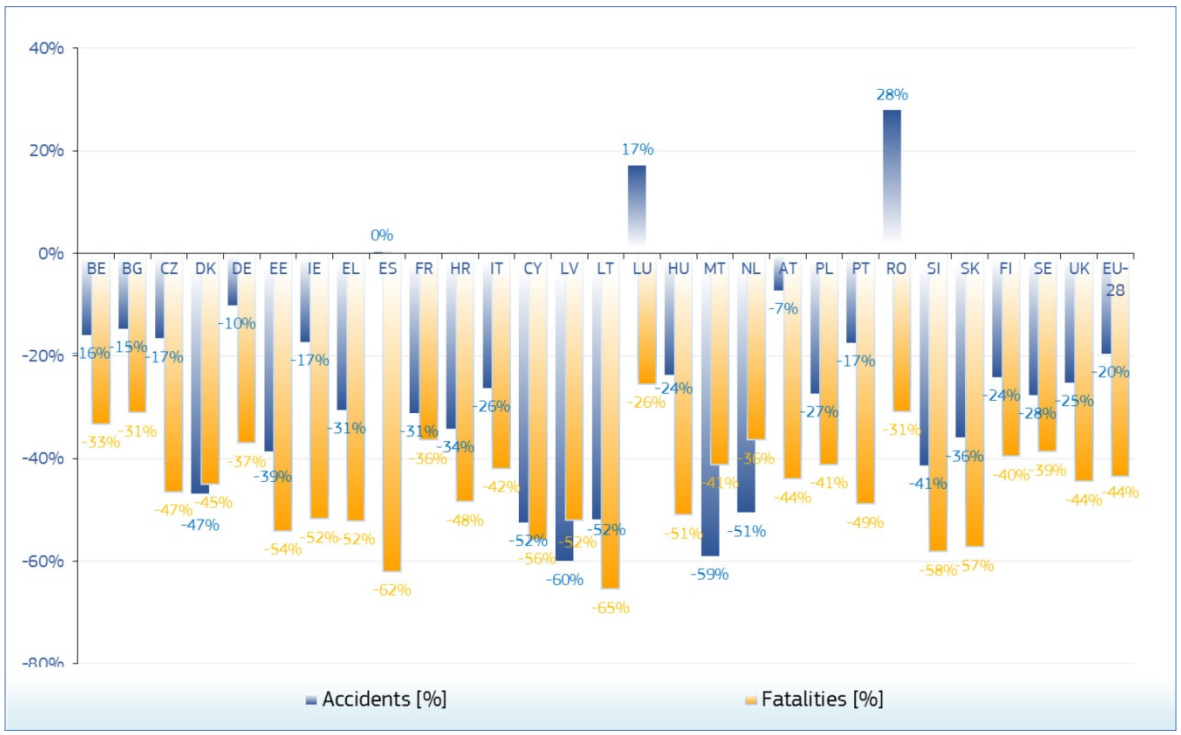


Figure 68: Percentage change in number of fatalities and injury accidents by country, 2014 compared to 2005 (Source: European Road Safety Observatory, Annual Accident Report 2016)

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 motorways for local traffic

Comment

The Zagreb bypass is part of A3 motorway which represents a major east–west transportation corridor in 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 closed toll system or constructing parallel roads for local traffic in the corridor of the existing bypass should be assessed, to try to reduce local traffic on the motorway that would be thus free for transit traffic.

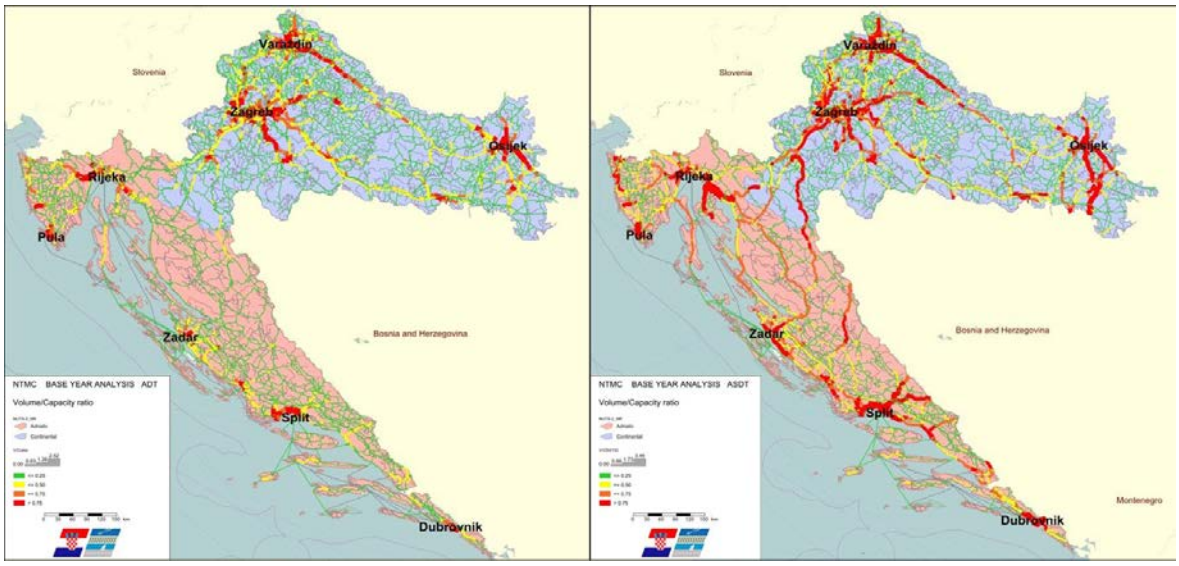


Figure 69: Volume/Capacity ratio – For off-season and season traffic (Source: NTM)

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 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.
- An integrated logistic concept for the luggage of tourist is missing.

Comment

Each year airports in 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%).

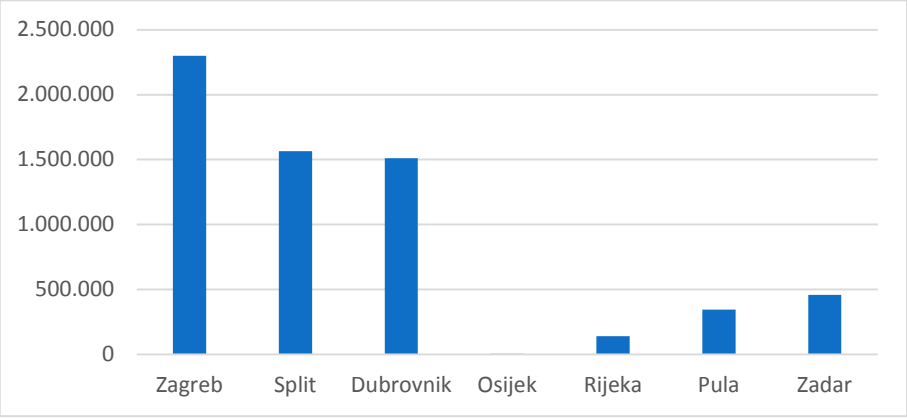


Figure 70: Annual passengers in Croatian airports. 2013 (Zagreb Airport, Split Airport, Dubrovnik Airport, Osijek Airport, Rijeka Airport, Pula Airport and Zadar Airport.)

Analysing the monthly distribution of the number of passengers, a conclusion is that the air transport sector in 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 annual passengers, respectively. The high seasonality in all the airports suggests that a touristic concept of widening the season is essential.

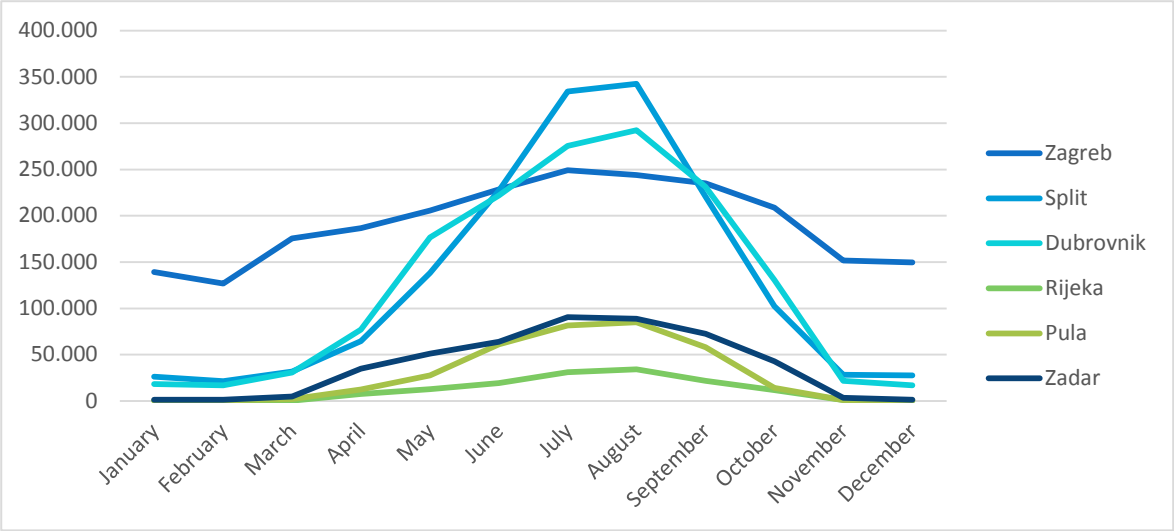


Figure 71: Monthly passengers in Croatian airports. 2013 (Zagreb Airport, Split Airport, Dubrovnik Airport, Rijeka Airport, Pula Airport and Zadar Airport.)

A significant increase in the number of passengers in during the summer months' results in a longer time prior to departure. An integrated logistic concept for the luggage could make a significant difference in the passenger travel experience, passengers' perception of the airports and airlines they use, and consequently reduce the time prior to departure.

Several different concepts for luggage already exist around the world. One concept is oriented to bag tags, permanent or home-printed, which in theory should reduce queuing times at the airport, as passengers only have to drop their bags off, rather than going through the check-in procedure and waiting for the check-in staff to print and attach the tag. The second concept is known as a baggage delivery service, which allows passengers

to drop off their bags or collect them from a booth. For example, passengers could have their bags delivered directly to their hotel once they land, and from their hotel to the airport on the return journey. Offsite or remote bag drop, which allows passengers to check-in and drop off their bags at a downtown location, is another service that can make the lives of travellers easier.

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 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 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.

Comment

The Dubrovnik Airport is located in the Dubrovačko-neretvanska County in Croatia, which is geopolitically and territorially isolated from the rest 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 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 72: 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.

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**

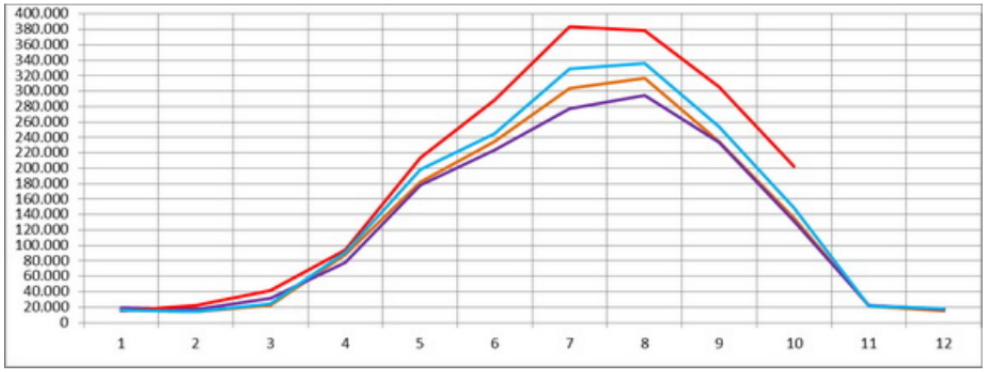
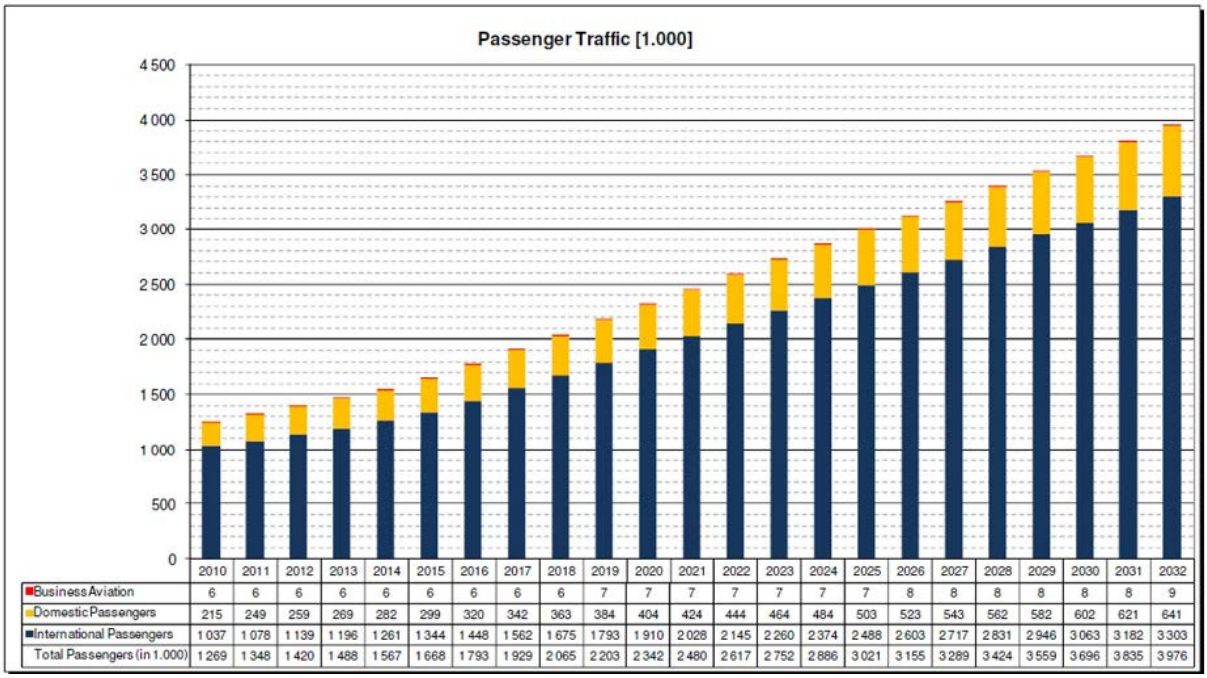


Figure 73: Monthly passenger flow on Dubrovnik airport (Source: Dubrovnik Airport)

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.



	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

Figure 74: Passenger traffic prognosis for DBV (basic scenario) 2010. – 2032. (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); Airport Franjo Tudjman official data from the airport Zagreb Airport 50 years (Monografie)

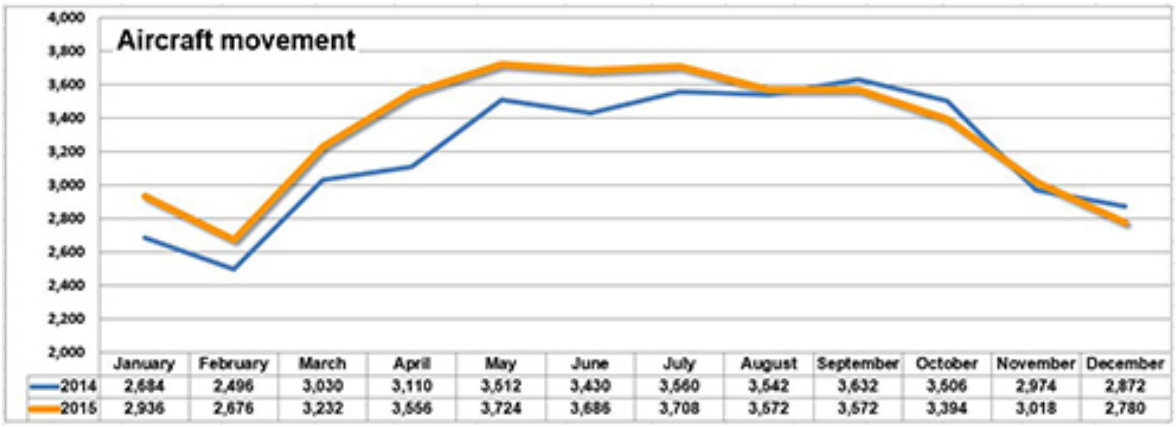
Key findings

- Airport Franjo Tudjman in Zagreb is the main exit / entry point from / to 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 Croatia.

Comment

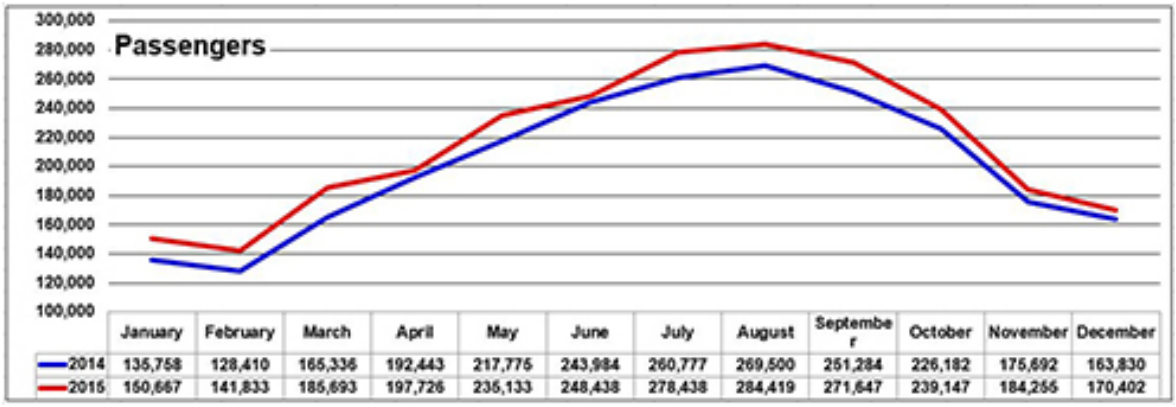
In the year 2015 the International Airport Franjo Tudjman had 2,587,798 passengers within 39,854 flights. Compared with the year 2014, there was a growth in the number of

passengers by 6.45%. According to these indicators Zagreb Airport is leading in the number of passengers in 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.



	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	3,572	3,572	3,394	3,018	2,780

Figure 75: Number of aircraft movement in year 2014 and 2015 (Source: Franjo Tuđman Airport)



	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

Figure 76: Number of passengers in year 2014 and 2015 (Source: Franjo Tuđman Airport)

There are 14 Airline companies that operates on scheduled routes in passenger traffic (2016/2017 winter flight schedule) at the airport Franjo Tudjman:

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: Koeln (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), Skopje (SKP), Sarajevo (SJJ), Split (SPU), Dubrovnik (DBV), Pula (PUY), Zadar (ZAD)

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)

Figure 77: Connection between airport Franjo Tudjman and other European centers (Source: Airport Franjo Tudjman official data from the airport Zagreb Airport 50 years (Monografie))

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.. Zagreb Airport Ltd. is still active and now acts as a mediator between the Croatian Government and the concessionaire with the aim of further development of infrastructure and all traffic segments that are not the subject of the concession agreement. Development plans for the airport include the construction of a new terminal to increase capacity. The completion of a new passenger terminal is scheduled for March 2017.

2.5.4 Hypothesis

"The accessibility of airports in 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.

Comment

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 Croatia. The monthly distribution of passengers on national flights at all Croatian Airports is not so seasonal.

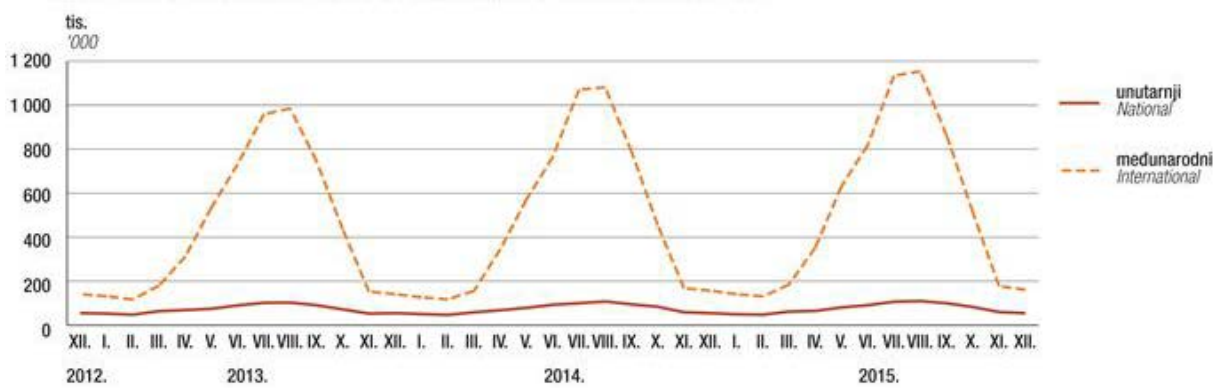


Figure 78: Passengers in Croatian airports, by types of transport, December 2012 – December 2015 (Source: Croatian Bureau of Statistics - CBS)

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).

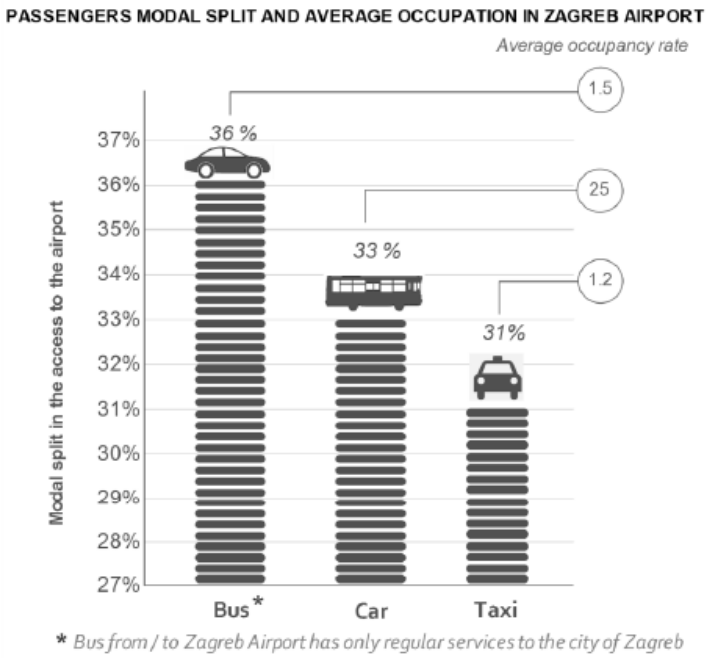


Figure 79: Estimated modal split in the access to the Zagreb Airport (Source: NTM)

Table 26: Estimated modal split in the access to airports according to the transport supply (Source: NTM).

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%

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 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.

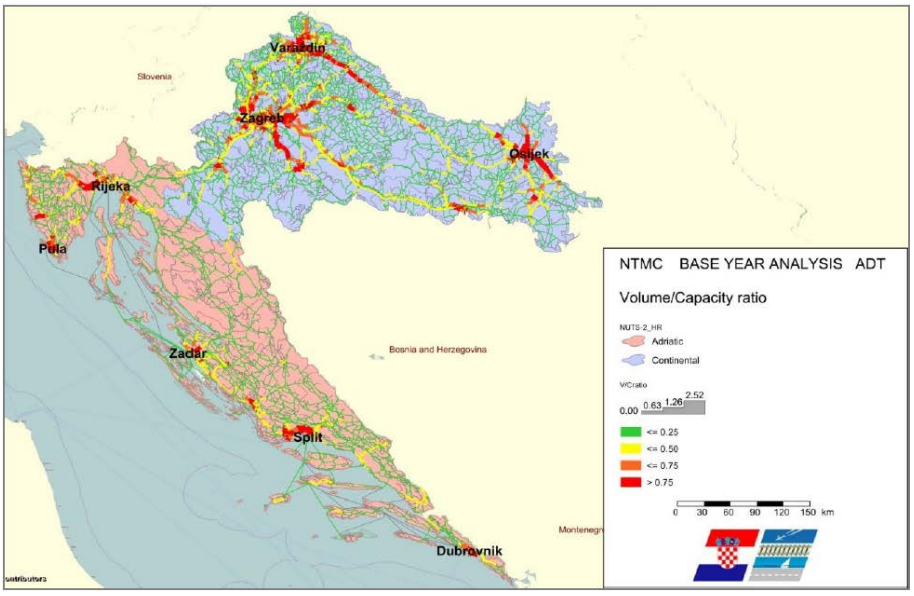


Figure 80: Volume / Capacity ADT for ration base year (Source: NTM)

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.
- Safety standards on all Croatian airports are not in line with the respective EU (EASA) requirements (No 139/2014); they are in a transition period called "conversion", which lasts until 31 December 2017.

Comment

By joining the European Union on 1 July 2013, Croatia has also become a full Member of EASA. The Agency had worked closely with 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.

Aerodromes in 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 not in the line 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

- 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.

Comment

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

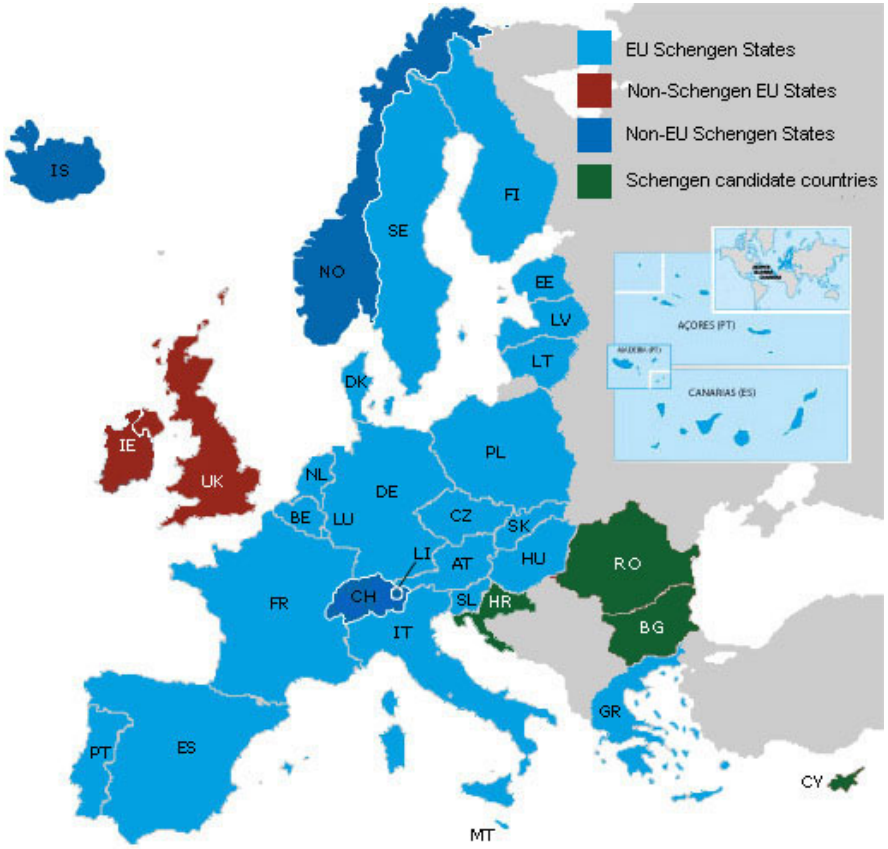


Figure 81: Schengen Area as of 1/7/2013 (Source: European Commission http://ec.europa.eu/dgs/home-affairs)

Schengen requirements must be incorporated into all future Master Plans for international Airports in 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 dramatic.

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.

Comment

The Croatian Government has established Costal Liner Service Agency (CLSA) in 2006, on the basis of Liner Shipping and Seasonal Costal Maritime Transport Act, 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.

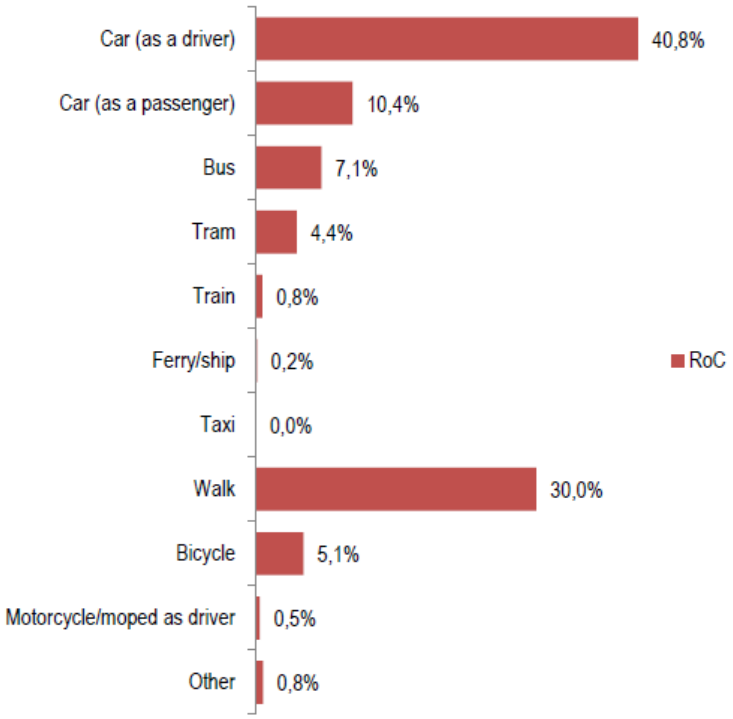


Figure 82: Proportion of all trips taken by different methods of transport, at the national Level (Source: NTM)

- 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.

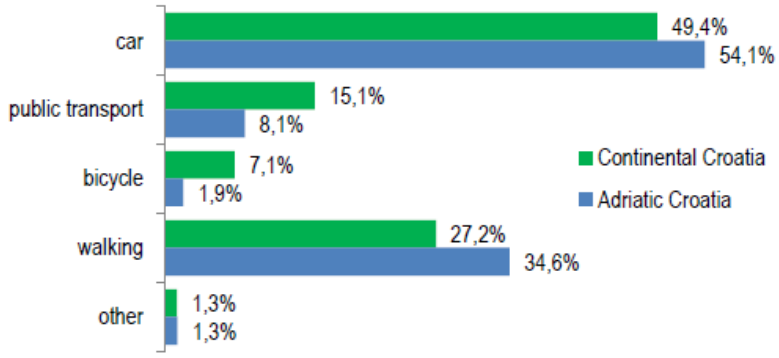


Figure 83: Proportion of all trips taken by different methods of transport, at the regional (NUTS-2) level (Source: NTM)

- 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 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.

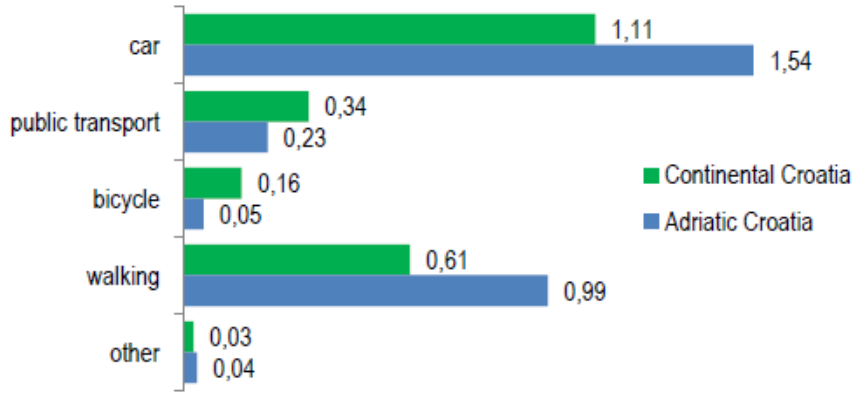


Figure 84: Trip rates by different methods of transport, at the regional (NUTS-2) level (Source: NTM)

- 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.

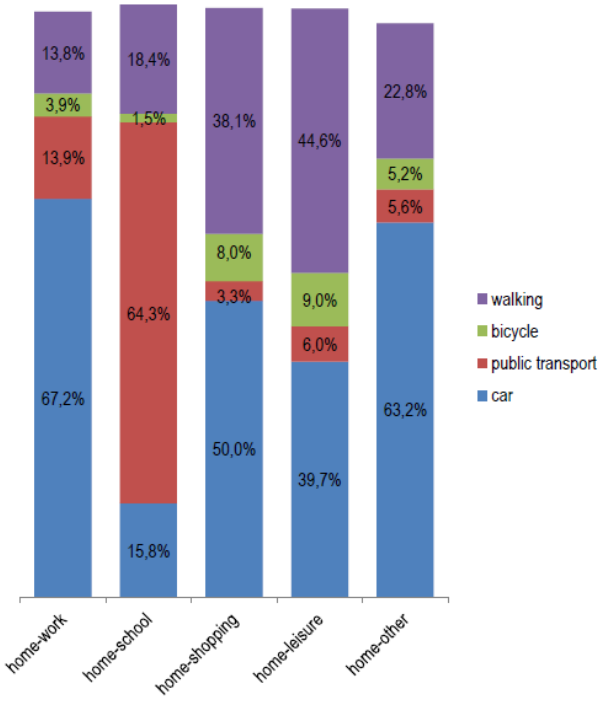


Figure 85: Trip purpose pairs with home as the origin of a trip by mode of transportation (Source: NTM)

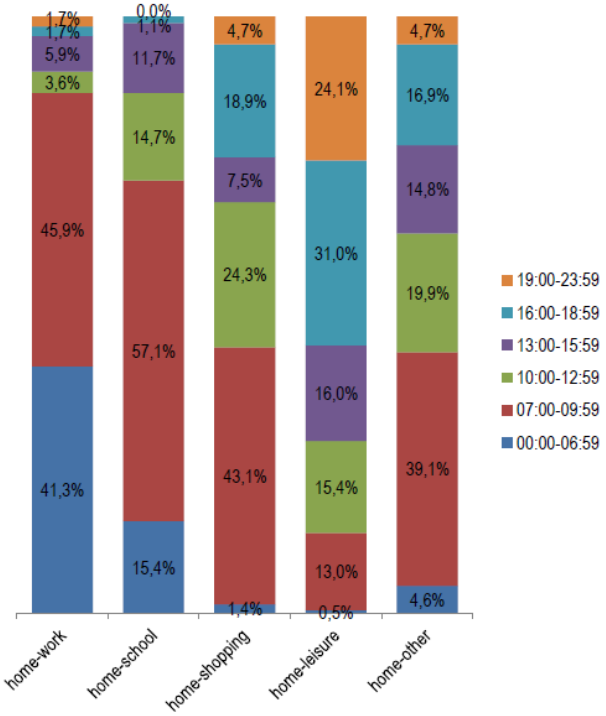


Figure 86: Start time for trips by purpose pairs with home as the origin of a trip (Source: NTM)

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. 1/14, 52/15, 56/15) are as follows:

- residents on islands and the Pelješac peninsula,
- children from the age of 1 to the age of 12 years,
- 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,
- health workers and vehicles in carrying out regular and emergency patient transport from the island to the mainland and vice versa,
- workers and other public service vehicles in case of emergencies.

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.

Comment

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).

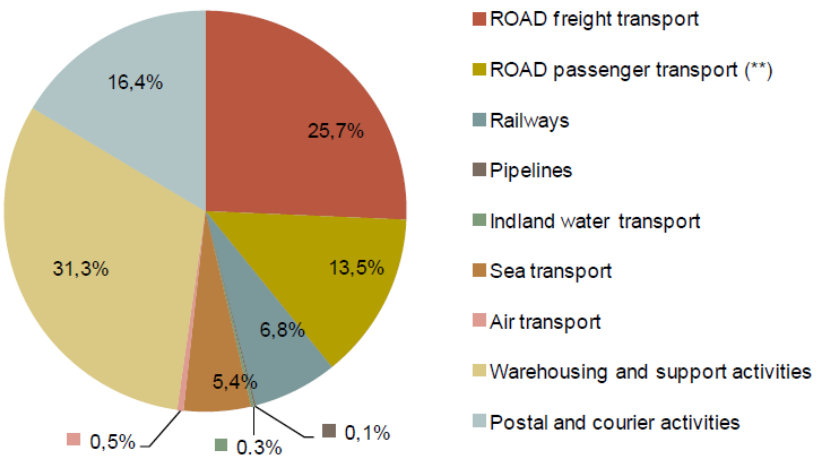
According to Maritime Development and Integrated Maritime Policy Strategy of the Republic of Croatia for the Period from 2014 to 2020 (MDIMPSRC), coastal line passenger transport is characterized as an unprofitable business activity and therefore subsidized by budget funds in a way that the financial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



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

Figure 87: Employment in the Transport Sector in Croatia by mode of transport in 2011 (Source: EUROSTAT)

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

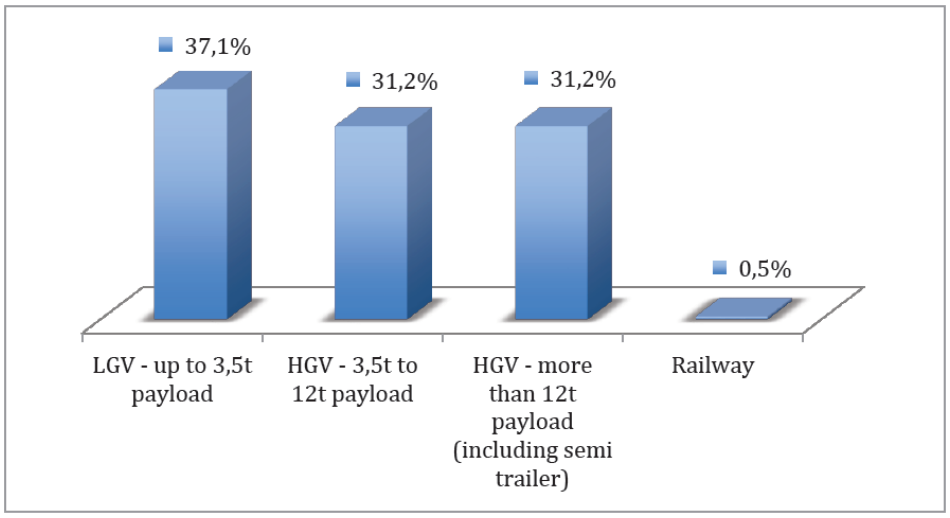


Figure 88: Type of vehicles used for freight transport (Source: NTM)

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%).

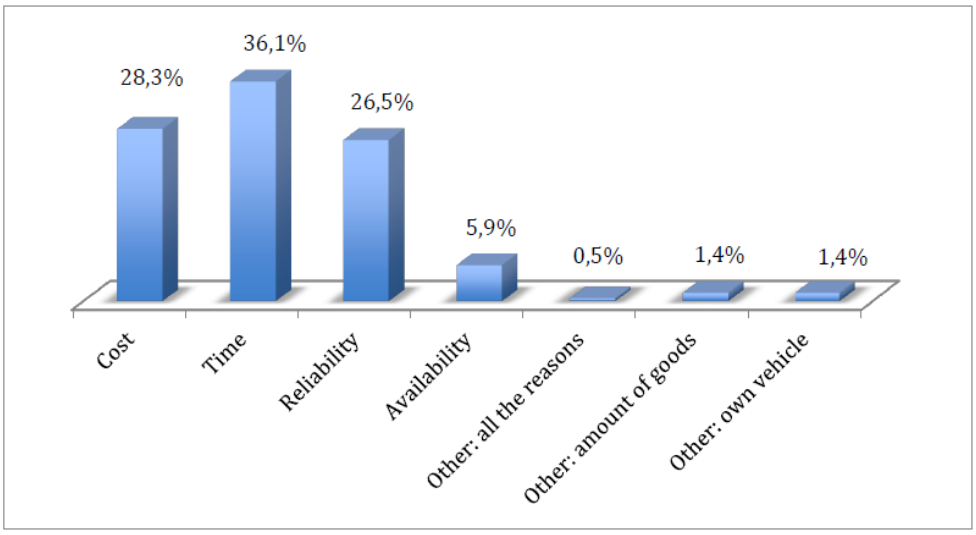


Figure 89: Reason of choice (Source: NTM)

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.

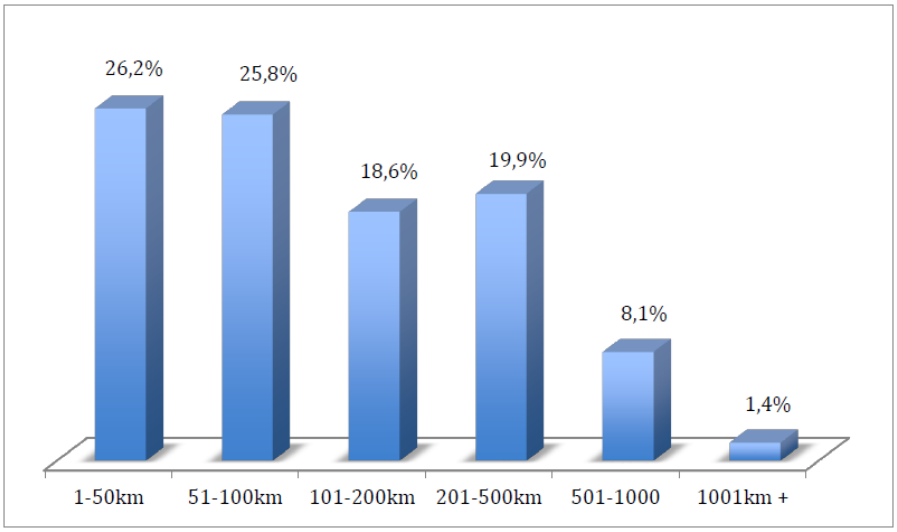


Figure 90: Distance travelled (km) (Source: NTM)

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 27: Traffic counters locations on state road D8 and percentage of the LGV and HGV in AADT (Source: NTM)

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

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 28: Traffic counters locations on motorway A1 and percentage of LGV and HGV in AADT (Source: NTM)

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

Taking into account that the transport network in Central and Northern Italy is congested - especially during summer time - there is a potential to shift part of the freight traffic from Southern and Central Italy via Maritime transport to Croatia, where the existing transport network is of good quality and level of service. This potential should be checked in specific studies.

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

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.

Comment

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.

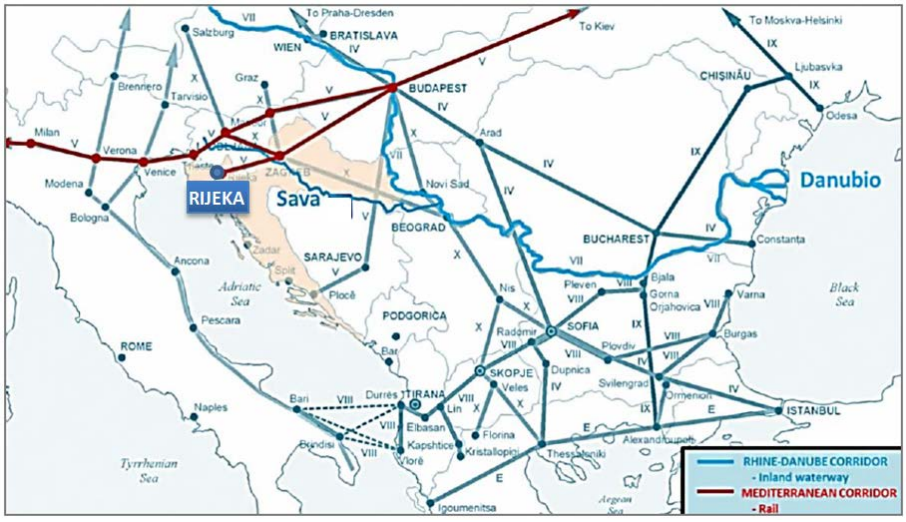


Figure 91: Location and connectivity of Port of Rijeka (Source: NTM)

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 504 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. The total cargo transport in Port of Rijeka in year 2013 amounted to 8.7 million tons while in Port of Ploče amounted 2.7 million of tons.

The statistical data for period between 2009 and 2013 shows that total cargo traffic in the Port of Rijeka decreased by 22.7%. Positive trend can be seen between year 2012 and 2013 when total cargo transport increased by 1.6 %. The statistical data for the monitored five years clearly points out the effects of the global economic crisis on the maritime transport of cargo. Observed by types of cargo, it can be seen that liquid cargo brings more than 50% of the total cargo traffic with 4.0 to 6.0 million of tons. Also, it is possible to see a positive trend for general cargo, its transport increased by 11.5% since 2009. Another positive trend compared to the year 2009 was recorded in the traffic of wood,

while a negative trend was noticed only in the traffic of bulk cargo (decreased by 67%). Liquid cargo throughput brings more than 50% of the total cargo traffic.

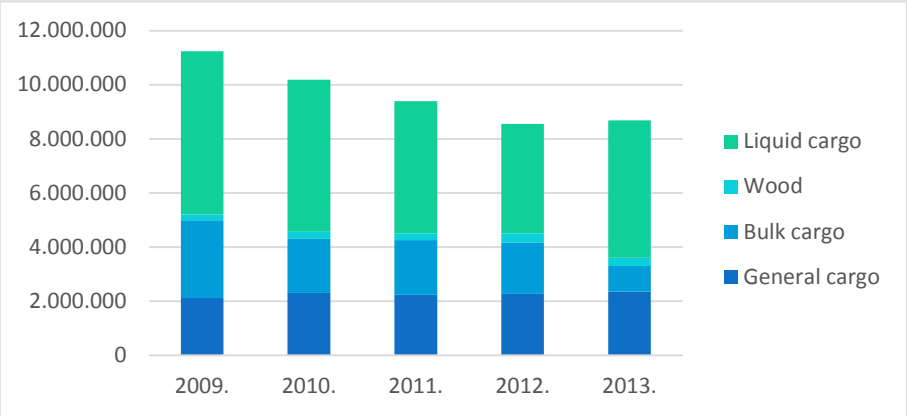


Figure 92: Port of Rijeka - total cargo traffic (in tons) between 2009 - 2013. (Source: Port of Rijeka)

In the period 2009 - 2013 container traffic registered an increase of 30%, from 130.740 TEU in 2009 to 169.943 TEU in 2013.

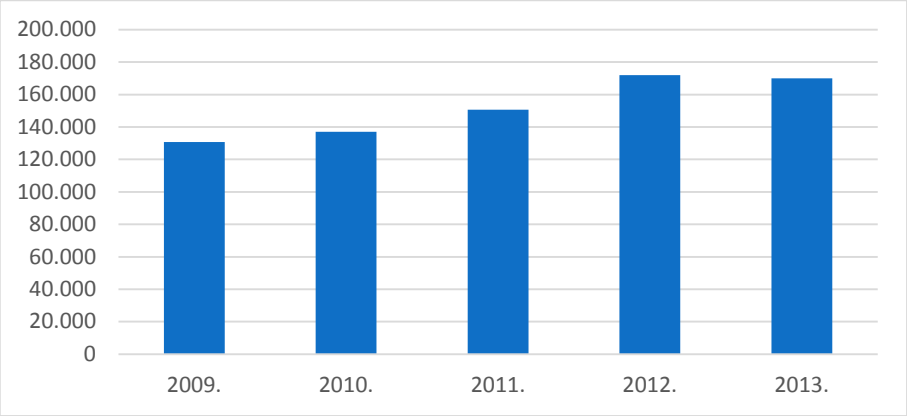


Figure 93: Port of Rijeka – total container cargo traffic (in TEU) between 2009 - 2013. (Source: Port of Rijeka)

Statistics shows that most of the cargo (general, bulk and wood) ends up in 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).

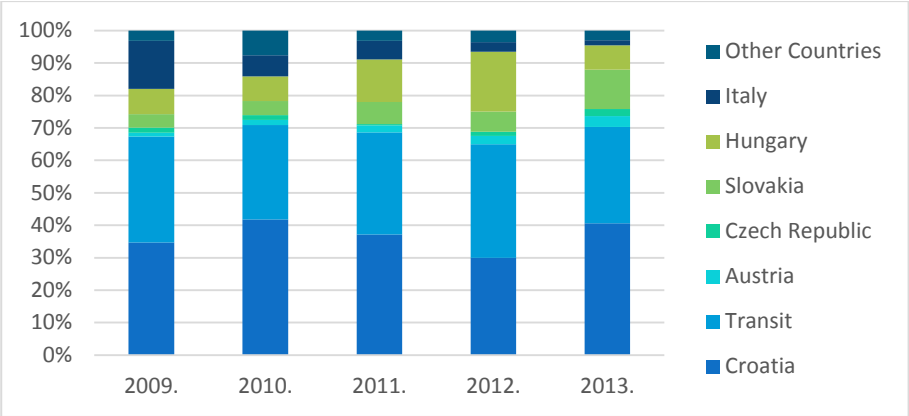


Figure 94: Cargo transport by destination (liquid cargo is not included) between 2009 - 2013. (Source: Port of Rijeka)

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. 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. The further development of Rijeka port is focused on container and liquid cargo transport.

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,

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

- The Port of Ploče have the great market potential for cargo transhipment.

Comment

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. It is directly connected with its hinterland in Bosnia and Herzegovina and also with the North-East of Croatia, as well as with Central Europe by railway and by road (E-73), which stretches along the route of Corridor Vc (Budapest-Osijek-Sarajevo-Ploče).

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.

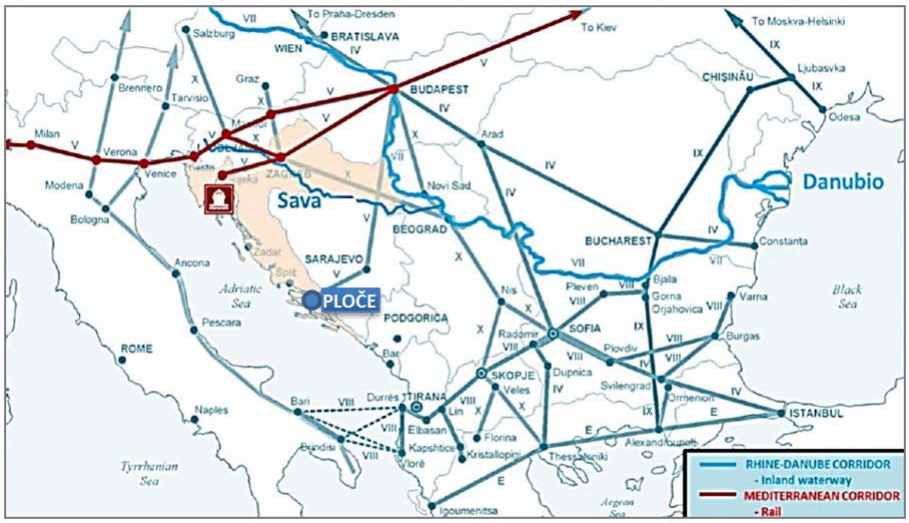


Figure 95: Location and connectivity of Port of Ploče (Source: NTM)

Even though it is a Croatian port, it 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 currently being built), while the total storage capacity for liquid cargo is around 600,000 tons.

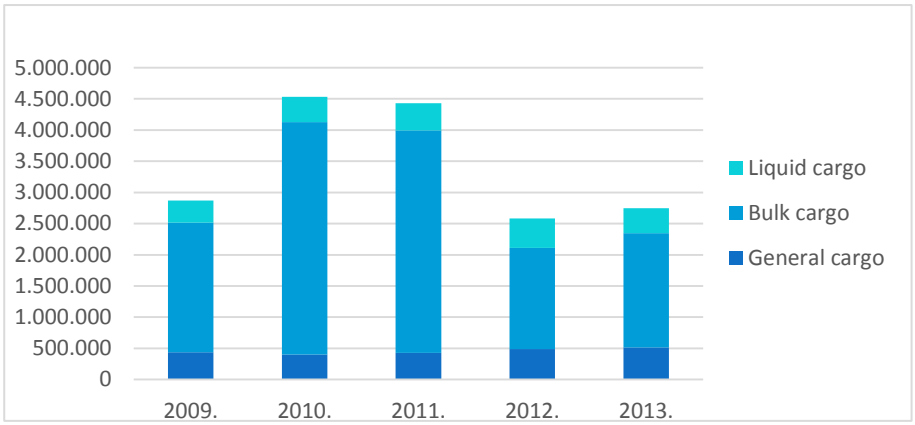


Figure 96: Port of Ploče - total cargo transport (in tons) between 2009 - 2013 (Source: Port of Ploče).

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).

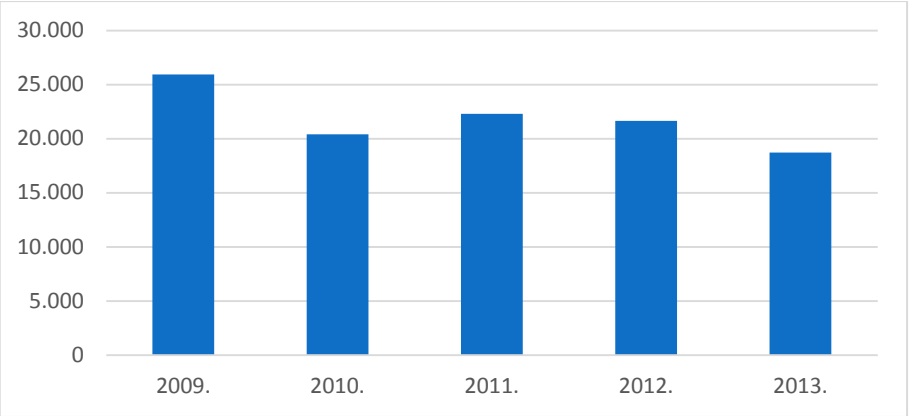


Figure 97: Port of Ploče – total container cargo transport (in TEU) between 2009 - 2013 (Source: Port of Ploče).

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%.

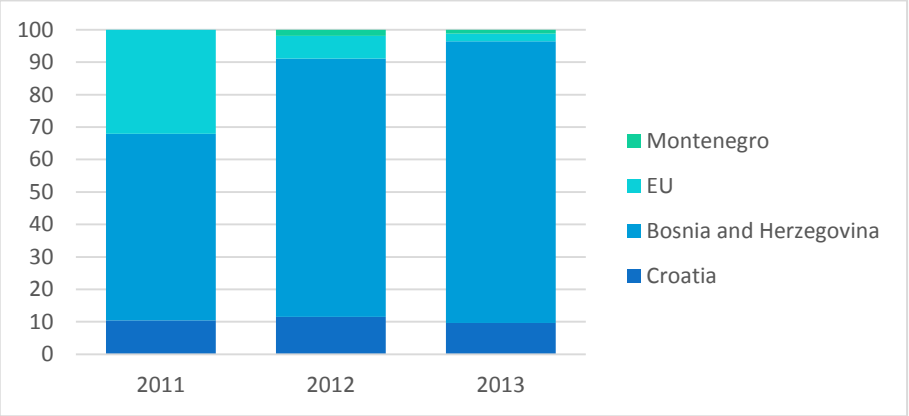


Figure 98: Cargo transport by destination between 2011 - 2013 (Source: Port of Ploče).

The Croatian Government has provided support for the construction of a new bulk cargo terminal and are funding work on the construction of infrastructure. 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.

2.6.5 Hypothesis

"The ports of Zadar, 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 Šibenik Authority; Transport Development Strategy of the Republic of Croatia (TDS)

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.

Comment

The Port of Zadar is located at the central part of the Adriatic coast and is the second Croatian port for passengers. Cargo traffic remains limited due to physical constraints and proximity to Port of Rijeka. 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. General cargo has almost constant throughput around 20-30 thousand tons within the observed years.

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.

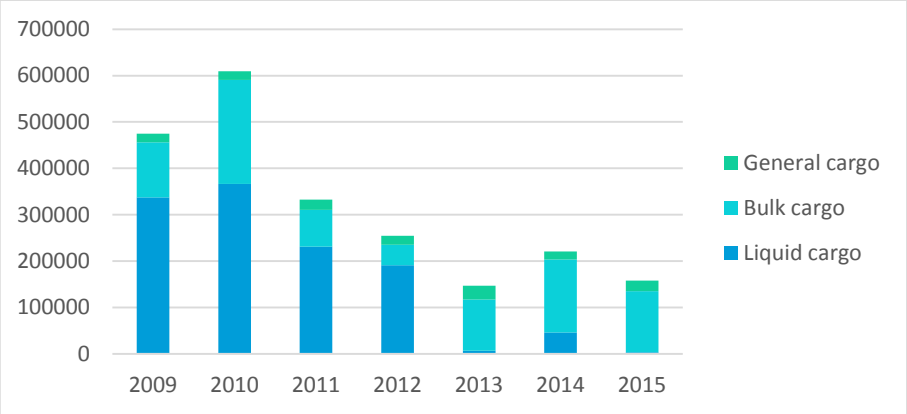


Figure 99: Port of Zadar - total cargo transport (in tons) between 2009 - 2015 (Source: Port of Zadar).

The Port of Šibenik is located on 430 ha of the Krka River estuary. The port specializes in bulk, timber, and mineral traffic notably phosphates transhipment. 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 superyachts.

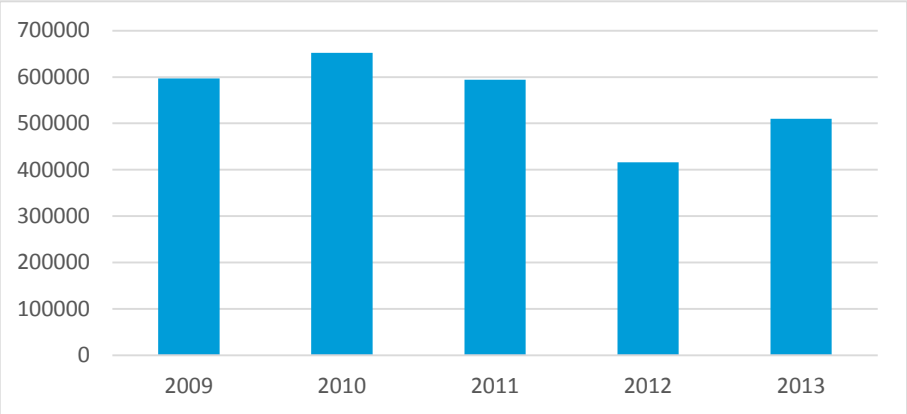


Figure 100: Port of Šibenik - total cargo transport (in tons) between 2009 - 2013 (Source: Port of Šibenik).

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.

Figure 101: Location of the Port of Zadar, Port of Šibenik and Port of Dubrovnik in Croatia (Source: Port of Šibenik Authority)

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.

Comment

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 Maritime Development and Integrated Maritime Policy Strategy of the Republic of Croatia for the Period from 2014 to 2020 (MDIMPS) includes 56 state lines (27 ferries, 16 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.

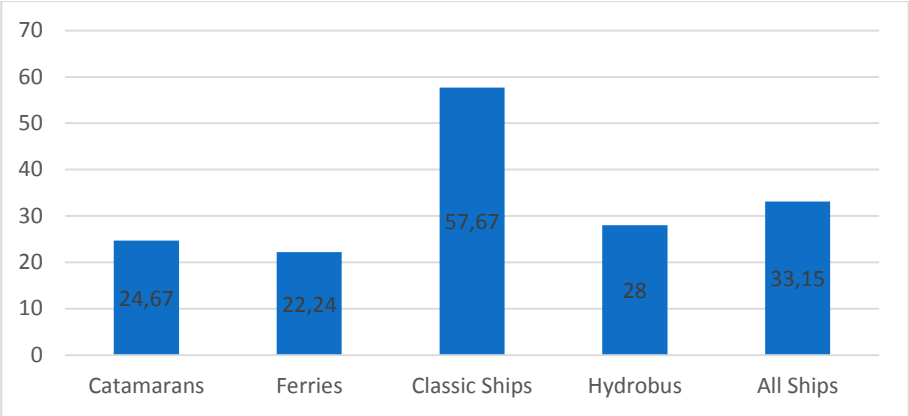


Figure 102: Jadrolinija – Average Fleet Age (Source: Jadrolinija - official web page)

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, 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 143/12); Coastal Shipping Agency (CLSA)

Key findings

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

Comment

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.

Improving the organisational setup of the transport system and reorganising 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. 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.

Comment

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.

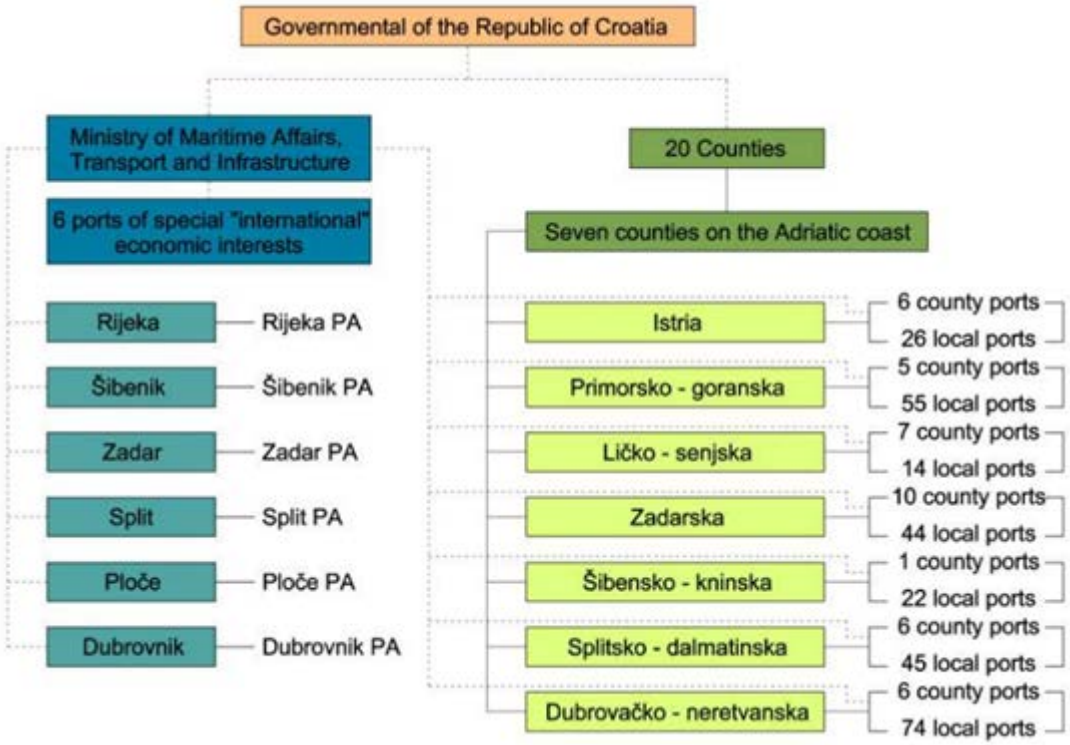


Figure 103: Organisational structure of the port system in Croatia (Source: Croatian National Strategy (CNS))

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 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.

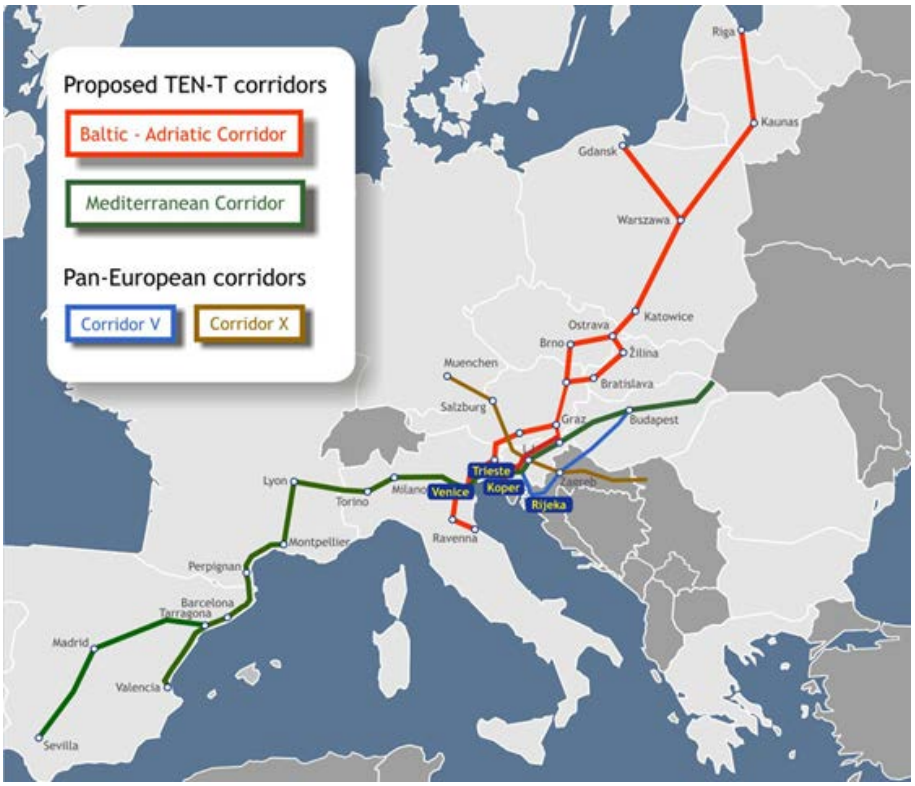


Figure 104: Location and connectivity of NAPA ports (Source: NAPA official web page)

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."

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 29: NAPA ports' cargo volumes in 2014 (Source: NAPA)

	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

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 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.

Comment

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.

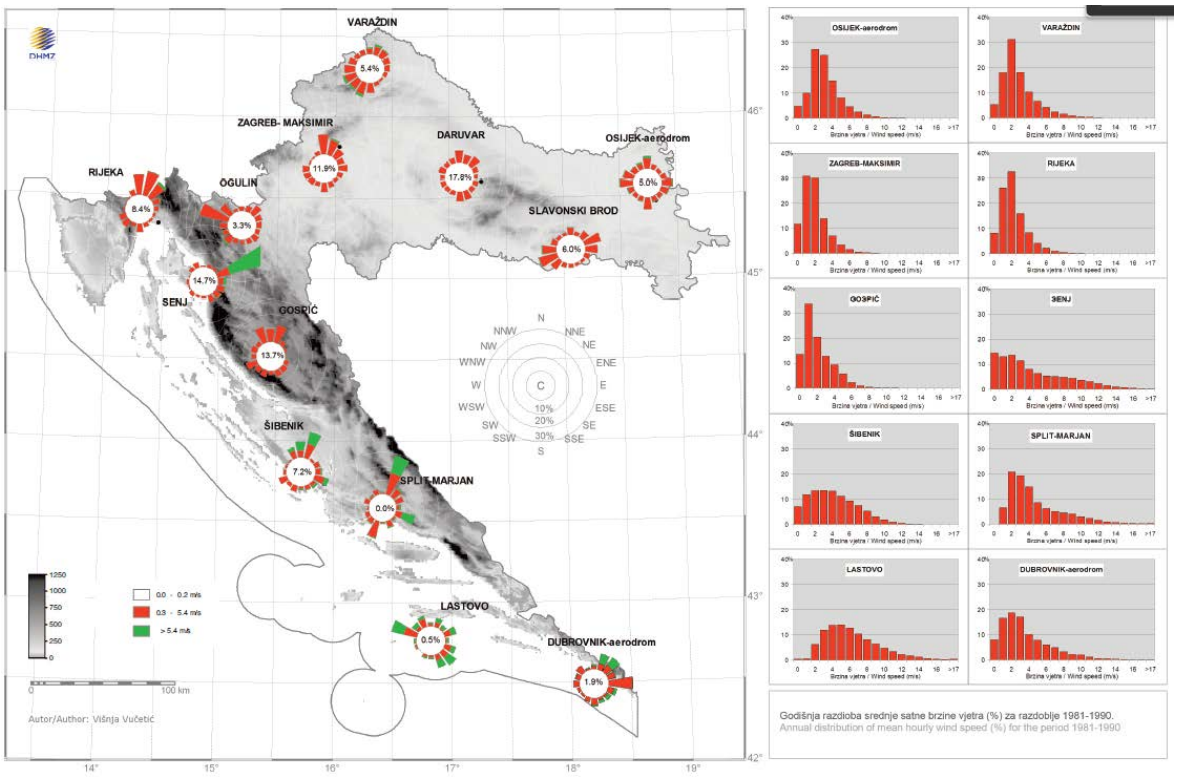


Figure 105: Annual distribution of mean wind speed (%) for the period 1981 – 1990 (Source: Zaninović, K., Gajić-Čapka, M., Perčec Tadić, M. et al, 2008: Climate atlas of Croatia 1961–1990., 1971–2000. Meteorological and Hydrological Service of Croatia, Zagreb, 200 p.)

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 56 state lines (27 ferries, 16 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.

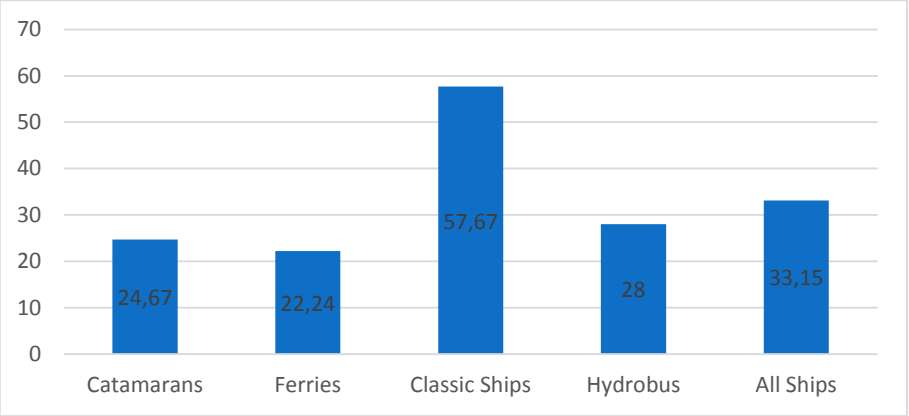


Figure 106: Jadrolinija – Average Fleet Age (Source: Jadrolinija - official web page)

2.7 Inland navigability and river transport

2.7.1 Hypothesis

"There is a potential for the development of Vukovar port (Danube) and Osijek (Drava) as the main relevant inland ports"

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 Croatia with yearly transport of 30,000 passengers and half of million tons of cargo
- The accessibility and reliability of operation of the port needs to be safeguarded

Comment

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.

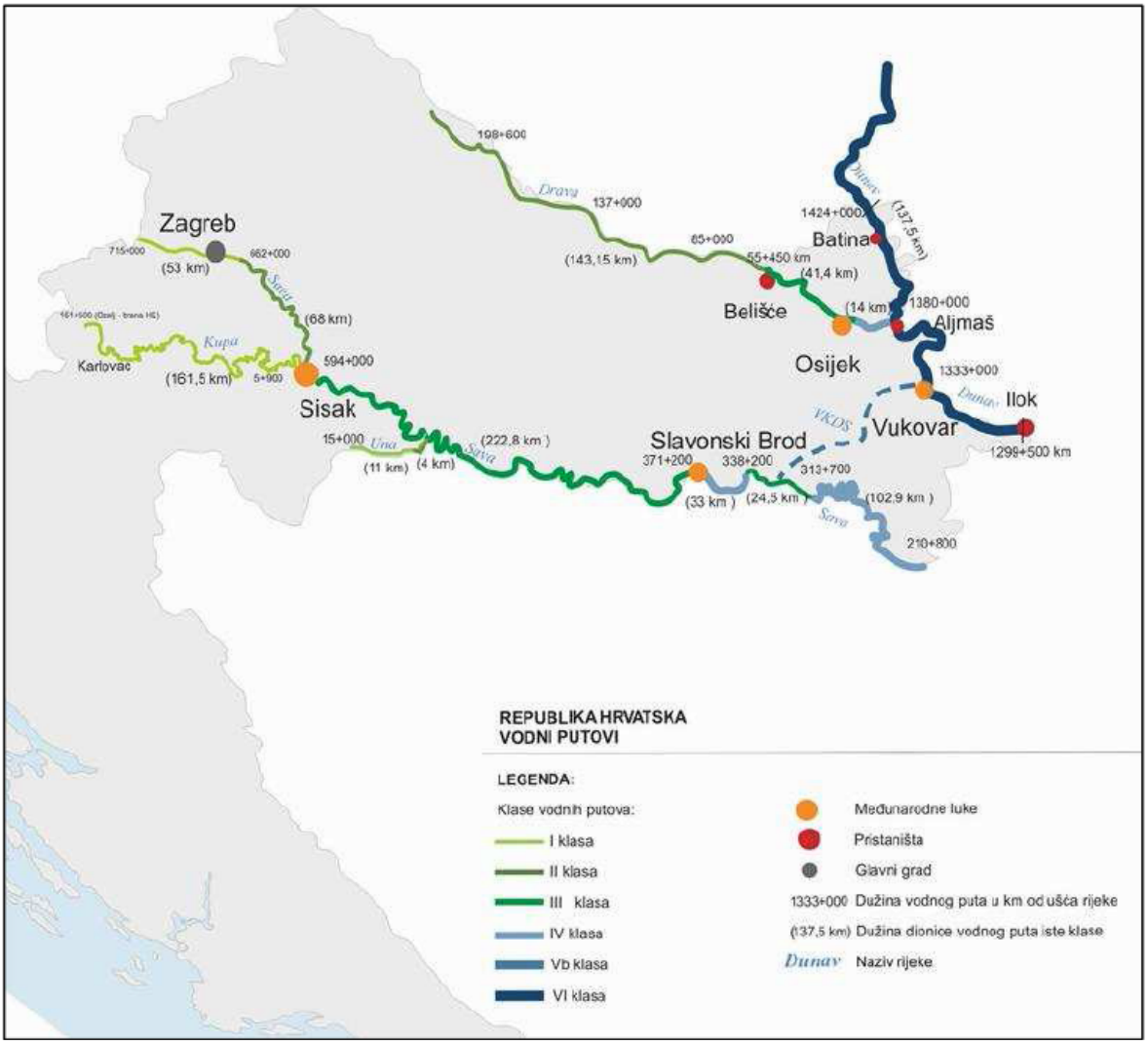


Figure 107: Classification of inland waterways in Republic of Croatia (Source: MSTI)

All ports have a good connection with other modes of transport, international railway and road network (corridors X and Vc). Port Slavonski Brod is 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.

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.

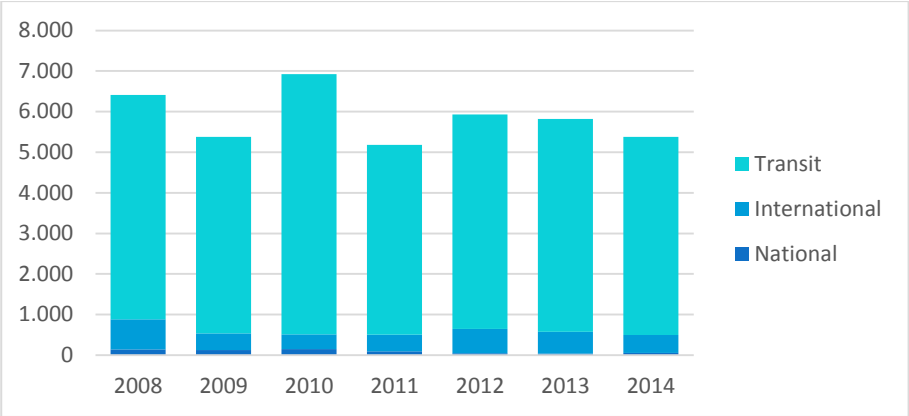


Figure 108: Transport of goods in inland waterways in ’000 tons (Source: CBS, The Statistical Report 'Transport and communication’)

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 with the share of 2/3 of overall trans-shipped cargo in the Republic of Croatia. In 2013 port Vukovar has trans-shipped 427 thousand tons of cargo, mostly bulk cargo, fertilizers and cereals. Port Osijek is the second largest port with the share of ¼ of overall trans-shipped cargo, of which 60% is bulk cargo and 10% are agricultural products (wheat, sunflower and rapeseed). Ports Slavonski Brod and Sisak are the smallest ports with total share of 12% of overall trans-shipped cargo. Crude oil is transported by vessels from port Slavonski Brod to port Sisak which primarily serves the oil refinery in Sisak.

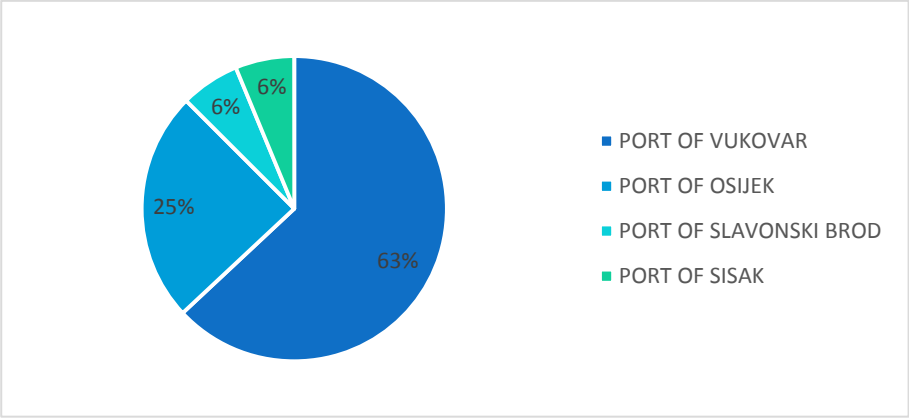


Figure 109: Distribution of transhipped cargo in inland ports (Source: Port statistics)

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 passenger transport. Looking at official statistics in 2013 port of Vukovar recorded 29,215 passengers which is almost 90% of all

passengers recorded in all inland ports in the Republic of Croatia. In the same year port Sisak recorded 2,607 and port Osijek only 1,136 passengers.

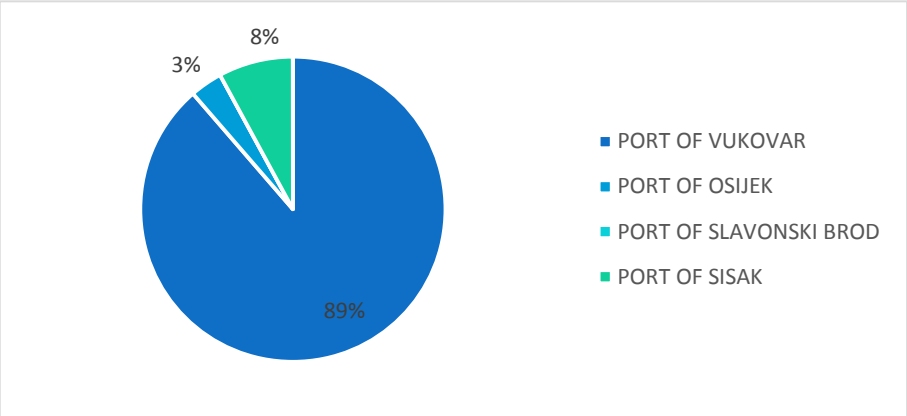


Figure 110: Distribution of passengers in inland ports (Source: Port statistics)

Port Vukovar, as the largest and 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 22 km from the mouth of Danube, with the 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 of particular importance for Bosnia and Hercegovina but 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.

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)

Key findings

- Waterway Danube with Class VIc navigability comply with the requirements of international navigation standards
- Navigability according to AGN requirements is secured

Comment

Inland waterways are generally divided into navigable or non-navigable. Croatia has in total 1.016 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.

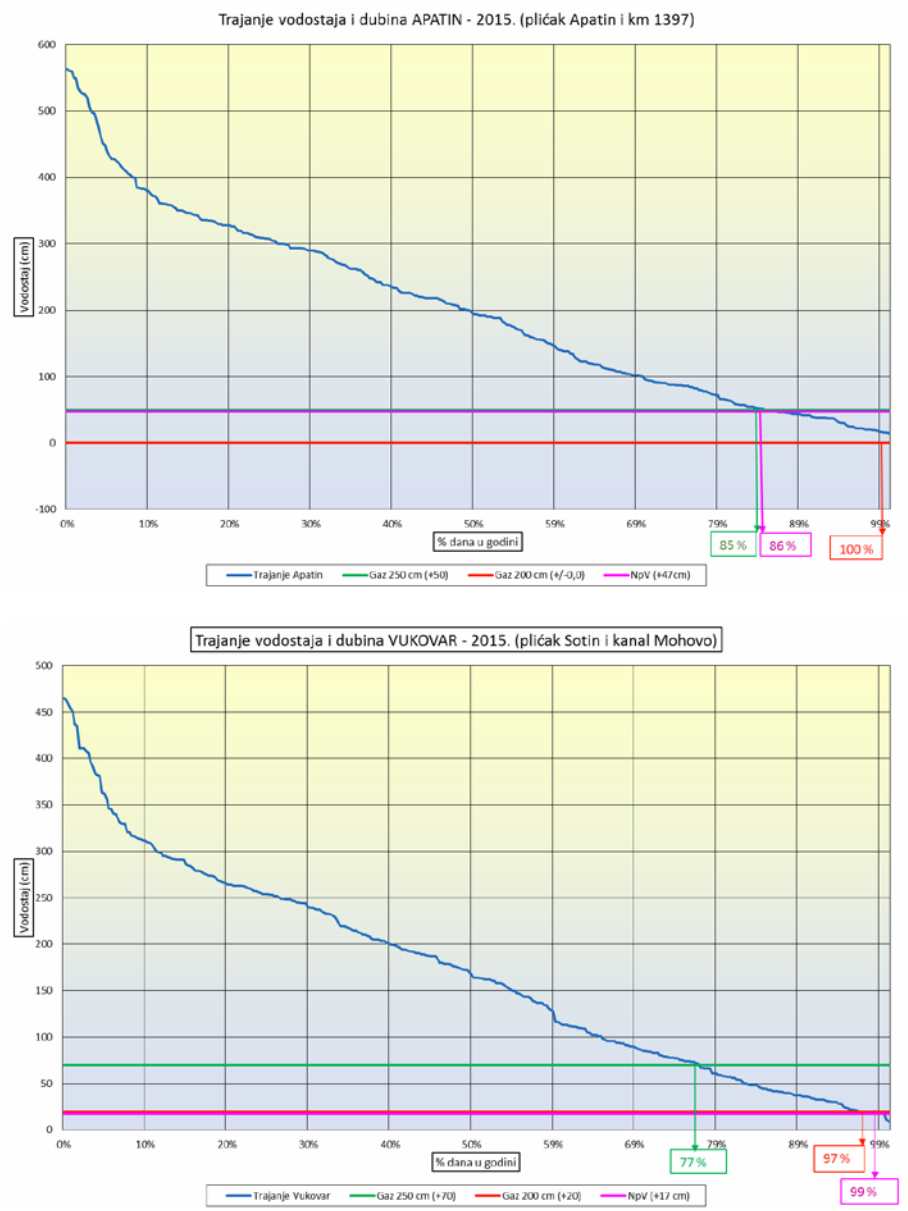


Figure 111: Water levels on critical sectors (Source: Agency for Inland Waterways)

2.7.3 Hypothesis

"The Sava – Danube canal has a high potential for the improvement of the Modal Split in 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 navigability requirements of the river Danube and the river Sava are different
- 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.)
- From transport perspective, the potential of the Sava – Danube canal to shift traffic from road and rail to inland navigation is very limited
- Transport purpose of the canal is in contradiction to other such as irrigation

Comment

The most significant inland waterways in Croatia are the Danube and the Sava rivers. 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.

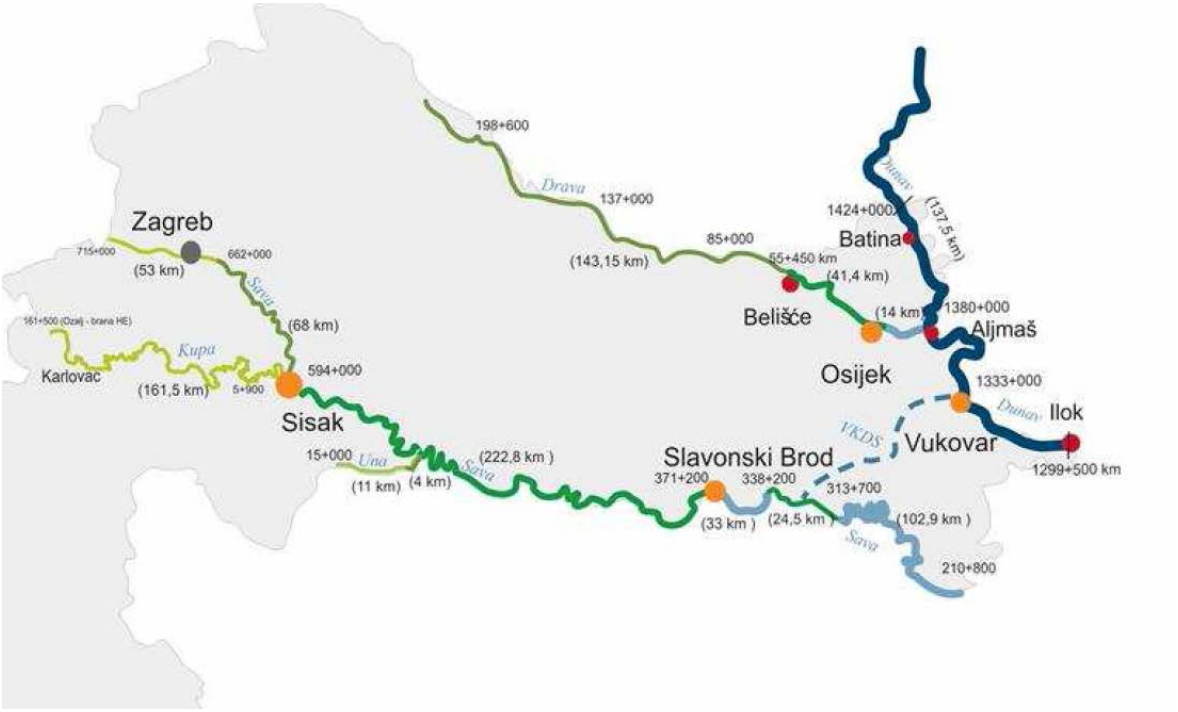


Figure 112: Classification of inland waterways, proposed canal Danube – Sava (Source: MSTI)

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 more than half of total cargo trans-shipped in inland ports, has trans-shipped in the year 2013. mostly fertilizer (57%) and cereals (26%) cargo. Bulk cargo (sand and gravel) 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 2013 port Sisak has trans-shipped 42 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.

Eligibility of the building of proposed channel will be assessed through the Feasibility study which is under way.

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.

- Minimal navigability of Class III on the waterway Sava is sufficient for the current operational requirements
- By increasing the navigability of the waterway, competition to parallel road and rail corridors with high level of service is difficult.

Comment

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 (Sl.Šamac) and section 338+200 (Oprisavci) - 371+200 (Sl.Brod-city), comply with the requirements of international navigation standards, Class IV navigability. Other two sections, section 313+700 (Sl.Šamac) - 338+200 (Oprisavci) and section 371+200 (Sl.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 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.

Table 30: Classification of inland waterways in 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	

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.

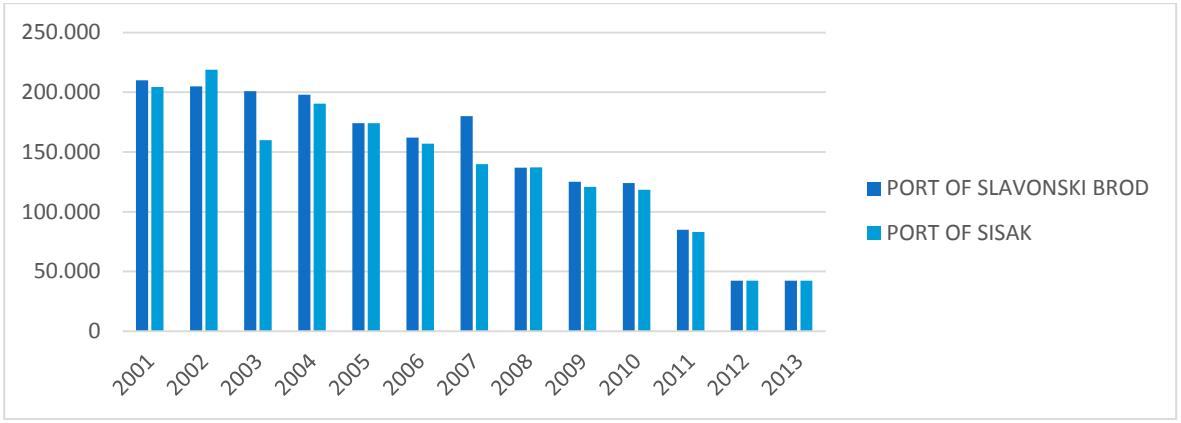


Figure 113: Overview of trans-shipped cargo in tons

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

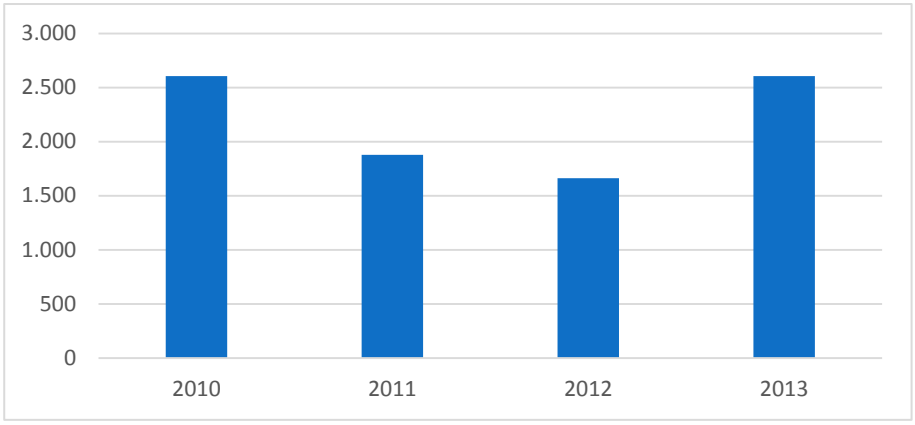


Figure 114: Overview of passenger traffic

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.

2.7.5 Hypothesis

"The port of Slavonski Brod plays a key role for the freight transport system in BiH"

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

Comment

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 crossroads 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 m^2 with capacity of 1.5 million tons of cargo. Port Slavonski Brod serves only freight transport. In year 2013 port has trans-shipped only 42 thousand tons of crude oil which was transported by vessels as the national transport from port Slavonski Brod to Sisak refinery.

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
- Integration of the inland navigation system with the public transport system should be examined by the master plans for functional regions
- Currently there is no real need for integration of the inland navigation system with the public transport system in the Sisak

Comment

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).

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

Comment

Current characteristic of inland waterway ports in 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.
- For the river Sava, a prototype version has been developed but not put to commercial use.

Comment

Although the number of accidents in 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 (RIS) has been designed to operate within the European network of information services in the inland navigation. 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 CRORIS 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 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 covers 159.6 km of inland waterways. A prototype version has been developed for the Sava River.

The service has so far not been put to commercial use, since regulations in Croatia as well as in neighbouring countries need to be amended and a National control centre needs to be established.

It is necessary to define more clearly and completely the legal framework for the implementation of the RIS, the powers of competent authorities, and to strengthen the administrative capacity of the system users. The next step is to establish the national head office for the RIS as an independent organisational unit which will be the national coordinator and international centre for the exchange of information. Moreover, it is necessary to define the organisational and hierarchical structure of the RIS in Croatia.

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)

- GO1 – Developing the passenger Modal Split in favour of Public transport (PT) and 0 emission modes. This includes agglomeration PT (trams, local buses, etc.), rail transport, maritime and inland water PT (boats), regional and long distance buses as well as pedestrians and bikers.
- GO2 – Developing the freight Modal Split in favour of rail transport, maritime freight transport and inland water transport
- GO3 – Developing the transport system (operation, organization and infrastructure development and maintenance) according to the principle of economic sustainability.
- G04 – Reducing the Climate change impact of the Croatian transport system
- G05 – Reducing the impact on the Environment of the Croatian transport system (Environmental sustainability)
- G06 – Improve the traffic safety in the Croatian Transport system

- G07 – Improve the interoperability of the Croatian transport system (PT, rail, road, maritime, inland water and air)
- G08 – Improve the integration of transport modes in Croatia (operation, ITS, P&R, etc.)
- G09 – To further develop the Croatian TEN-T (core and comprehensive) network

3.2 Specific Objectives (SO)

- Specific objectives which apply cross sectorial
    - SO – To better harmonize the transport operations with neighbouring countries (BiH – Ploče Port, road and rail connections BiH, Slovenia, Serbia, Italy, Montenegro and Hungary
    - SO – 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
    - SO – To improve accessibility to remote areas of Croatia (for example island, Southern Dalmatia…)
    - SO – 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, Zagreb hub)
    - SO – Strengthening of Croatia as a logistic hub for the wider region with particular focus on Zagreb.
    - SO – To improve the integration of the transport sector into the social and economic developments of the regions (Functional Regional Concepts)
    - SO – To address the specific situation in Croatia related to the seasonality of traffic
- Public transport and 0 emission modes
    - SO – To develop on the potential for road PT (regional and national) where other PT modes are not economic
    - SO – To improve the competitiveness of the tram systems in Zagreb and Osijek

- SO – To better integrate the international/national transport system with the local and regional transport systems (passenger hubs, integrated ticketing, etc.)
- SO – To increase the efficiency and to reduce the economic impact of PT operations/organization
- SO – To increase the attractiveness of PT by improving operational concepts and modernizing the rolling stock

- Rail transport
  - SO – 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)
  - SO – To better utilize the Croatian railway system in the main Croatian agglomerations (Zagreb, Rijeka, Split, Varaždin, Osijek)
  - SO – To improve the LOS and environmental impact of rolling stock
  - SO – To improve the integration of the railway system into the local transport systems (safety and security of stations, interfaces with other transport modes, etc.)
  - SO – To improve the safety at level crossing with roads
  - SO – To improve the efficiency of the Croatian rail system (traffic management, operations etc.)
  - SO – To safeguard the maintenance of the infrastructure taking into account economic considerations
- Road transport
  - SO – To improve the safety of the road system
  - SO – To better utilize the Croatian road system for PT (Local, regional and national bus systems)
  - SO – To reduce the environmental impact the oldest parts of the Croatian motorway network
  - SO - To optimize and harmonize the different tolling systems in Croatia
  - SO - To improve the technical requirements for road design addressing more economic technical solutions, safety standards, green mobility and the integration of 0 emission modes

- SO – 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
- SO – To increase the connectivity to neighbouring countries in order to reach a higher level of cooperation and territorial integration
- SO – 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
- SO – To reduce congestion in heavily burdened agglomerations taking into account the specific requirements of protection of National Heritage

- Air transport
  - SO – To support the development of Zagreb airport in order to safeguard the international accessibility of the Croatian capital
  - SO – To improve the operations and the operational reliability of Dubrovnik airport in order to safeguard the accessibility of Southern Dalmatia
  - SO - To improve the accessibility of the airports in general and in relation to PT in specific
  - SO – To improve the safety standards on the airports and in air traffic
  - SO – To improve the compatibility with Schengen requirements where applicable
- Maritime transport
  - SO – To improve the development and competitiveness of Rijeka port as the main maritime port of Croatia
  - SO – To reduce the environmental impact of maritime transport (development of the fleet, measures of prevention and suppression of pollution from marine facilities, environmental protection)
  - SO – To improve the Modal Split of freight transport across the Adriatic sea or along the coastline in favour of maritime transport

  - SO - To improve the reliability of maritime (transport PT and supply chains) in case of difficult weather conditions
  - SO – To improve the level of economic efficiency of the maritime transport system
  - SO – To improve the safety of the maritime transport system
  - SO - Better integration of the ports into the local transport system (passenger/freight)
- Inland navigability and river transport
  - SO – To improve the competitiveness of Vukovar and Osijek as the main inland freight ports
  - SO – To cooperate with BiH related to the development of Slavonski Brod freight port
  - SO – To address the potential of inland navigation for tourism and local PT
  - SO – To adjust the navigability requirements to the traffic needs and to safeguard the necessary level of navigability
  - SO – To improve the operational and organizational conditions of the inland transport sector (economic sustainability)

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.

	Duly aligned with the Strategy; the measure is needed and well defined, even if some further studies might be necessary.
	Missing data to determine the duly 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 in terms of current and mid-term traffic forecasts. If the new studies confirm the eligibility of this investment , the measure will be reviewed.
	Measure covered by General measure

4.1 General measures

Code	General measure	General measure description
G.1	National logistic concept for freight	Croatia should define a national concept for freight logistics involving all modes of transport. It is very important to define a role for, among others, ports Rijeka and Ploče and Zagreb node. A specific study needs to be developed involving all relevant stakeholders. As generally speaking the Croatian Transport system has large unused capacities available, it should be assessed whether shifting of traffic from other countries - where bottlenecks have been identified for example Italy - is feasible.
G.2	Improvement of the public transport accessibility for the international airports	Accessibility of the airports by public transport is not adequate. Individual solution should be found for each airport taking into account specifics. Solution should be assessed in the context of the functional region master plan and taking into account potential functionality of connections such as connectivity of Velika Gorica with Zagreb, Trogir with Split,..
G.3	Improvement of safety in transport system	As safety is one of the main objectives of the TDS it is necessary to improve it in all modes of transport system. • To increase the level of safety of the railway system specific measures such as 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. • 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. To improve road safety in Croatia, the following measures should be developed: 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 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. Security of ports and waterways 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 defining the conditions of navigability 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. • To raise up the safety level on waterways to a higher level, besides the implementation of the River Information Services and the availability of timely and accurate information regarding the movement of vessels, it is necessary to establish clear procedures regarding the actions

Code	General measure	General measure description
		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 and even construction 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. A network of intermodal terminals should be established to allow the passengers to easily interchange between transport modes. A well-conceived, balanced, intermodal network is key to maximizing the efficiency of the overall system, minimising nuisances to users. Location and modes of each terminal will be determined according to a specific area study (e.g. Masterplan). In the road sector it is important to ensure the proper accessibility to demand generation/attraction nodes (such as ports, airports, railway stations, working areas, commercial zones, etc.). An increase in the number of parking spaces linked to public transport systems, port and airports will help to increase the modal shift in favour of public transport and consequently reduce the congestion on the roads.
G.5	Maintenance concept for different transport sectors	Owner of the national infrastructure should have maintenance concept which would ensure long term sustainability of different modes. Adequate structures and organisation for maintenance must be put in place in order to provide an efficient and effective/sustainable rail service. The concept must derive from an appropriate and specific analysis of the Croatian and HZ Infrastructure Ltd. context, taking into account technical, financial and users' requirements, the indications from Directive 2008/57/EC on the interoperability of the rail system and the main international standards related to RAMS. Road maintenance is essential in order to preserve the road in its originally constructed condition, protect adjacent resources and user safety and provide efficient, convenient travel along the route. For efficient and effective/sustainable maintenance, adequate structures and organisation for maintenance must be put in place. The concept must derive from an appropriate and specific analysis of the Croatian and relevant stakeholders context, taking into account technical, financial and users requirements. The concept of maintenance in maritime sector can be divided into: maintenance of ports and port infrastructure, and maintenance of shipping

Code	General measure	General measure description
		fleet. Adequate structures and organisation for maintenance must be put in place in order to provide an efficient and effective/sustainable maritime transport service. The concept must derive from an appropriate and specific analysis of the Croatian and maritime operators context, taking into account technical, financial and users requirements.
G.6	Improve energy efficiency in transport system	Promoting the efficient and sustainable use of the infrastructure is one of the priorities for infrastructure development according to the guidelines for development of the Trans-European transport network. In this sense, it is necessary to improve energy efficiency and prioritise low carbon energy sources and propulsion systems. Further studies will analyse 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 objectives of the Trans-European transport network. To achieve this objective it is necessary to optimise the organisational setup of the transport systems and to increase the efficiency of the operation and maintenance. Financial sustainability of the transport system intends to reduce the dependence of the system on public subsidies.
G.8	Harmonization of legislatives and planning guidelines taking into account relevant EU requirements and policies	Legislation and planning guidelines must support the development of the sector and should be in line with international best practice and European regulations, especially regarding safety, security, interoperability, sustainability and environment. The overall legal framework should be harmonized to facilitate the implementation of major infrastructure projects. In all laws and regulations certain procedures need to be simplifies and the definitions harmonized.
G.9	Preparation and adaptation to Schengen requirements	Future scenarios of Croatia and surrounding countries entering the Schengen area will increase the relevance of international traffic. The adaptation of the transport systems requires the elimination of infrastructure and administrative bottlenecks. Elimination of bottlenecks with non-Schengen surrounding countries will help in increasing the relevance of international traffic on certain corridors with international connections. Specific studies will assess on the technical requirements to be met in each specific case.
G.10	Increase administrative capacity/training	The lack of administrative capacity and the properly trained staff is one of the key issues identified in the transport sector and is one of the priorities in the EU cohesion policies. The implementation of new technologies and increasing requests for the control of traffic and means of transportation implies the necessity to train the existing and new staff in accordance with their specific needs.
G.11	Improvement of the public perception of the transport system in Croatia	Promoting and creating a positive image of the public transport system as a reliable, safe and environmentally friendly mean of transport is important for encouraging the demand, and consequently the investments. For better promotion, it is necessary to have complete and up to date information and knowledge of the infrastructure, possibilities and development plans. In the road sector is very important to inform users of the current situation of the traffic and weather conditions to reduce the amount of traffic jams and accidents by offering information's on alternative routes. It is also important to inform drivers of amendments to the existing or adoption of new laws in the sector relevant for the users and to provide instant information on the motorways of the incidental situations that might require changes in the allowable speed or restrictions to the use of lanes. For that reasons, the need to constantly revise and update the information

Code	General measure	General measure description
		technologies and channels is very relevant for the improvement of the sector. It is important as well to increase the involvement of the media as a crucial partner for the transmission of the information. In the maritime transport sector, it is necessary to continuously modernize and integrate IT platform in order to ensure reliable and comprehensive data and information for all users. It is also necessary to establish network services of e-business for all users of public services, to establish a unique port information system in ports in order to improve business processes and raising the competitiveness of ports, to establish hydrographic information system, to improve services maritime meteorology, to develop ICT solutions for operation with emergencies at sea and to improve and to develop the nautical information service as public and free services of safe navigation of boats and yachts.
G.12	Reduce environmental impact of transport	Based on the environmental monitoring, negative environmental and socio-economic impacts of the transport system should be reduced by effective planning/implementation of the infrastructure and the establishment of the necessary measures of environmental protection. Mitigation of the negative impact of transport on the environment must be achieved through greater energy efficiency, in particular, the use of energy sources with low or zero emissions of hydrocarbons and reducing noise emissions and the amount of continuous pollution and waste. To prevent pollution of the Adriatic Sea with maritime facilities and vessels it is necessary to renew and modernize the fleet cleaner, to ensure the availability of services, equipment and devices for operational activities, particularly for interventions in case of large scale marine pollution. It should also provide the conditions for sustainable and accessible service of reception and disposal of ship generated waste and cargo residues in accordance with international and EU regulations and strengthen supervision of the Ballast Water Management on the basis of a risk assessment and in accordance with internationally agreed guidelines. Timely response to combat sea pollution is of particular importance, given that sea pollution could have far-reaching consequences.
G.13	Adaptation and mitigation of climate change	The development of the transport sector in Croatia should be done taking into account the need to reduce the CO2 emissions and thus mitigating the impact of transport on climate change. At the same time, transport infrastructure and operations should be developed taking into account the potential effects of climate change and weather extremes on them.
G.14	Improvement of data collection	For further development of the transport sector, it is necessary to have “up to date” data. It is necessary to improve and simplify the data collection, in order to increase the accessibility of data.
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 Croatia as a transport hub for the Western Balkans 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	Measure description
URBAN, SUBURBAN AND REGIONAL TRANSPORT			
Infrastructure			
U.1	Intermodal terminals development		Covered by the general measure G.4
U.2	Infrastructure development		A proper analysis of the existing situation and expected developments of the Transport System and socio-economic context in urban and regional areas, in a perspective of functional region, should identify the needs of rehabilitating/upgrading existing infrastructure or of creating new ones where mobility levels will justify it. On the other side, this might also mean to dismiss or functionally downgrade some parts of the network where expected mobility levels become non-relevant. Infrastructure investments will be primarily focused on public transport and low/zero emission modes and will be accompanied by complementary mobility management policies and interventions, together with appropriate ITS installations.
U.3	Station development		A proper analysis of the existing situation and expected developments of the Transport System and socio-economic context in urban and regional areas, in a perspective of Sustainable Mobility/Integrated Public Transport Plans, will identify the needs of rehabilitating/upgrading existing stations or of creating new ones where mobility levels will justify it. On the other side, this might also mean to dismiss or functionally downgrade some existing stations where expected mobility levels become non-relevant. Station development will be primarily focused on improving passengers accessibility, especially for persons with reduced mobility, assuring safety and security of the passenger movements and introducing information and PA systems.
U.4	Separation of modes - prioritization to PT, removal of bottlenecks		Public transport (buses and tramways, mainly) has to coexist with the private car since the available space in cities is always limited. At the same time, more importance will be given to public transport and recovering part of the urban space for the use of the citizens. In this sense and in order to increase the efficiency of public transport, the level of separation of private traffic and public transport will be increased by building reserved lanes for public transport and/or dedicated public transport corridors (for tram and buses), and by implementing measures to increase the prioritisation of public transport by means of traffic management, such as traffic lights preferentiality. Additionally, detected obstacles and bottlenecks that impede the efficient operation of public transport will be removed. These obstacles and bottlenecks often cause delays on public transport and can even compromise 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	Measure description
U.6	Filling stations for alternative fuel		Alternative fuels have been largely improved in recent years especially in the context of public transport in urban and suburban areas. The building of filling stations for alternative fuels will be considered, to reduce the conventional fuel consumption, CO2 emissions and toxic particles. Specific studies, in the framework of the Functional Regional Concepts are necessary in each case, to identify the appropriate technology
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
Operation and 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	Adaptation of the legal framework and the implementation rules (PSC)		Covered by the general measures G.7 and G.8
U.12	Increase financial sustainability		Covered by the general measure G.7
U.13	Fare collection and joint ticketing systems		One of the most tangible benefits for users of the integrated transport systems is the introduction of integrated tariff systems. The level of integration of the tariff system and the type of tickets and technologies to be used (single tickets and/or e-ticketing, smart cards or contactless payment methods, etc.) will be analysed case by case based on the competences of the relevant transport authority and taking into account all the possibilities, such as the possibility to use smart cards to pay P&R, on-street parking, toll zones, etc.
U.14	Introduction of on-demand PT services		OTaking 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	Adjustment of timetable (coordinated)		In order to increase the share of public transport modes in the urban, suburban and regional transport, reorganization of time schedules (e.g. TAKT) is necessary to improve connectivity, efficiency and coordination of the different modes. Further studies will analyse this possibility taking into account origin-destination patterns and the operational and infrastructural requirements.
U.16	Administrative capacity and training		Covered by the general measure G.10

Code	Measure	Alignment	Measure description
U.17	Purchase of new rolling stock		With some exceptions, the current fleet of public transport vehicles is aged and based on outdated and inefficient technologies. In order to increase the competitiveness of public transport in comparison with private car it is necessary to modernise the rolling stock ensuring its compliance with the highest quality, safety and environmental standards and the accessibility for 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 to develop this measure is to perform a comprehensive analysis of the current organisational, operational and maintenance setup of the relevant operators analysing the future requirements and operational and maintenance plan. Once the real needs are identified further studies will define the specific technical requirements for the rolling stock.
U.18	Traffic reorganization		Offering competitive alternatives to the use of the private cars is important to achieve the objectives of the TDS and to ensure the sustainability of the transport system. The different transport modes' hierarchy will be rethought and traffic will be reorganized and integrated seeking prioritization of public transport against private car. At the same time, more pedestrian areas in urban centres will be constructed, bike paths for daily commuters will be built, public bicycle systems will be implemented and traffic schemes will be planned to adapt the traffic to seasonal requirements.
U.19	Information platform		Covered by the general measure G.11
U.20	Support of non-profit groups in the transport area		The role of non-profit groups that promote the use of alternatives to the private car has proven to be very successful in numerous cities across Europe. Among others, there are groups that promote daily bike use, groups that watch out for passenger rights, for the maintenance of pedestrian areas or even for traffic surveillance. These groups (neighbourhood associations or common interest groups, non-governmental organisations, etc.) can help the local administrations and transport authorities in their duties and help to promote the use of the public transport. The participation of such associations, local groups and non-governmental organizations in the transport planning decisions will hence be promoted and considered.
U.21	Traffic and logistics management and information		New technologies allow among others for real time data gathering and control of traffic conditions and public transport use. In order to take advantage of these new technologies, centres for centralized management of the public transport will be constructed, equipped with the latest advances in ITS solutions. New public transport vehicles will be equipped accordingly, ITS platforms for trip planning will be used and traffic signalling will be modernized so as to be integrated in the centralized management system (e.g. "Smart Traffic Lights" or public transport prioritization measures). This will allow for a qualitative improvement in the planning and monitoring of public transport, passenger user information, traffic control and real time data gathering regarding congestion, public vehicles arrival times.
U.22	Review/update local/regional Transport Masterplans		egarding the transport planning obligations, the functional regions and/or cities will be required to develop proper Functional Regional Masterplans (following the Sustainable Urban Mobility Plans principles). These Functional Regional Masterplans will analyse the

Code	Measure	Alignment	Measure description
			current situation of the transport systems considering not only infrastructural but also operational and organisational aspects, and based on the outcomes of these analyses the future needs will be identified. The existence of these plans is a pre-requisite for investing in public transport systems. These Masterplans will be periodically reviewed and updated and must be in line with the high level planning instruments such as the TDS.

4.2.2 Railway transport

Code	Measure	Alignment	Measure description
RAILWAY TRANSPORT			
Rail network elements			
R.1	Zagreb - SLO border towards Ljubljana (core/X/Mediterranean)		Line M101 belongs to the TEN-T core network and to RH1 and is one of the main international connections to Zagreb, the only urban node of the rail TEN-T core network in Croatia. As a result, RH1 historically has been the most relevant corridor in terms of long distance passenger traffic. Although some specific activities for the improvement of this line are being developed, the fact is that at present, some sections of M101 line have a speed limit of 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, 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 (core/Vb/Mediterranean)		The corridor connecting Zagreb and Rijeka is mainly relevant for freight and partially for commuter traffic. The analysis shows that this commuter activity is mainly related to the section from Zagreb to Karlovac. At present, this part of the line M202 runs mainly on single track, which is limiting the potential to increase in capacity. It is expected that the importance of this line for freight will increase in the medium to long term due to the fact that Rijeka has been defined as the TEN-T core port of Croatia. Further studies will analyse the design speed and capacity requirements taking into account economic and environmental aspects. Besides increase in capacity, freight traffic requires that the line meets the following technical criteria: 22.5 axle load, ERTMS. siding length depends on logistical concept.
R.3	Karlovac+ to Rijeka (core/Vb/Mediterranean)		The analysis shows that this part of the corridor connecting Zagreb and Rijeka in mainly used for freight. At present, this part of the line M202 runs on single track which is electrified and some sections have speed limits of 50 km/h. Rijeka has been defined as the TEN-T core port of Croatia and consequently, the importance of this line for freight will increase in the medium to long term perspective. Therefore, this section needs to meet the following technical criteria: 22.5 axle load, ERTMS. Siding length depends on logistical concept. Further studies will analyse the design speed and capacity requirements taking into account economic and environmental aspects.
R.4	RRailway network around Rijeka		Current preliminary analyses show that there might be a potential for a reorganisation of the Rijeka railway node with introduction of commuter services, thus favouring modal shift from private cars. Further analysis should investigate railway capacities taking into account logistical concept and capacities of the terminals in the port Rijeka. Remaining capacities could be used for regional passenger transport. Improvement of the link to Slovenia needs to be seen in line with measures R.2 and R.3.

Code	Measure	Alignment	Measure description
R.5	Zagreb - Križevci (core/Vb/Mediterranean)		The corridor connecting Rijeka and Zagreb to East Europe via Hungary is mainly used for freight and partially for commuter traffic. The analysis shows that in this part of the corridor, commuter activity is mainly related to Dugo Selo (15,568 passenger trains in 2012) and Križevci (11,516 passenger trains in 2012). At present, this part of the line M201 runs on double track to Dugo Selo and single track to Križevci. This fact is limiting the potential of increase in capacity, specially taking into consideration that the importance of this line for freight will increase in the medium to long term due to the fact that Rijeka has been defined as the TEN-T core port of Croatia. Besides the increase in capacity, 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.6	Križevci -HU border towards Budapest (core/Vb/Mediterranean)		The analysis shows that this part of the corridor connecting Zagreb and Rijeka to East Europe via Hungary is mainly relevant for freight and partially for commuter traffic. Complementary developments are currently under implementation on the Hungarian side (Gysev network development and Szekesfehervar - Boba line development). At present, this part of the line M201 runs on single track which is electrified and some sections have speed limits of 80 km/h. Rijeka has been defined as the TEN-T core port of Croatia and consequently, the importance of this line for freight will increase in the medium to long term perspective. Therefore, and taking into account that this section belongs to the TEN-T core network, it needs to meet the following technical criteria: 22.5 axle load, 750 m siding length, ERTMS.
R.7	Zagreb - Novska (core/X)		Lines M102 and M103 belong to the TEN-T core network and to RH1, one of the main international connections of Zagreb, the only urban node of the rail TEN-T core network in Croatia. As a result, RH1 historically has been the most important corridor in terms of long distance passenger traffic (between Zagreb and Dugo Selo over 59,000 passenger trains in 2012). Although some specific activities for the improvement of the line from Dugo Selo to Novska are being developed, the fact is that at present, some sections of both lines have a speed limit of 50 Km/h. Further studies will analyse the design speed and capacity requirements taking into account 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.8	Novska - SRB border towards Belgrade (core/X)		Line M105 belongs to the TEN-T core network and to RH1, one of the main international connections of Zagreb. RH1 historically has been the most important corridor in terms of long distance passenger traffic. Future scenarios like Croatia entering the Schengen area and other surrounding countries like Serbia entering EU will increase the volume of traffic in this line. At present, M105 runs on double track between Novska and Tovarnik, which has been designed as the core rail network crossing point between Croatia and Serbia. Further studies will assess the technical requirements to be achieved, 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.

Code	Measure	Alignment	Measure description
R.9	HU border - Osijek - BIH border (comprehensive/core/Vc)		Line M303 belongs to the TEN-T core network in Croatia, and Slavonski Šamac is the railway core network border crossing point to Bosnia and Herzegovina. Lines M301 and M302 belong to the comprehensive network but serve as a Bosnia Herzegovina-Croatia-Hungary link, following the Pan European corridor Vc. From the NTM it can be seen that at the moment there is no need to invest. The potential of this international connection will increase in future scenarios in which Schengen borders will vary from its present configuration.
R.10	Regional connection Vinkovci - Vukovar (core/access to Pan-European corridor X)		Railway line M601 Vinkovci – Vukovar will serve as the railway line connection of RH1 and the only inland core port on the Danube within Croatia, Vukovar. Future scenarios related to the development of the port of Vukovar will increase the importance of freight traffic on this line for the medium to long term perspective. 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, ETRMS.
R.11	Zagreb node		The present configuration of the Croatian rail network and the fact that Zagreb is the only urban node of the core transport network, outline the importance of the capital city of Croatia within the entire transport system. In order to enhance the role of railways in the regional connectivity and in urban transport system of Zagreb, further studies will analyse specific requirements to be fulfilled.
R.12	Zagreb freight		Covered by the general measure G.2
R.13	Zagreb airport connection		Zagreb Main Station must play a key role not only in long distance traffic but also in local and regional traffic. Adaptation of the existing accesses and platforms, organization of passenger flows inside and outside the station, favouring modal interchange, are likely to be required. Specific technical requirements will be a result of functional regional concept, which will take into consideration economic, social and environmental aspects.
R.14	Zagreb main station		Line M101 belongs to the TEN-T core network and to RH1 and is one of the main international connections to Zagreb, the only urban node of the rail TEN-T core network in Croatia. As a result, RH1 historically has been the most relevant corridor in terms of long distance passenger traffic. Although some specific activities for the improvement of this line are being developed, the fact is that at present, some sections of M101 line have a speed limit of 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, 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.
Rail network			
R.15	ETCS L1, L2 on other lines, GSM-R		Installation of ETCS on lines other than the ones described in the previous measures would allow increasing the interoperability of the entire network. Dependent on the operational concept it might be feasible to install ETCS and GSM-R also on other lines of the Croatian

Code	Measure	Alignment	Measure description
			network (comprehensive and non-TEN-T). Functional Region Concept will define specific needs and technical parameters in each case.
R.16	Electrification of other lines		Dependent on the operational concept, electrification of railway lines would allow increasing efficiency on existing infrastructure. Further studies will define specific needs and technical parameters in each case.
R.17	Rehabilitation, upgrading of other lines		Case by case studies will identify the need to rehabilitate and upgrade lines other than the ones described in the previous measures, taking into account the operational concept and also economic and environmental aspects.
R.18	Regional traffic other than Zagreb and Rijeka (Split, Varaždin, Osijek, etc.)		Rail transport can play as well an important role in regional transport in regional centres outside the railway TEN-T core network, due to the existing configuration of the network in these areas. Functional Region Concept will analyse this potential in cities such as Split, Varaždin and Osijek. These studies will also assess case by case the necessary technical parameters.
R.19	Improvements and new marshalling yards		Functional Region Concept will analyse, based on demand forecasts, the necessity to develop new marshalling yards or improve the existing ones to increase the potential of railways for freight.
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
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
Rail operation/organization			
R.26	Reorganization of Track access charge		Track Access Charge can be used as a tool for improving the sustainability of the rail transport system. Track Access Charge has to be proportional to the emissions and therefore addressing the polluter pays principle. Coordinating Track Access Charge with rail administrations of neighbouring countries will facilitate international traffic.

Code	Measure	Alignment	Measure description
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	Improvement of passenger rolling stock		The current railway fleet is aged and based on outdated and inefficient technologies. In order to increase the competitiveness of rail transport in comparison with other transport modes it is necessary to modernise the rolling stock, in coordination to the foreseen improvements on the infrastructure. The first step to develop this measure is to perform a comprehensive analysis of the current organisational, operational and maintenance setup of the railway operator analysing the future requirements and operational and maintenance plan. Once the real needs are identified further studies will define the specific technical requirements for the rolling stock.
R.31	Improvement of freight rolling stock		The freight fleet consists mostly of conventional covered or open wagons, some suitable for combined traffic operations. A large number of locomotives are in need of replacement, with an estimated 70% reaching the end of their working lives within the next decade. The first step to develop this measure is to perform a comprehensive analysis of the current organisational, operational and maintenance setup of the railway operator analysing the future requirements and operational and maintenance plan. As the freight market has been liberalized, it is important to involve the interested and relevant freight operators. Once the real needs are identified further studies will define the specific technical requirements for the rolling stock.
R.32	Update legislation and planning guidelines		Covered by the general measure G.8
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	Liberalization of operations for passengers		Gradual opening of the transport market ensuring equal opportunities to all potential operators is one of the main criteria of compliance fulfilled by Croatia in the process of harmonization with the EU Acquis Communitaire, in line with the objectives of the White Paper. Croatian administrative institutions like the Regulatory Body and the Safety Agency must be prepared for the future situation.

Code	Measure	Alignment	Measure description
R.36	Liberalization of operations for freight		Liberalization of the railway freight sector in Croatia has already started. and the following freight operators are active in 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. i Pružne građevine d.o.o.
R.37	Increase administrative capacity/training		Covered by the general measure G.10
R.38	Reorganization of the operations/time schedules		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. Functional Region Concept will analyse this possibility taking into account origin-destination patterns and the operational and infrastructural requirements.
R.39	Information platforms		Covered by the general measure G.11
R.40	Reduce environmental impact		Covered by the general measures G.12 and G.13
R.41	Improvement of data collection		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 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). GP Gradiška is one of two major border crossings between the Croatia/EU and Bosnia and Herzegovina for all types of traffic.
Ro.2	A5 Osijek - HU border Pecs (comprehensive/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). The construction of the Bridge Drava (length 2.5 km), the most important infrastructural facility on the motorway A5, section Beli Manastir – Osijek, have already started and is in the final stage. The construction of the motorway section from the bridge Drava to Osijek (length 3.8 km) is 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 (comprehensive/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. The section from Sredanci (motorway A3) to the B&H border is 3.5 km long and is under construction. The section includes a bridge over the river Sava (660m in length). The continuation on the BiH side is already constructed.
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 orographic 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 jug (10,9 km), Velika Gorica – Lekenik (20,2 km) and Lekenik – Sisak (10,8 km). Two of them, Jakuševec – Velika Gorica jug 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. Further development of the project should be coordinated with HU authority.
Ro.8	Zagreb main network reorganization		agreb 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 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 SLO border to SRB border		D2 is the existing state road for transit traffic in the northern areas 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

Code	Measure	Alignment	Measure description
			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.
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). 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 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 - MNE border		The Corridor Dubrovnik – MNE border is at different stages of development per sections. The development would bypass the Dubrovnik airport. 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.
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. Section Zagreb – Karlovac is one of the oldest part of motorway network in the Croatia with quite low environment standards. According to feasibility study capacity limitations are caused by existing tolling system and the need for a capacity increase has not been proven as necessary in the medium-term horizon. The potential change of the tolling system, see measure Ro.18, would have a clear impact on this road section. Specific interventions to increase the safety and environmental standards of this section could be justified.
Ro.13	Increase of capacity - dedicated PT lane Zagreb bypass		The Zagreb bypass is the busiest traffic route in 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 economic, social and environmental aspects, as well as the developments planned in other modes of transport.

Code	Measure	Alignment	Measure description
Ro.14	Slavonski Brod port access improvement		Slavonski Brod, as the main port on the river Sava, is the only inland port in 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.
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: Trogir – Split – 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)		Long distance accessibility will be mainly solved through the airport connection in the mid-term scenario but for the local and regional needs and for freight transport, the bridge „Pelješac“, in combination with local road network on Pelješac and a bypass of Ston need to be constructed. This will not only serve the purpose of accessibility of Dubrovnik and further to Monte Negro, but also the accessibility of Pelješac Peninsula as well as Korcula.
Ro.18	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.19			
Ro.20	Secondary and tertiary road rehabilitation and realignment		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. 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.
Ro.21	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

Code	Measure	Alignment	Measure description
			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), is planned.
Ro.22	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 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.23	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.24	Road safety		Covered by the general measure G.3
Ro.25	Network development to intermodal hubs, agglomerations in line with demand		Covered by the general measure G.4
Ro.26	Improve interoperability (intermodal hubs, P&R, etc.)		Covered by the general measures G.4 and G15
Ro.27	Reduce environmental impact		Covered by the general measures G.12 and G.13
Ro.28	Energy efficiency		Covered by the general measure G.6
Road operation/organization			

Code	Measure	Alignment	Measure description
Ro.29			
Ro.30	Increase administrative capacity/training		Covered by the general measure G.10
Ro.31	Preparation/adaptation for Schengen borders		Covered by the general measure G.9
Ro.32	Preparation/adaptation of non-Schengen borders		Covered by the general measure G.9
Ro.33	Improve financial sustainability of the road network and tolling system		Covered by the general measure G.7
Ro.34	Information platforms		Covered by the general measure G.11
Ro.35	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.36	Enforcement		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.37	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)		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)		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)		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.

Code	Measure	Alignment	Measure description
A.6	Rijeka airport development (comprehensive)		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 / 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)		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)		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 development (core)		Airport Franjo Tuđman is the main gateway to 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. Zagreb Airport Ltd. company is still active, now having the role of an intermediary between the Government of the Republic of Croatia and the concessionaire, with the aim of further development of the infrastructure and all the transport segments that are not subject to the concessionaire contract. Should the concessionaire withdraw from the project and operation of the airport, Zagreb Airport Ltd. will immediately takeover the airport from the concessionaire to ensure continuous and uninterrupted operation of Zagreb Airport. The development plans of the airport include the construction of a new terminal to increase the 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

Code	Measure	Alignment	Measure description
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			
A.14	Adaptation of legal national framework as well 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 it is necessary to fully implement and finalize the restructuring of Croatia Airlines. 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.

Code	Measure	Alignment	Measure description
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
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 Croatia. The stages for implementation of the "motorways of the sea" projects in 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)
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 eco-shipping, by stimulating the procurement/construction of new eco-ships 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 eco-shipping it is necessary to develop bunkering facilities for gas powered and eco ships.
M.5	Navigability		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.

Code	Measure	Alignment	Measure description
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 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 and LNG terminal)		Rijeka has been classified as the TEN-T core port 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. 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. The feasibility of developing of the LNG terminal on island Krk needs to be further assessed taking into account the National Energy Strategy and the potential demand and environmental considerations.
M.9	Specialise Ploče port (container and bulk cargo)		The Ploče port has been classified as a TEN-T comprehensive port 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. 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.
M.10	Specialise Dubrovnik port (cruising vessels)		The Dubrovnik 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 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. Further analyses will identify the feasibility of these measures and prioritise them, taking into account environmental requirements and

Code	Measure	Alignment	Measure description
			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 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. 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.
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. Cargo traffic is limited due to physical constraints and proximity to Rijeka. 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 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 vessels) and super-yachts. 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 berths, dry docks and warehouses for yachts, etc. Fishing ports on islands are needed for the sustainable development of islands. Industrial ports are mainly berths for some industrial plants: thermal power plants, oil refinery. 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.

Code	Measure	Alignment	Measure description
M.15	Energy efficiency		Covered by the general measure G.6
M.16	Closure or change of role/ownership of unused ports		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
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 transport, the operation plan must be improved by considering the need for cruise passenger ships in ports with important cruise liner traffic due to port and city congestion.
M.21	Traffic management and IT system, VTMIS		Traffic management with IT system for public maritime transport needs to be improved. 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).

Code	Measure	Alignment	Measure description
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.
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 137.5 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). 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.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. However, level of navigability is sufficient for the current operational requirements.
I.3	Vukovar port development (core)		he 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. It has a VIc class of navigability. 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)		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 (core)		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 BIH, is largely dependent on the

Code	Measure	Alignment	Measure description
			development of navigability of the Sava river and the developments in BiH and Serbia. Reliability and safety of navigation on the 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 logistical concept.
I.6	Sisak port development (comprehensive)		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 Danube - Sava canal		Multipurpose canal Danube – Sava is planned to have four equally important functions: shipping, irrigation, drying out and equalization of low water level. Due to its multiple functions, the canal will have an important impact on the Croatian economy. From the transport perspective the canal is part of intermodal transport corridor Podunavlje-Jadran which is long 560 km and is connecting the river of Sava through railway connection to Port of Rijeka Eligbility of building this multipurpose channel will be assessed through Feasibility study for the channel which is ongoing.
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 31: 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 (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 Croatian transport system
		5	Reducing the impact on the Environment of the Croatian transport system (Environmental sustainability)
		6	Improve the traffic safety in the Croatian Transport system
		7	Improve the interoperability of the Croatian transport system (PT, rail, road, maritime, inland water and air)
		8	Improve the integration of transport modes in Croatia (operation, ITS, 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, 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 32: 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
URBAN, SUBURBAN AND REGIONAL TRANSPORT																						
Infrastructure																						
U.2	Infrastructure development						■		■	■				■	■	■		■	■	■		
U.3	Station 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 33: 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 (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 Croatian transport system
		5	Reducing the impact on the Environment of the Croatian transport system (Environmental sustainability)
		6	Improve the traffic safety in the Croatian Transport system
		7	Improve the interoperability of the Croatian transport system (PT, rail, road, maritime, inland water and air)
		8	Improve the integration of transport modes in Croatia (operation, ITS, 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 centers (Rijeka maritime port, Ploče maritime port, Split maritime port, Vukovar inland port, Osijek 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)
		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 34: 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 - SLO border towards Ljubljana (core/X/Mediterranean)		■	■	■	■	■	■	■	■	■			■	■	■	■			■	■	■	■	■
R.2	Zagreb - Karlovac (core/Vb/Mediterranean)		■	■	■	■	■	■	■	■	■	■		■	■	■	■	■		■	■	■	■	■
R.3	Karlovac+ to Rijeka (core/Vb/Mediterranean)		■	■	■	■	■	■	■	■	■	■		■	■	■	■	■		■	■	■	■	■
R.4	Railway network around Rijeka	■	■	■	■	■	■	■	■			■		■		■			■	■	■	■	■	■
R.5	Zagreb - Križevci		■	■	■	■	■	■	■	■	■			■	■	■			■		■	■	■	■

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
	(core/Vb/Mediterranean)																							
R.6	Križevci -HU border towards Budapest (core/Vb/Mediterranean)																							
R.7	Zagreb - Novska (core/X)																							
R.8	Novska - SRB border towards Belgrade (core/X)																							
R.9	HU border - Osijek - BIH border (comprehensive/core/Vc)																							
R.10	Regional connection Vinkovci - Vukovar (core/access to corridor X)																							
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	Rehabilitation, upgrading of other lines																							
R.18	Regional traffic other than Zagreb and Rijeka (Split, Varaždin, Osijek, etc.)																							
R.19	Improvements and new marshalling yards																							
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 35: 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 (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 Croatian transport system
		5	Reducing the impact on the Environment of the Croatian transport system (Environmental sustainability)
		6	Improve the traffic safety in the Croatian Transport system
		7	Improve the interoperability of the Croatian transport system (PT, rail, road, maritime, inland water and air)
		8	Improve the integration of transport modes in Croatia (operation, ITS, 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, 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
		9	To reduce congestion in heavily burdened agglomerations taking into account the specific requirements of protection of National Heritage

Table 36: 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																									

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
Ro.2	A5 Osijek - HU border Pecs (comprehensive/Vc)																									
Ro.3	A5 from A3 to BIH border (comprehensive/Vc)																									
Ro.4	A7 Križišće to Žuta Lokva (comprehensive/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.18	Reconsideration of tolling system in Croatia																									
Road network																										
Ro.20	Secondary and tertiary road rehabilitation and realignment																									
Ro.21	Develop a resting station concept for the high level road network																									
Ro.22	Traffic management, monitoring, traffic counting and information system																									
Ro.23	Interchange development plan																									
Road operation/organization																										
Ro.35	Recategorization of the road network																									
Ro.36	Enforcement																									

5.4 Air transport

Table 37: 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 (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 Croatian transport system
		5	Reducing the impact on the Environment of the Croatian transport system (Environmental sustainability)
		6	Improve the traffic safety in the Croatian Transport system
		7	Improve the interoperability of the Croatian transport system (PT, rail, road, maritime, inland water and air)
		8	Improve the integration of transport modes in Croatia (operation, ITS, 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, 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 38: 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 (comprehensive)			■		■	■	■	■	■		■	■				■		■	■	■	■
A.2	Pula airport development (comprehensive)			■		■	■	■	■	■		■					■			■	■	■
A.3	Brač airport development			■		■	■	■	■			■	■				■			■	■	
A.4	Mali Lošinj airport development			■		■	■	■	■			■	■				■			■		
A.5	Osijek airport development (comprehensive)			■		■	■	■	■	■							■			■		■
A.6	Rijeka 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
	(comprehensive)																					
A.7	Split airport development (comprehensive)																					
A.8	Zadar airport development (comprehensive)																					
A.9	Zagreb airport development (core)																					
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 39: 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 (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 Croatian transport system
		5	Reducing the impact on the Environment of the Croatian transport system (Environmental sustainability)
		6	Improve the traffic safety in the Croatian Transport system
		7	Improve the interoperability of the Croatian transport system (PT, rail, road, maritime, inland water and air)
		8	Improve the integration of transport modes in Croatia (operation, ITS, 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, 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 40: 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 eco																							

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
	ships																							
M.6	Improve the accessibility of islands, port development																							
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	Closure or change of role/ownership of unused ports																							
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 41: 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 (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 Croatian transport system
		5	Reducing the impact on the Environment of the Croatian transport system (Environmental sustainability)
		6	Improve the traffic safety in the Croatian Transport system
		7	Improve the interoperability of the Croatian transport system (PT, rail, road, maritime, inland water and air)
		8	Improve the integration of transport modes in Croatia (operation, ITS, 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, 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 address 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 42: 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 (core)		■	■		■			■	■				■				■				
I.4	Osijek port development (comprehensive)		■	■		■			■	■				■				■				
I.5	Slavonski Brod port development (core)																		■			
I.6	Sisak port development (comprehensive)																			■		

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																					