



# DIOMIS

## Evolution of intermodal rail/road traffic in Central and Eastern European Countries by 2020

CROATIA



**Developing Infrastructure & Operating Models for Intermodal Shift**

January 2010

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## FOREWORD

In January 2008, the Combined Transport Group of the UIC presented the **AGENDA 2015 FOR COMBINED TRANSPORT IN EUROPE**, which constituted the epitome of the work carried out over two years in the **UIC DIOMIS project**: developing infrastructure and operating models for intermodal shift.

Previously, with KombiConsult and K+P Transport Consultants, we investigated whether enough capacity would be available for Combined Transport (CT) on the European railway infrastructure by 2015 considering the expectations placed on Rail Freight and particularly on Combined Transport. In other words, given the most realistic growth projections, taking into account the foreseeable evolutions of the other Railway activities and visualising, on the basis of the current and planned infrastructure realisations and projects, the railway infrastructure available in 2015, would there be sufficient and appropriate infrastructure? If not, what should be done, in terms of investments and organisations, including those related to terminals?

It was shown that severe bottlenecks would constrain many parts of the European railway network and that, in all fields (infrastructure network, operations, terminals, ...), there was a need for innovative solutions leading to a deep re-evaluation of our current infrastructure and operating models.

A recent update of our growth projections for CT, in the light of the present recession, indicates that, despite the current traffic downturn caused by the recession, CT will have grown considerably by 2015, compared to 2005, and that, with unchanged methods of production and without considerable improvements in productivity, we will still be faced, on the central part of the European network covered by the initial phase of **DIOMIS**, with severe capacity constraints in the field of railway infrastructure, CT terminals and even wagons.



**DIOMIS** established that CT has become the growth business segment of freight railways and provides the opportunity to increase the market share of rail freight in Europe. However, considering the prospective capacity constraints that were identified by 2015, **DIOMIS** considered how the stakeholders, i.e. railways undertakings, operators and terminal managers, besides inevitable infrastructure expansions, can, within the projected infrastructure constraints, increase capacity and optimize capacity use in order to face the expected strong growth of combined transport of 7,3 % domestic and 8,7 % internationally ?

The results published in this **AGENDA 2015 FOR COMBINED TRANSPORT IN EUROPE** constituted a call for action for all the decision makers of the stakeholders (Railway Undertakings, Combined Transport Operators, Terminal Managers, Infrastructure Managers etc. ), including national and supranational authorities and port authorities. The ambition of **AGENDA 2015** is to become an integral part of their respective strategies.

The second phase of DIOMIS, covering 2008-9, has ensured the full dissemination of AGENDA 2015 and updated the overall detailed report on Combined Transport (CT).

Most importantly, it expanded to a number of Central and Eastern European Countries (CEEC) the geographical scope and the investigation methods of **DIOMIS**. The countries investigated in the course of this second phase were Bulgaria, Croatia, the Czech Republic, Hungary, Poland, Romania, Slovakia, and Slovenia.

For each of these countries, the team identified the current situation of CT, its challenges and prospects, the prospective capacities of the railway infrastructure and of the CT terminals, and the related investment plans and needs. The impact of the current recession, that is hitting hard some of the countries involved, was also taken into account.





The result is a set of comprehensive reports, constituting for the deciders in these countries, and for the stakeholders of CT interested in developing CT business within and in relation with the CEEC countries, and in conjunction with **AGENDA 2015**, a precious information source but, even more importantly, also a useful analytical and decision tool.

As was the case for the other **DIOMIS 1** and **2** modules, KombiConsult and K+P Transport Consultants carried out the work and prepared these reports. We are very thankful to Hans-Paul Kienzler, from K+P Transport Consultants, and to Rainer Mertel, from KombiConsult, and their respective teams.

**DIOMIS** was also coached by a very active Steering Committee, composed of Martin Burkhardt (Director General UIRR), Javier Casanas (Trenitalia, partim), Gerard Dalton (Infrastructure Director of UIC), Gilberto Galloni (Chairman Europlatforms), Sandra Géhénot (Senior Freight Advisor UIC), Eric Peetermans (SNCB Holding, Chairman CTG UIC), Eric Pfaffmann (DB Intermodal), Erich Rohrhofer (Head of Combined Transport, RailCargo Austria), Daniel Molcan (Head of Combined Transport, CD Cargo) and Oliver Sellnick (Freight Director UIC).

Our dearest wish is now that these papers be integrated into the strategies of the stakeholders and we are confident that all parties concerned will share our excitement at this perspective and will co-operate to this achievement. We certainly remain available to discuss with the interested parties the results and prospects detailed in these reports.

**Eric Peetermans**  
**Chairman**  
**UIC Combined Transport Group (CTG)**

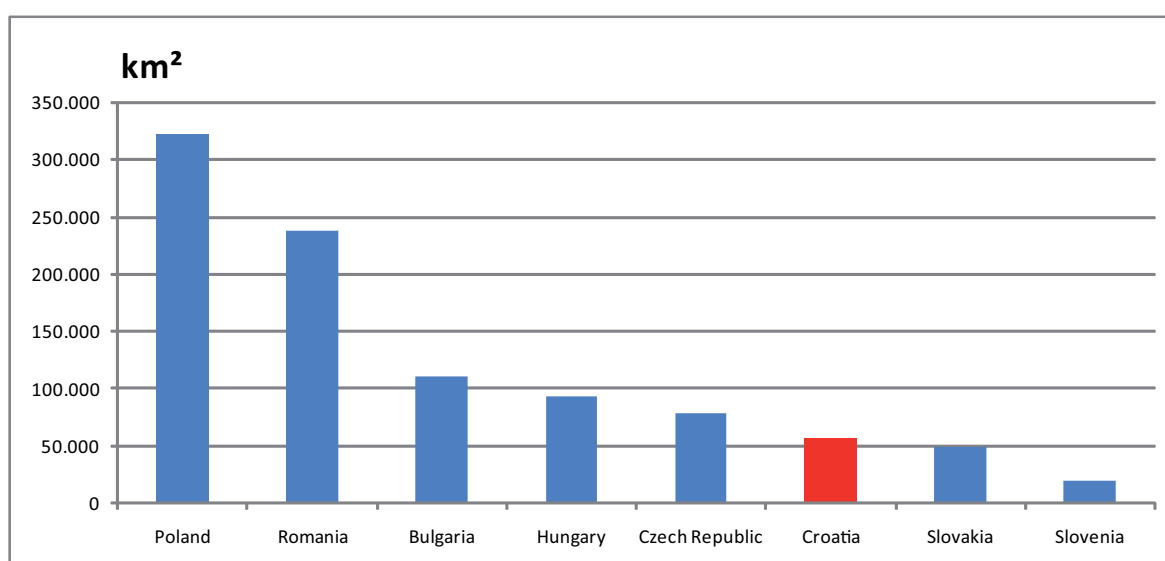
**Oliver Sellnick**  
**Director Freight**  
**UIC**

*December 2009*

## 1. SOCIO-ECONOMIC INFORMATION ON CROATIA

The Republic of Croatia is located in South-East Europe and stretches out on 56.5 million m<sup>2</sup> between the Adriatic Sea in the West and the Pannonian Plane in the East. Its neighbouring countries are Slovenia, Hungary, Serbia and Bosnia-and-Herzegovina as well as Montenegro. Among the DIOMIS study countries Croatia is the sixth largest.

**Figure 1: Size of selected CEE countries (km<sup>2</sup>)**



*Source: Eurostat, KombiConsult analysis*

The population of 4.4 million inhabitants stagnated in the last years and is likely to remain stable in the years to come. More than 50 per cent of the population concentrates in the following larger areas: town and county of Zagreb (1.2 million), counties of Split-Dalmatia (481,000), Osijek-Baranja (322,000) and Primorje-Gorski Kotar (305,000).

The Republic of Croatia, Ministry of the Sea, Tourism, Transport and Development, Transport has set up Operational Programme 2007-2009 as an instrument for pre-Accession assistance in September 2007. According to that the cities of Zagreb, Osijek, Rijeka and



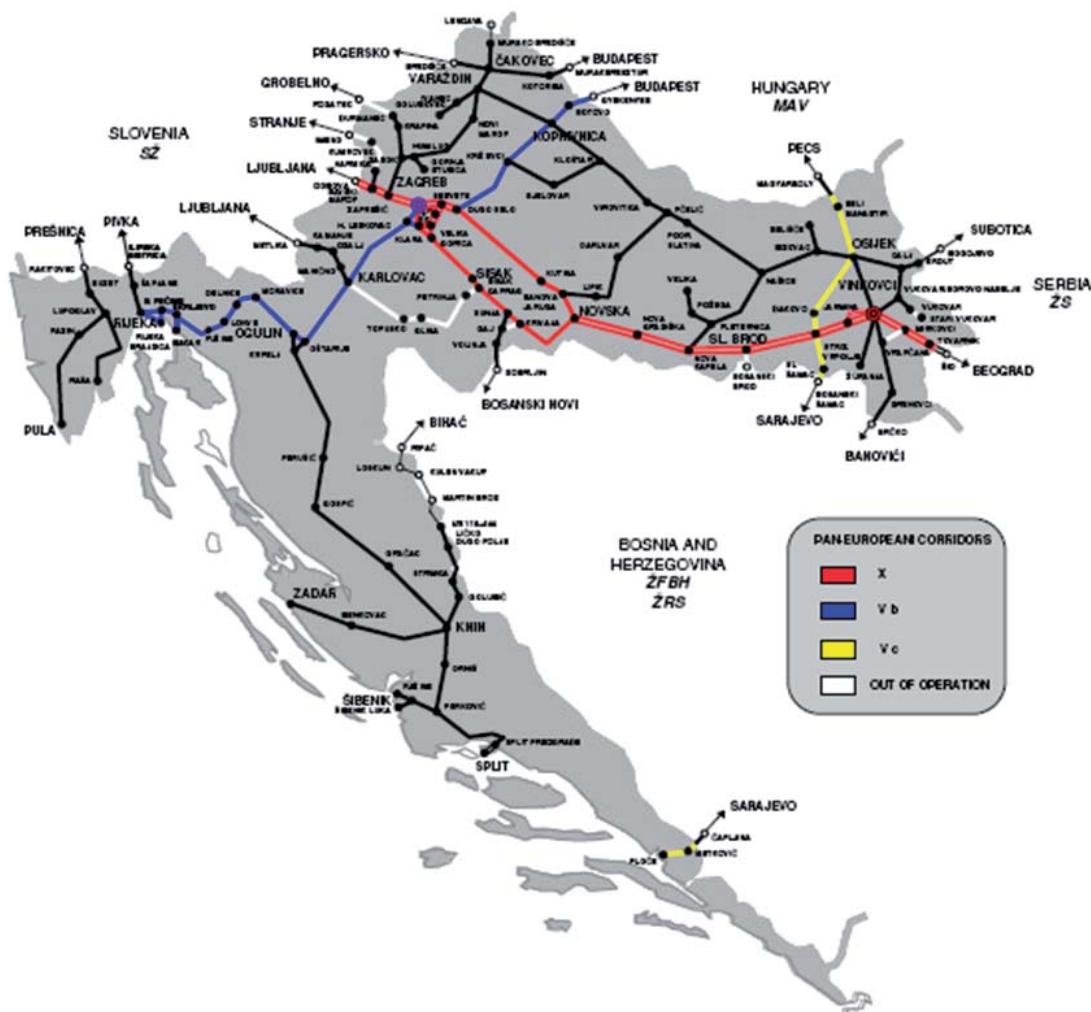
Split as well as Zadar are thus nominated as of “supernational importance” in the countries’ national traffic and development axis concepts.

Due to its geographic position Croatia is highly important for the establishment of effective transport links between Western European and the Balkans as well as for the connection between Central Europe and the Adriatic / Mediterranean Sea.

The following Pan-European Transport Corridors are intersected in the country:

- Corridor N° X (Salzburg – Villach – Ljubljana / Graz – Maribor - Dobova) - Zagreb – Novska - Vinkovci – (Sid - Beograd – Skopje – Thessaloniki)
- Corridor N° Vb : Rijeka – Ogulin - Zagreb - ( Budapest)
- Corridor N° Vc: Ploče – (Sarajevo – Osijek – Budapest)
- Corridor N° VII The Danube river with tributaries / Sava river

Figure 1-1: Pan-European (rail) corridors crossing Croatia

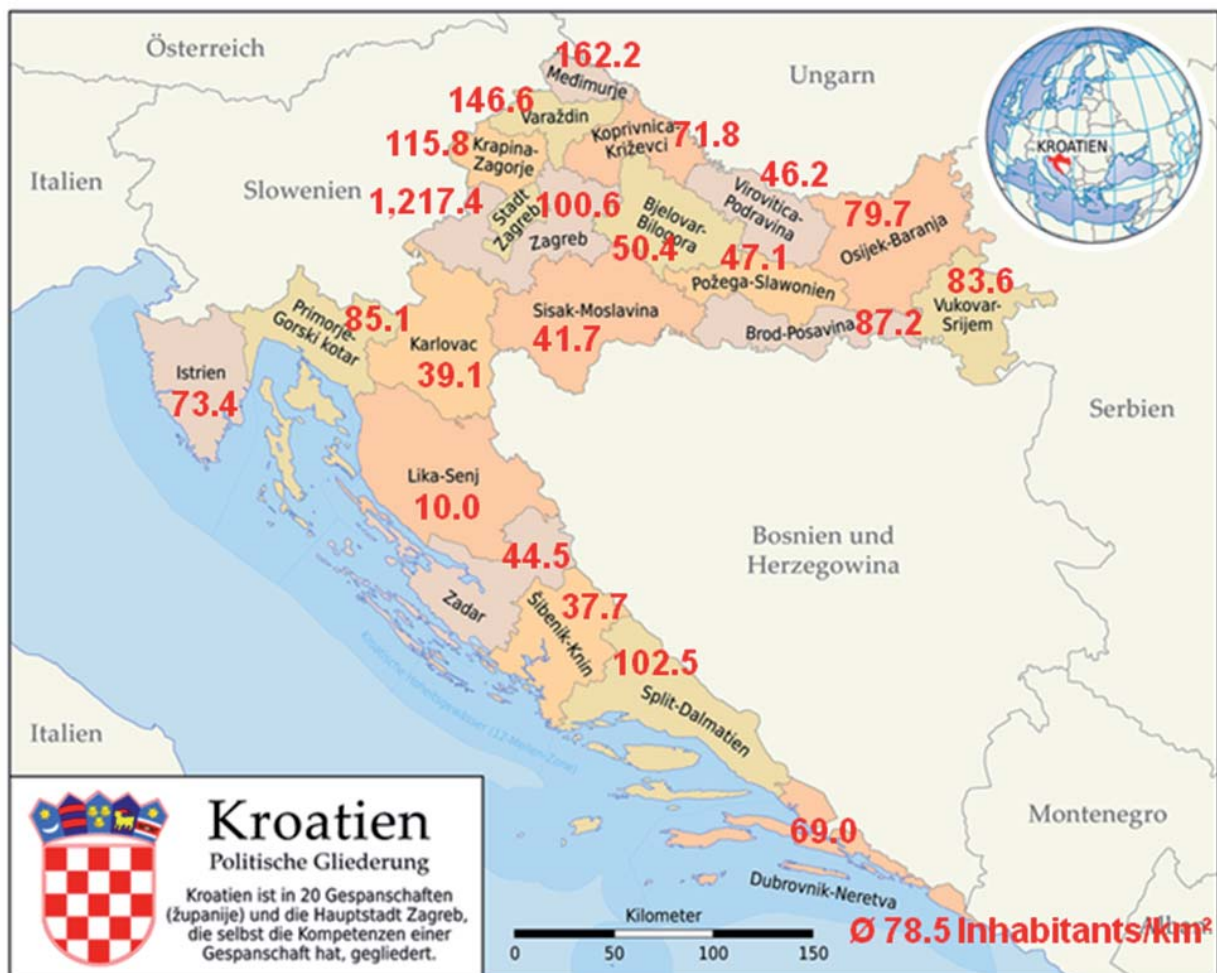


Source: HZ Infrastructure Network Statement 2010

Nevertheless, the particular “U”-shape of the country, which is in fact “surrounding” Bosnia-and-Herzegovina, and the entire diameter of not more than about 400 km create a real challenge for building appropriate line infrastructures and establishing competitive domestic rail freight services.

The Republic of Croatia administratively is divided into three statistical regions, which themselves consist of 20 counties (*županije*) and the capital city Zagreb, which itself is characterised as a county (see **Figure 1-2**). The political power is shared among the central government and the elected bodies in the counties, nevertheless Croatia features a comparatively strong central administration.

**Figure 1-2: Croatia: administrative division by counties and population density**



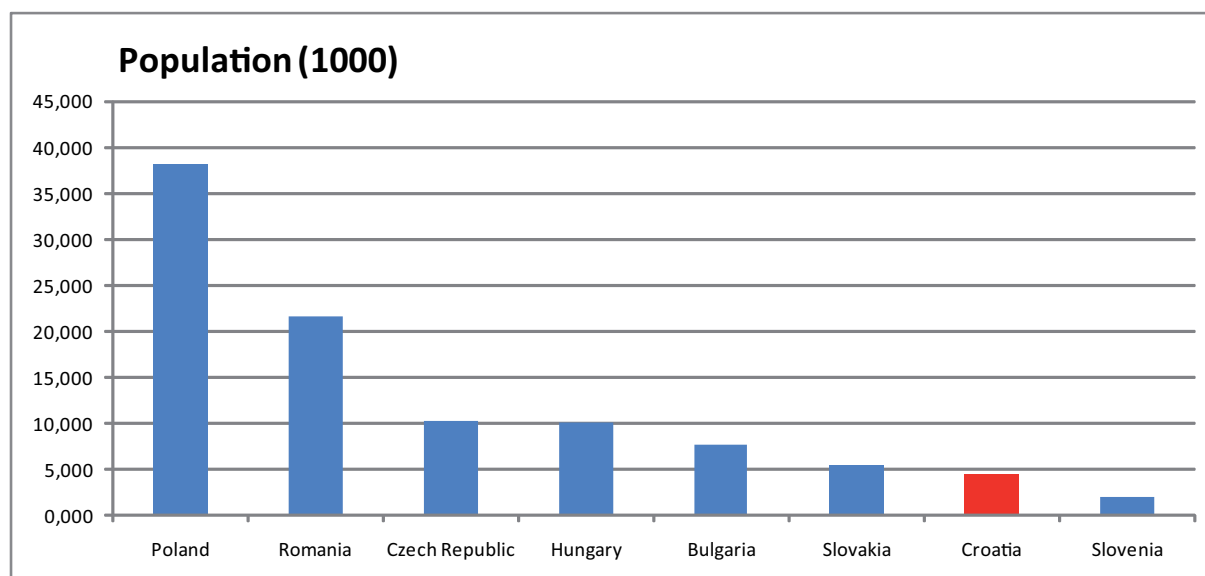
Source: wikipedia.de, KombiConsult analysis

## 1.1 - Population

Similar to the administrative powers, the Croatian population is concentrated in the Centre. 25 per cent of a total of 4.436,000 persons (2008) live in the region of Central Croatia that comprises the town of Zagreb (779,000 inhabitants) and the adjacent county Zagreb (309,000 inhabitants). Zagreb, of course, is by far the biggest city. The next bigger settlement is the county of Dalmatia with the capital Split in south-west Croatia accounting for a population of about 463,000; Osijek in east Croatia with 330,000 and Rijeka in West Croatia with 305,000 inhabitants. All other towns such as Pazina, Vukovar or Sisak have less than 200,000 inhabitants (see **Figure 1-2**).

Among the CEE states covered by this DIOMIS study Croatia is the seventh largest country in terms of the population and six largest in term of the size of the territory, which accounts for 56,594 km<sup>2</sup> (see **Figure 1-3**).

**Figure 1-3: Population of selected CEE countries, 2007**

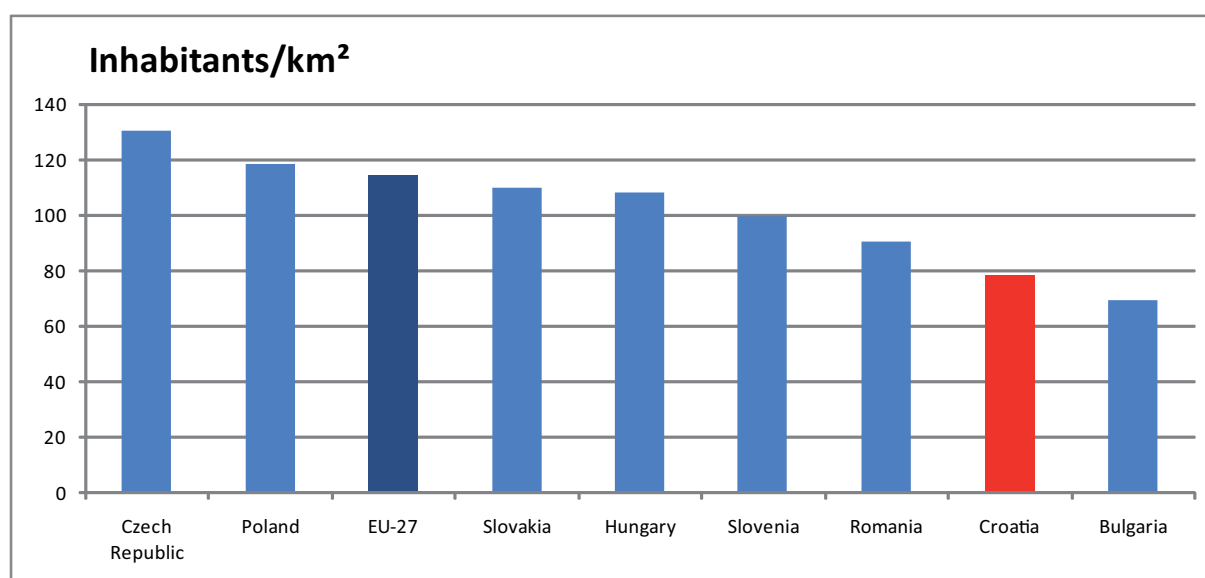


Source: Eurostat, KombiConsult analysis

In 2008, this resulted in an average population density of 78.5 inhabitants per km<sup>2</sup>, which is smaller than the EU-27 average and the 2<sup>nd</sup> smallest among the DIOMIS Study countries (see **Figure 1-4**). The population density is considerably smaller in rural areas in the centre and west. It goes without saying that such patterns impact on the volumes of freight traffic

and on the market potential for intermodal services. These relations will be analyzed in-depth in chapter 3.

**Figure 1-4: Inhabitants per area of selected CEE countries, 2007**



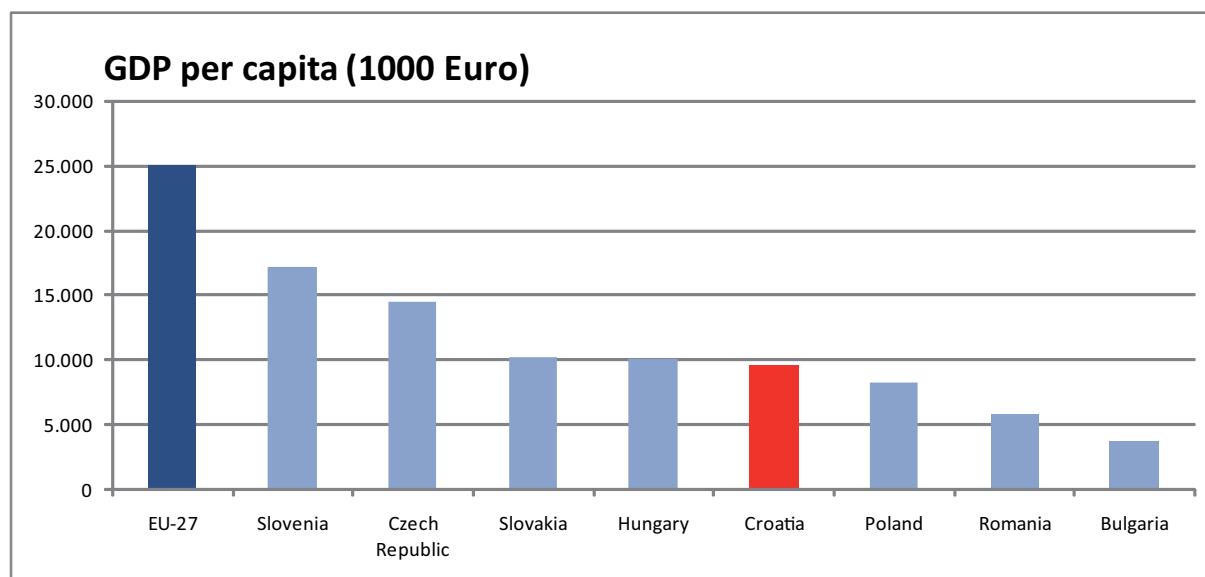
Source: Eurostat, KombiConsult analysis

## 1.2 - Economy

In Croatia, GDP per capita was Euro 9,642 in the year 2007 corresponding to more than one third of the EU average of approximately Euro 25,000. With respect to the eight CEE countries involved this study Croatia ranks in the middle (see also **Figure 1-5**).

The gross domestic product of about Euro 47.400 million in 2008 resulted mainly from services ("other"), while manufacturing contributed 16 per cent, wholesale and repair 11 per cent, transport, storage and communication 8 per cent, construction 6 per cent and agriculture, forestry and fishing 6 per cent (see **Figure 1-6**). The importance of the Croatian touristic industry, that recovered in recent years, for the wealth of the nation is mirrored in these data.

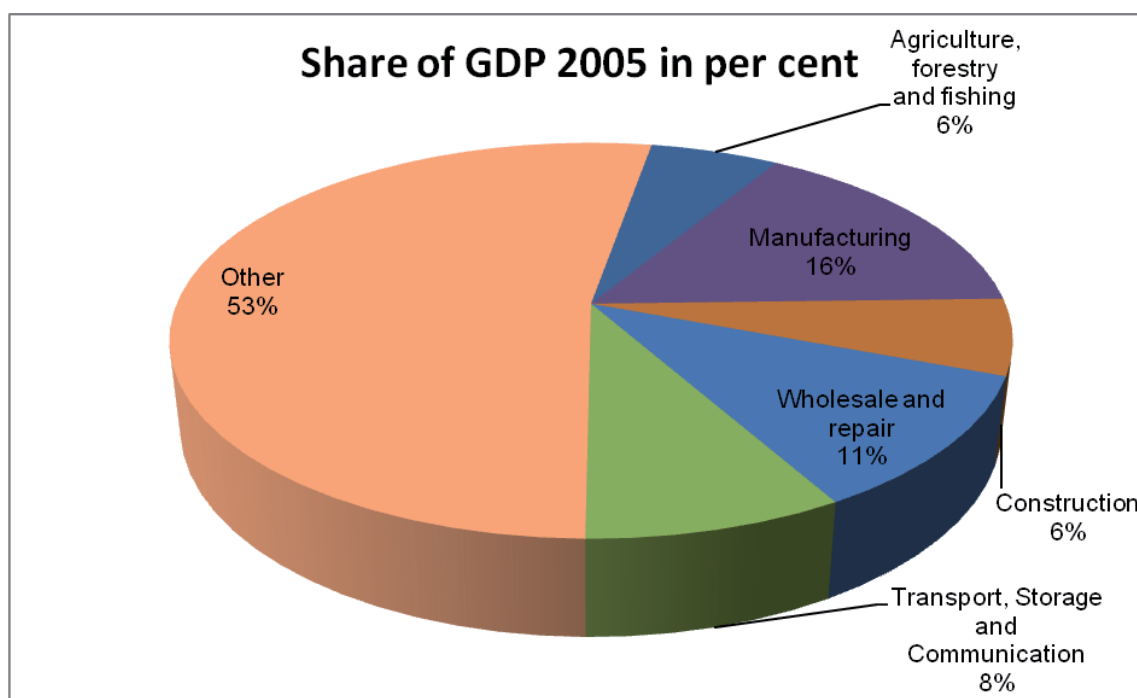
Figure 1-5: Gross Domestic Product per capita at current prices, 2007



Source: Eurostat, KombiConsult analysis

The Croatian trade shows an imbalance with a considerable higher import value of goods. In 2008 the value of the imported goods and services amounted to Euro 20,818 million (+10.5 per cent to previous year), while the export figured Euro 9,576 (+6.4 per cent).

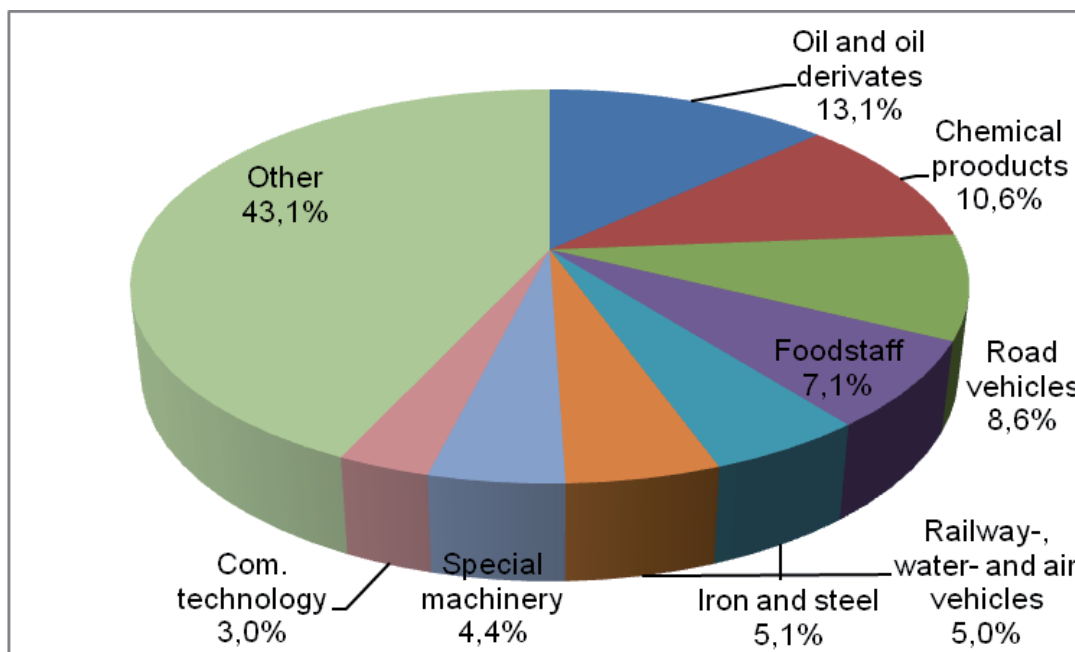
Figure 1-6: Share of Gross Domestic Product of Croatia, 2005



Source: Central Bureau of Statistics, yearbook 2008, KombiConsult analysis

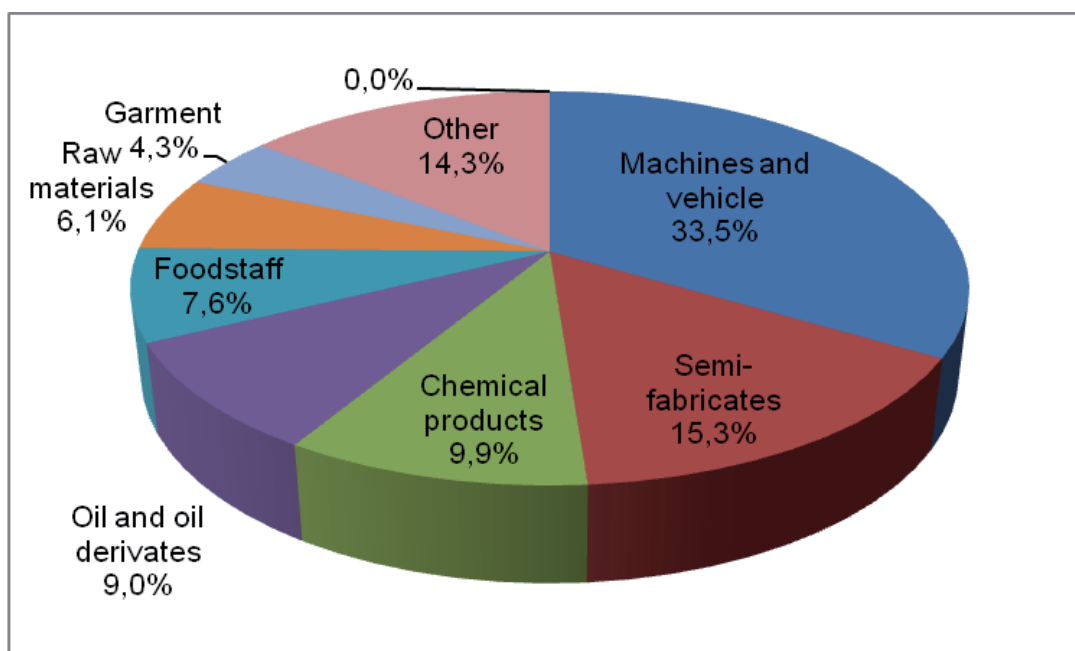
The structure of imported goods is shown in **Figure 1-7**, while **Figure 1-8** is showing the exports by commodity: machines, semi-fabricates and chemical products are dominant

**Figure 1-7: Share of imported goods by commodity, 2008**



Source: GTAI, Wirtschaftsdaten kompakt: Kroatien 5/2009, KombiConsult analysis

**Figure 1-8: Share of exported goods by commodity, 2008**

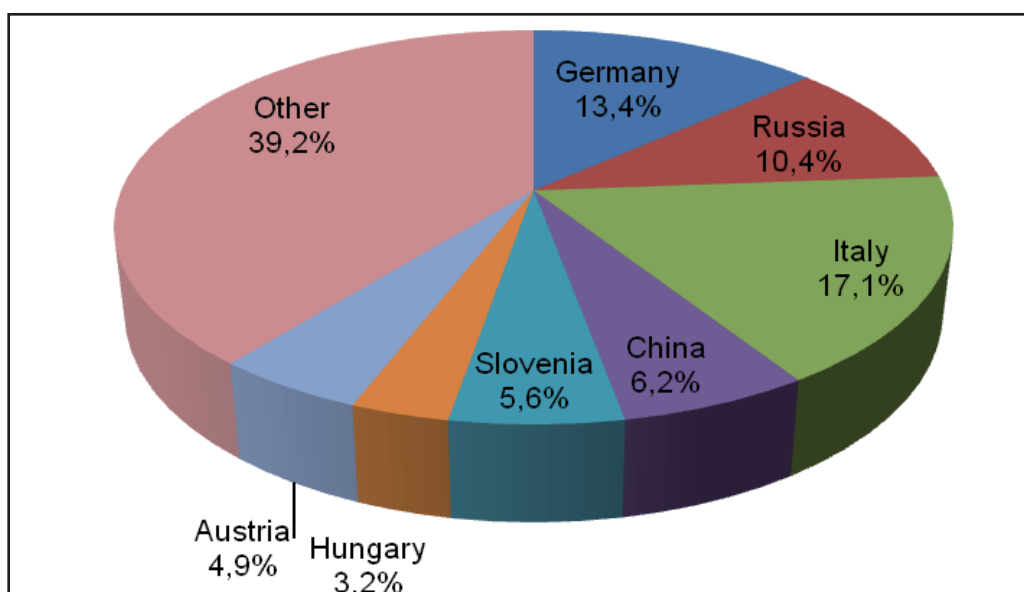


Source: GTAI, Wirtschaftsdaten kompakt: Kroatien 5/2009, KombiConsult analysis



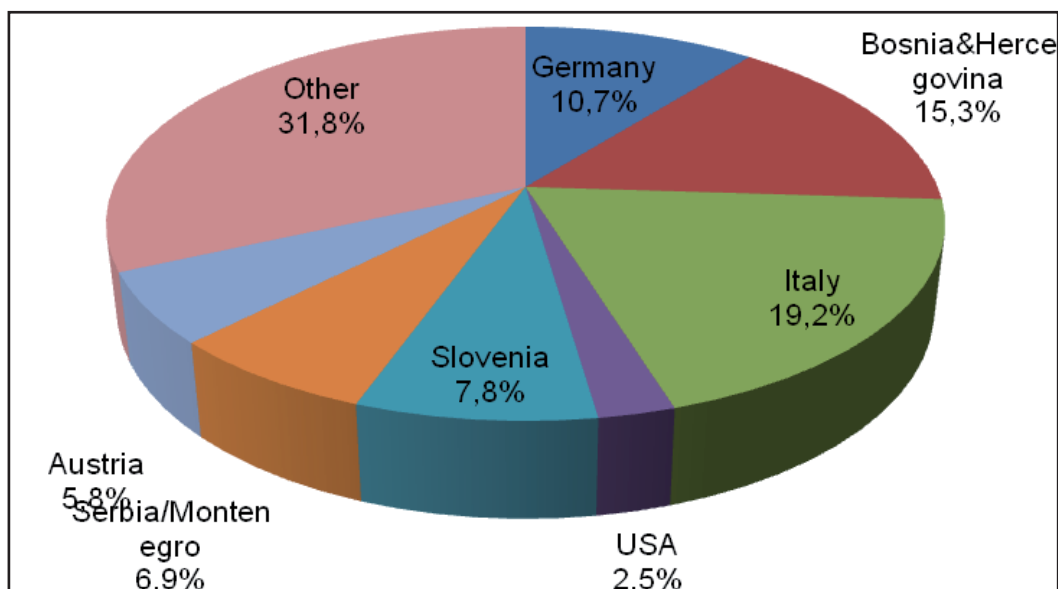
Croatia's trade partners are located in the European Union to a large extent: 64,1 per cent of supplies and 61 per cent of deliveries are with European countries. The detailed share of supplying partner countries in 2008 are illustrated in the following **Figure 1-9**, while **Figure 1-10** shows the buying countries.

**Figure 1-9: Share of supplying partners by country, 2008**



Source: GTAI, Wirtschaftsdaten kompakt: Kroatien 5/2009, KombiConsult analysis

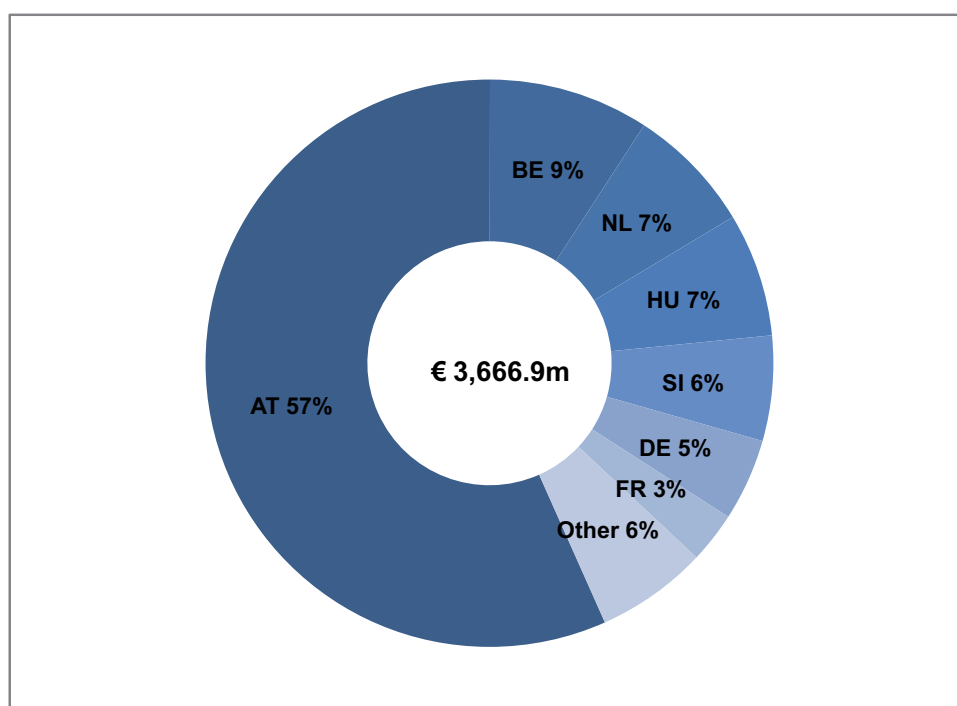
**Figure 1-10: Share of buying partners by country, 2008**



Source: GTAI, Wirtschaftsdaten kompakt: Kroatien 5/2009, KombiConsult analysis

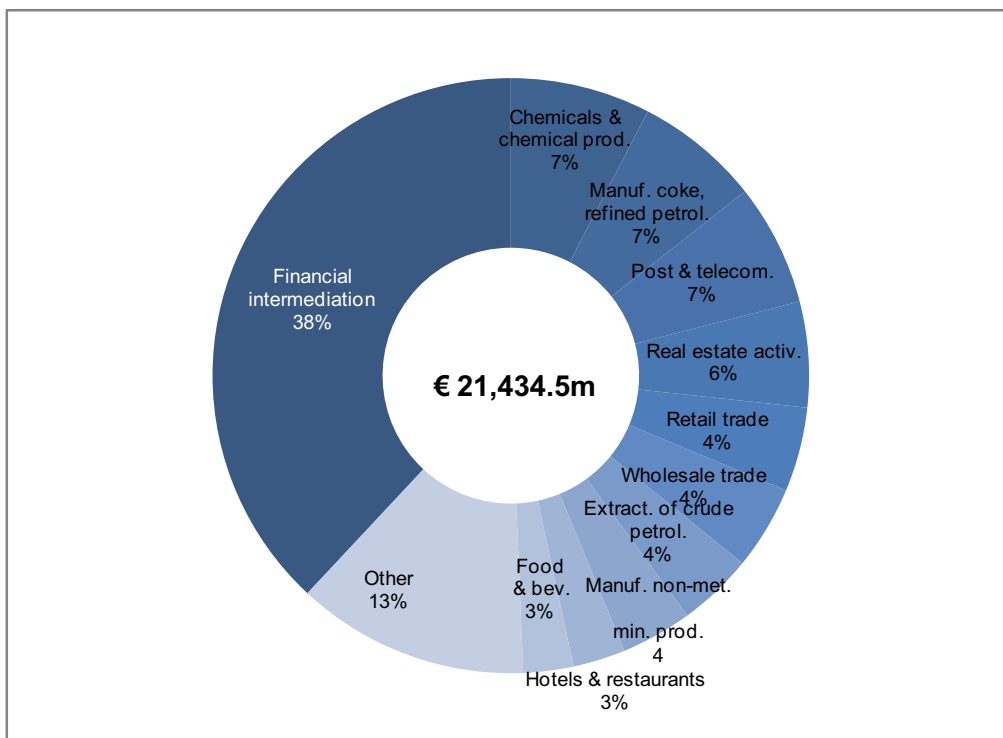
Croatia also has become one of the most attractive places in Central and Eastern Europe for Foreign Direct Investments (FDI). In the period between 2000 and 2007 foreign capital stock in Croatia has almost trebled to Euro 21,434.5 million. Main investing countries are Austria, Belgium, The Netherlands and Hungary (see **Figure 1-11**). Even if the majority of capital went into the service industries the importance of Croatia for manufacturing and trade is expressed in the share of 26 per cent of all FDI invested into these sectors.

**Figure 1-11: Foreign direct investments in Croatia by investing country, 2007**



Source: Croatian National Bank (HNB), KombiConsult

Figure 1-12: Foreign direct investments in Croatia by industry, 1993-2007

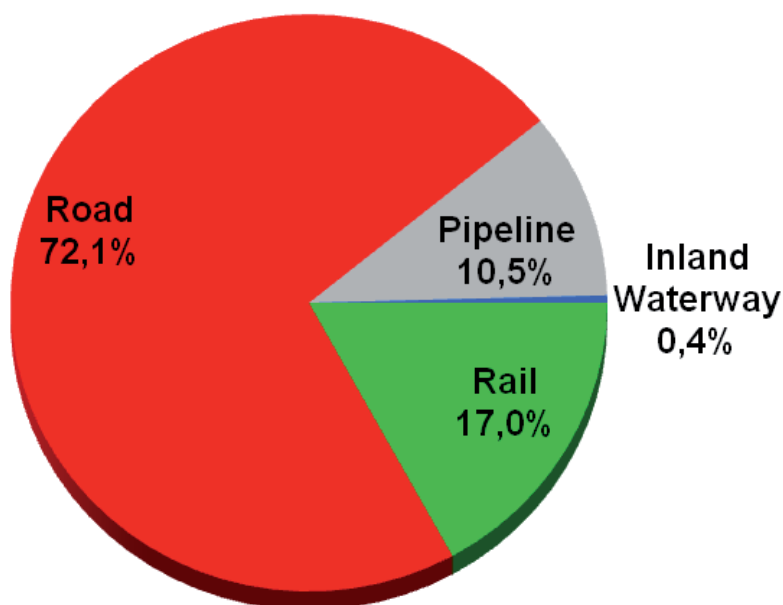


Source: Croatian National Bank (HNB), KombiConsult

### 1.3 - Freight traffic

In 2007, road vehicles carried 72.1 per cent of the total volume of 92.7 million tonnes of goods, moved on national and international journeys in Croatia. Yet this is not surprising since the majority of cargo (more than 86 per cent of all road cargoes) was moved in domestic traffic over short, local or regional distances (see **Figure 1-14**). 17 per cent (15.8 million tonnes) were carried by rail, 10 per cent (9.7 million tonnes) by pipeline and less than one per cent by inland navigation and air. Coastal shipping along the Adriatic coast is not included in these data.

**Figure 1-13: Modal split of freight traffic in Croatia (related to volume), 2007**



*Source: Central Bureau of Statistics, Statistical Yearbook 2008*

Even if rail could not compensate the transport volume lost since the early 1990<sup>th</sup>, since 2001 this transport mode increased the volume by 45.9 per cent, while road could gain volume by 63.8 per cent. In rail this was mainly due to the increase of border crossing transports by 55 per cent while domestic transports grew only by 12 per cent. In the road sector the increase was almost equally resulting from domestic and international transports.

This reflects not only the impact of a free choice of mode of transport in a market economy compared to the previous central planning state, a development effective since the 1990s, but even more the changed pattern of freight. The volume of rail- and barge-oriented bulk cargo is more or less stagnating whereas the transportation of consumer goods and finished and semi-finished industrial products has been grown strongly. The latter have comparatively demanding logistics profiles, which road apparently is much more capable of complying with than rail.

As a consequence the modal split of total freight traffic in Croatia increasingly has turned towards road. In 2007, road transport had a share of 72.1 per cent of total traffic and thus had won nearly 5 percentage-points within six years (see **Figure 1-14**).

**Figure 1-14: Freight traffic in Croatia: transported goods (million tonnes)  
by mode and traffic type, 2001-2008**

	Road	Rail	Pipeline	Inland Waterway	Air	Total
2001	40,801	10,807	7,969	1,123	6	60,706
<b>2002</b>	<b>45,957</b>	<b>10,654</b>	<b>8,839</b>	<b>739</b>	<b>6</b>	<b>66,195</b>
2003	52,147	11,723	9,070	706	6	73,652
<b>2004</b>	<b>55,323</b>	<b>12,234</b>	<b>9,879</b>	<b>897</b>	<b>5</b>	<b>78,338</b>
2005	58,886	14,333	9,396	430	6	83,051
<b>2006</b>	<b>63,840</b>	<b>15,395</b>	<b>8,644</b>	<b>400</b>	<b>6</b>	<b>88,285</b>
2007	66,814	15,764	9,688	385	6	92,657
2008	n,a,	n,a,	n,a,	n,a,	n,a,	n,a,

Source: Central Bureau of Statistics, Statistical Yearbook 2008, KombiConsult analysis

Analysing the transport performance, road freight transport could increase its mileage by 54.8 per cent, while rail was able to gain 72.3 per cent in particular by the increase of international transports (+86 per cent) compared to +31 per cent in domestic services.

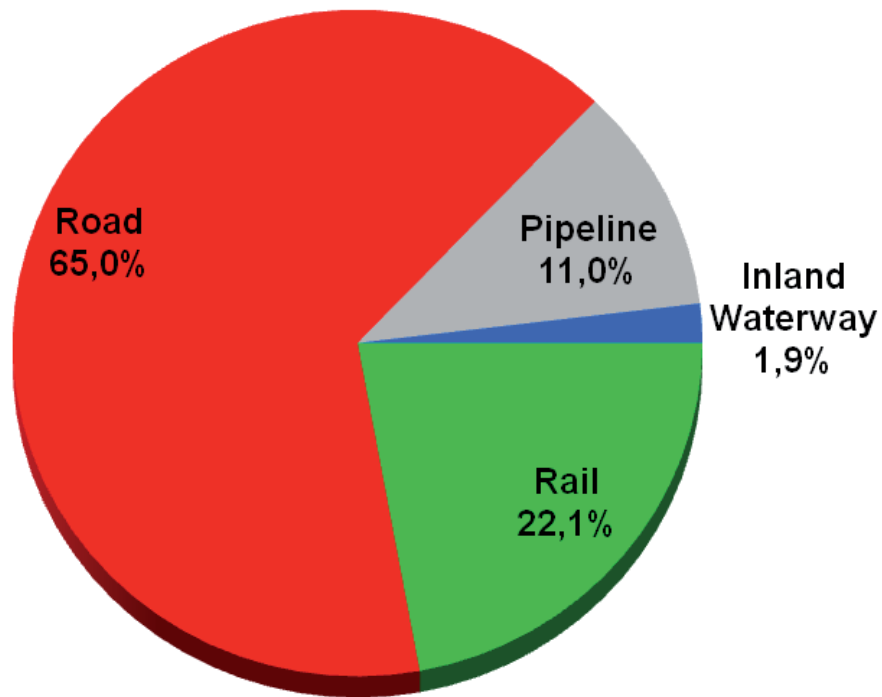
**Figure 1-15: Freight traffic in Croatia: performance (billion tonne-kilometres)  
by mode and traffic type, 2001-2008**

	Road	Rail	Pipeline	Inland Waterway	Air	Total
2001	6,783	2,074	1,158	78	4	10,097
<b>2002</b>	<b>7,413</b>	<b>2,206</b>	<b>1,557</b>	<b>90</b>	<b>4</b>	<b>11,270</b>
2003	8,241	2,487	1,623	84	4	12,439
<b>2004</b>	<b>8,819</b>	<b>2,493</b>	<b>1,841</b>	<b>199</b>	<b>4</b>	<b>13,356</b>
2005	9,328	2,835	1,774	311	4	14,252
<b>2006</b>	<b>10,175</b>	<b>3,305</b>	<b>1,533</b>	<b>296</b>	<b>3</b>	<b>15,312</b>
2007	10,502	3,574	1,781	306	3	16,166
2008	n,a,	n,a,	n,a,	n,a,	n,a,	n,a,

Source: Central Bureau of Statistics, Statistical Yearbook 2008, KombiConsult analysis

Due to that, the share of road in freight transport performance is 65 per cent in 2007, while rail has a share of 22.1 per cent, pipelines perform 11 per cent of the transport performance and inland waterways play a minor role, only.

**Figure 1-16: Modal split of freight traffic in Croatia (related to performance), 2007**



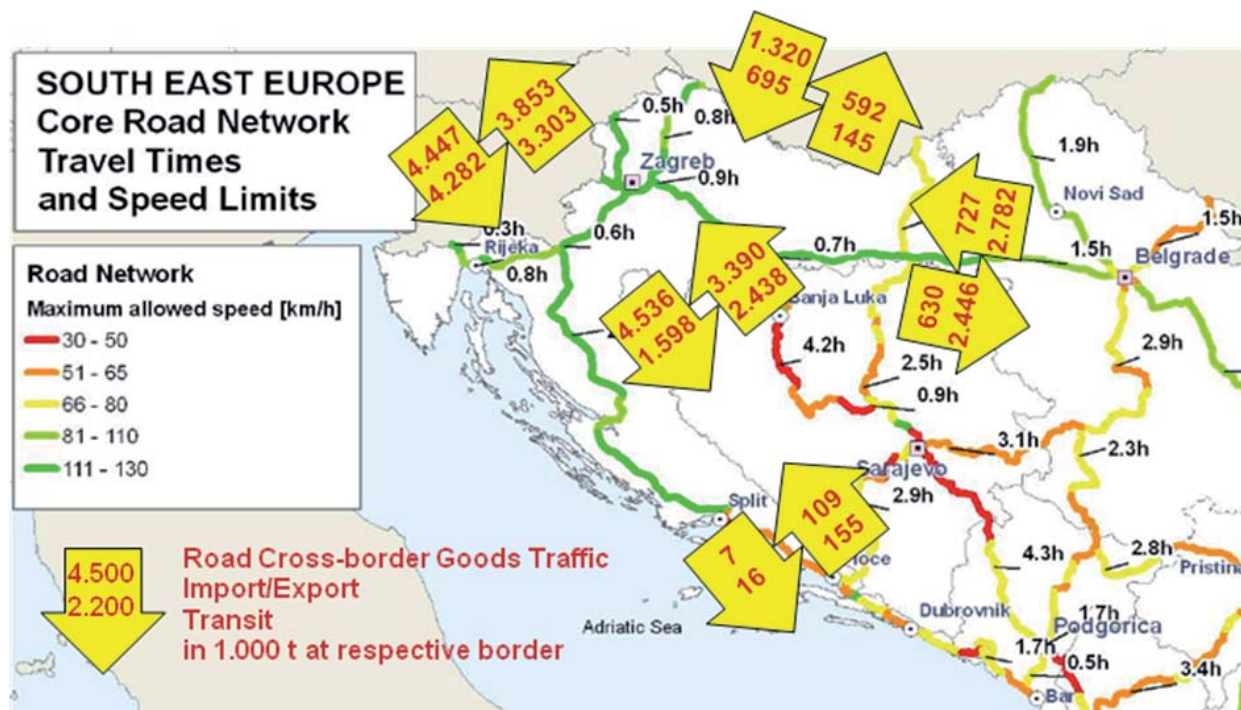
*Source: Central Bureau of Statistics, Statistical Yearbook 2008*

The road cross-border traffic of goods amounted to 19,611 million tonnes for Import and Export and about 9 million tonnes for transit through Croatia. The transit flows are performed by more than 500,000 truck movements per year (Ø 16.5 t/truck). By far the largest quantities of road freight are transported along the TEN-Corridor X, thus being handled at the borders of Croatia and Slovenia in the North-West and Bosnia-and-Herzegovina and Serbia in the South-East part of Croatia.

While the road freight transport showed an average annual growth rate of 10.6 per cent (2007/2001) the rail freight volume grew only by 7.6 per cent in the same time.

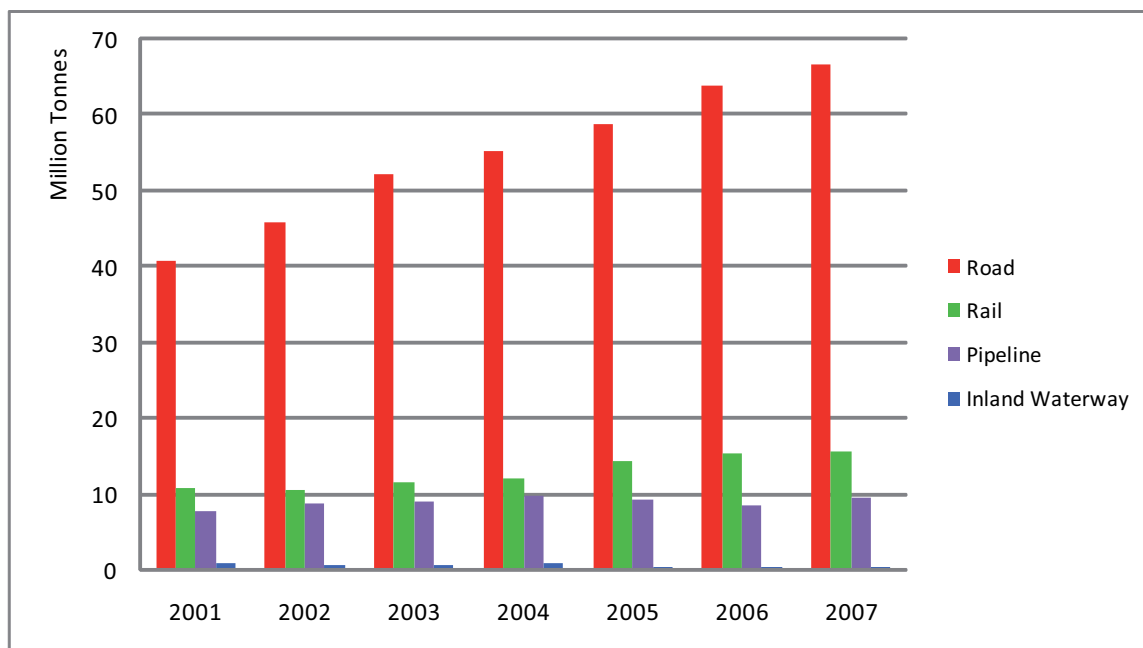


Figure 1-17: Border crossing road freight transport in Croatia, 2007



Source: data Central Bureau of Statistics, Statistical Yearbook 2008, visualization KombiConsult analysis

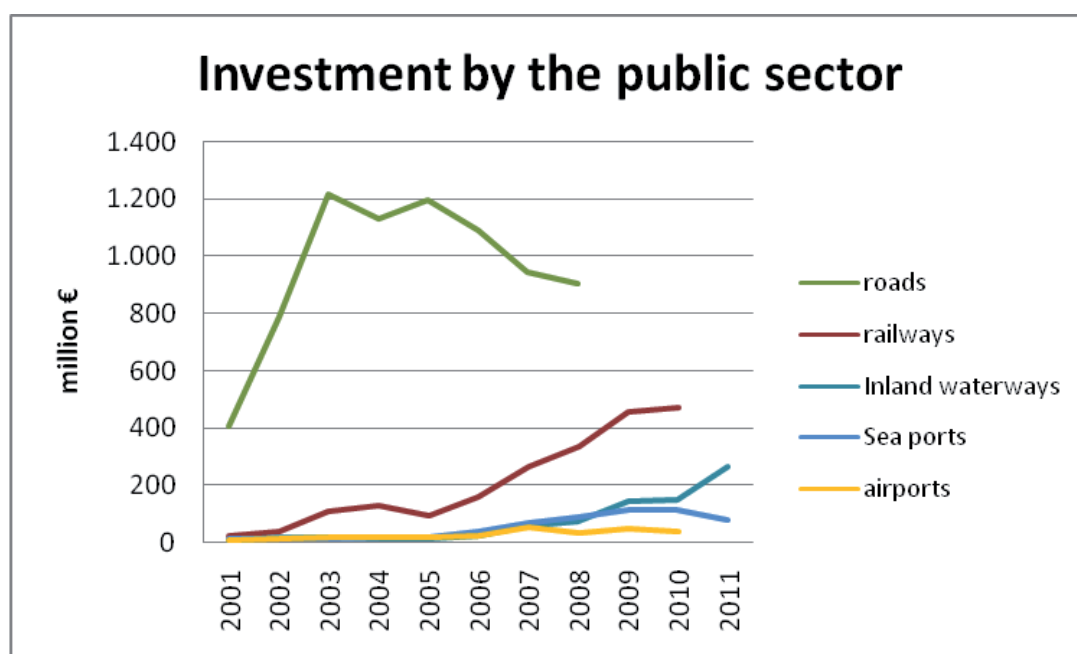
Figure 1-18: Development of road and rail transport volume in Croatia, 2001-2007



Source: Central Bureau of Statistics, Statistical Yearbook 2008, KombiConsult analysis

This could, partly, be explained by the logistic effect which tends to favour road (high value goods, smaller quantities, higher frequency) but also by the investment priorities of the Croatian government which favoured to build and renew the motorways first. Since 2001 the length of motorways was expanded from 429 km to 959 km (2007) by almost 20 per cent per year, while the length of the railway lines stagnated.

**Figure 1-19: Investment by the public sector in Croatia, 2001-2011**



*Source: TOR 2007-2009, KombiConsult analysis*

In the same period (2007/2001) the number of road freight vehicles registered in Croatia grew by 6.3 per cent per year from 120,000 units to almost 166,000 units, while the number of locomotives decreased by 3.3 per cent and performing rail wagon are hardly available (see also chapter 2.6).

## 2. CURRENT STATE OF INTERMODAL RAIL/ROAD TRAFFIC IN CROATIA

### 2.1 - Intermodal actors

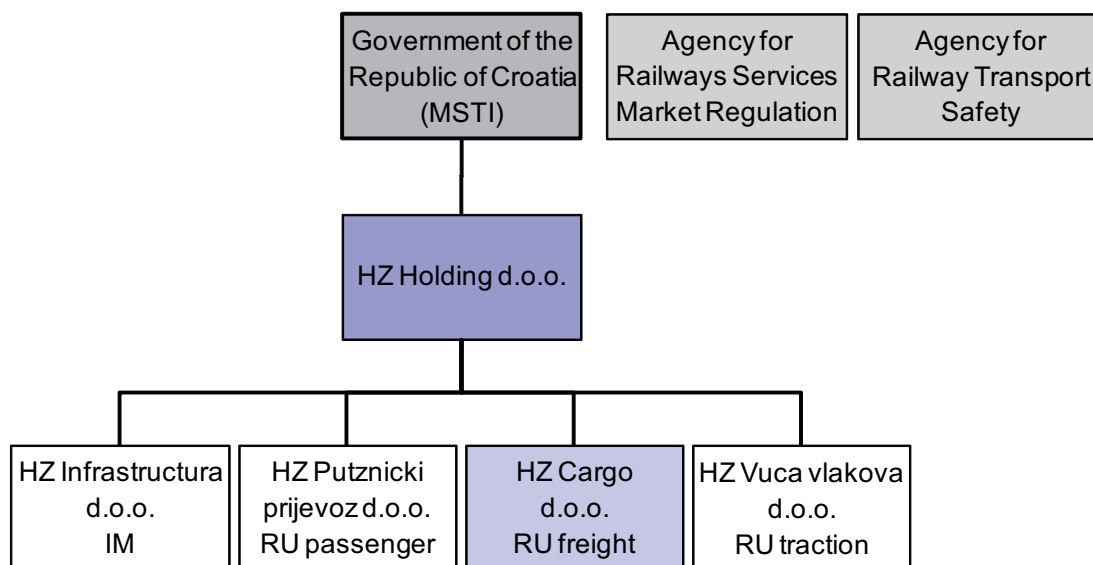
The main actors who are co-operating in the organization, implementation and operation of intermodal rail/road services are railway undertakings, intermodal operators and infrastructure managers.

Like in virtually each EU Member State the public nation-wide rail network is managed by a single company which originated from the former state railway administration.


HŽ Hrvatske željeznice d.o.o. Separation Act (OG 153/05) regulated the separation of the company into four new companies for the following business areas:

- management, maintenance and construction of railway infrastructure,
- transport of passengers,
- transport of cargo and
- train traction.

**Figure 2-1: Organisation of railway in Croatia**



Source: HZ Infrastruktura Network Statement 2010, KombiConsult analysis



As of August 30, 2006, the Government of the Republic of Croatia established HŽ Infrastruktura d.o.o. as company for management, maintenance and construction of railway infrastructure. A fifth company, HŽ Holding d.o.o. (Ltd.), was established under the same law. The Republic of Croatia transferred its shares of four newly founded companies to HŽ Holding d.o.o.

**Railway infrastructure** in the Republic of Croatia is a public good in general use, owned by the Republic of Croatia, and can be used on equal terms by all interested railway undertakings, under conditions prescribed by the Railway Act (OG 123/03, 30/04, 153/05, 79/07 and 120/08).

Although the railway legislation would allow the operation of third party **railway undertakings** in “open access” on the Croatian rail network, for the time being HZ Cargo, the freight company of the state-owned incumbent railway, is the only operational railway in Croatia. In the sphere of **intermodal service suppliers** the following companies were relevant as customers of HZ Cargo in Croatia:

- Intercontainer-Interfrigo / ICF (Basel),
- Crokombi (Zagreb),
- AGIT (Zagreb),
- Shipping lines and forwarders to a small extend.

**ICF** is a European network operator serving the Croatian market in single wagon load traffic on demand via their South-East European hub in Sopron (Hungary). The current service offer is marginal. ICF trains to South East Europe (including Turkey and Greece) are transiting via corridor X.

**Crokombi** d.o.o., Zagreb, is a limited liability company, founded in 1998 with the following current shareholders:

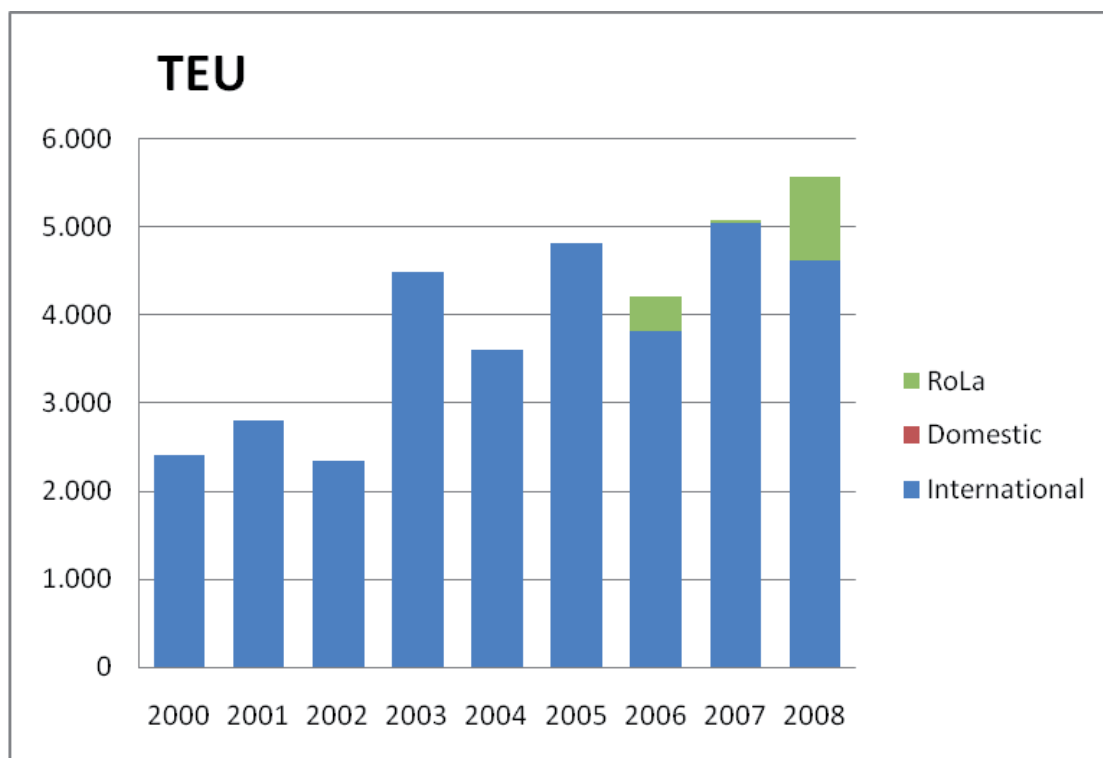
- |                              |                |
|------------------------------|----------------|
| ● HZ Cargo                   | 22.10 per cent |
| ● AGIT                       | 11.90 per cent |
| ● 5 Road Transport Operators | 32.96 per cent |
| ● 7 Forwarders/Terminals     | 33.04 per cent |

Being a member of UIRR it operates „terminal-terminal” transport services jointly with its partner organisations namely Adriakombi as regards the connection to Slovenia and Ökombi with respect to organising accompanied intermodal services (RoLa services).

The development of CT volume is quite volatile, since in particular the accompanied combined transport vanished after the neighbouring countries Slovenia, Hungary, Bulgaria and Romania entered the European Union and their truck drivers could circulate more freely. Attempts to set up a new RoLa service from the designated terminal in Spacva to Wels were cordially prepared with Ökombi and started in October 2008 for only two months, when the service had to be terminated again due to lack of demand.

Crokombi's main role is thus to manage the national collection/distribution of international consignments.

**Figure 2-2: Development of combined rail/road transport volume of Crokombi 2001-2008**



Source: Crokombi, KombiConsult analysis

The **AGIT** - Agencija za integralni transport d.o.o. (Agency for integrated transport) is a 100 per cent daughter company of HZ Cargo. AGIT

- Operates „door-to-door“ transport in Croatia,
- Container transport to/from seaports and
- Manages the terminal Zagreb – Vrapce.

In this role the AGIT company is the “logistics service provider” for HZ Cargo which operates a fleet of own lorries for collection and delivery and warehouses throughout the Country.

## 2.2 - Legal framework

The legal system currently regulating the field of railway transport in Croatia comprises of:

- The Railway Act (Official Gazette – OG 123/03, 194/03, 30/04)
- The Railway Safety Act (OG 40/07)
- Croatian Railways Division Law (OG 153/05)
- Act on the ratification of Protocol of 3 June 1999 for the modification of the Convention concerning International Carriage by Rail (COTIF) of 9 May 1980 (1999 Protocol) and the Convention concerning International Carriage by Rail (COTIF) of 9 May 1980, as amended by the Protocol of 3 June 1999 (Official Gazette - International Agreements (OG-IA)12/2000)
- Law on Agency for Railway Service Market Regulation (OG 79/07)

With the aim of alliances in the railway sector, Croatia has entered into a couple of bilateral and multilateral agreements with its neighboring countries (see **Figure 2-3**):

**Figure 2-3: Bilateral and multilateral agreements on railways in Croatia**

Agreement on	HU	SI	MK	BiH	SK	BG	AT	RS
Border Railway	➡➡	➡➡	➡➡	➡➡	-	-	-	-
International Combined Transport	➡➡	➡➡	O	O	➡➡	➡➡	➡➡	➡➡
Bihac-Knin rail line	-	-	-	➡➡	-	-	-	-

- As regards international organisations in the field of railway transport, the Republic of Croatia has acceded to COTIF and is a member of OTIF.
- With regards to UN membership, representatives of the Republic of Croatia regularly participate in UN-ECE meetings related to the railway transport. Croatia is also a signatory to AGC and AGTC agreements and a member of TER.



- Also, in May 2006, Croatia signed the "Agreement on the Establishment of a High Performance Railway Network in South East Europe", which aims to improve the railway network in South East Europe, and thus increase the use of railway transport services.

Specific incentive schemes with respect to intermodal traffic Rail/Road (see examples practices in one or several other European countries in **Figure 2-4**) are not known for Croatia. Since recently Croatia joined the Marco Polo Programme of the European Commission, so that international services can benefit from the tone-kilometers performed on Croatian territory.


**Figure 2-4: Potential actions in favour of intermodal rail / road traffic not yet applied in Croatia**

	Action	Impact on CT	Who can benefit ?
CT infra-structure	State grants for building new CT terminals or enlarge existing sites	Reduction of terminal handling and, consequently, total CT transport cost	Private and public companies
	Grants for CT facilities, systems and mobile equipment	Reduction of total CT cost, improved cooperation of road, rail and ship	All transportation, handling and logistic companies operating
CT traffic	State grants for starting up domestic services	Facilitation of new domestic services and market access of special technologies	Private companies
	Incentives for companies that commit themselves in providing full trainloads	Reduction of total CT transport cost	Private companies
	State grants for each consignment transported in CT	Reduction of total CT transport cost	Private companies
	Marco Polo II - grants for modal shift, catalyst action	partly compensation of start-up losses	Private companies offering new international intermodal services
	State grants for each consignment transhipped in Terminal	Reduction of total CT transport cost	Private companies
road vehicles	Exemption from road vehicle tax	Reduction of total CT transport cost	Owner of vehicle exclusively deployed for unaccompanied CT
	Reimbursement of road vehicle tax	Reduction of total CT transport cost	Owner of road vehicle employed on CT services
	Increased maximum gross weight of road vehicle	Increased payload, potential for increased revenues	Every company using CT services
	Exemption of road pre- and on-carriage from weekend and holiday driving ban	Pick-up and delivery of intermodal shipments during restricted periods	Every company using CT services
	Compensation of public services, MoT orders public services in CT	Reduction of operational cost of unaccompanied and accompanied CT	Railway companies

Source: KombiConsult analysis

### 2.3 - Overview on total intermodal market

For this DIOMIS study, the intermodal traffic performed in the year 2007 has been selected as the reference year, on which the assessment of the evolution of the industry by 2020 should be based. In order to establish the 2007 data base for the entire intermodal rail/road traffic in Croatia we advanced from the statistics supplied by HZ Cargo, the only Croatian railway undertaking for the time being. HZ Cargo data, in particular, provides for a consistent time series by market segment (see **Figure 2-8**).



In addition to the HZ Cargo data base we had access to the 2007 statistics of almost every railway undertaking and intermodal operator performing intermodal services in, with or through Croatia. A thorough analysis and comparison proved that, even if two co-operating companies were concerned, the majority of data sets were not consistent neither on an aggregate level such as the volume of a country-country link nor in sub-categories.

Owing to these inconsistencies we approached the “statistical reality” iteratively. First of all, we determined the transport volume of routes or market segments where we could rely on two independent and fairly congruent data sources. In a second step, we analyzed the statistics on intermodal services, for which we provided for in-depth market knowledge and/or reliable auxiliary information like frequency of departure, maximum train length or weight. By carrying out plausibility analyses and cross-checks for example with HZ Cargo data we were able to pinpoint traffic volumes and assign them rather precisely to market segments and traffic types. As a result, only a small percentage of less than 10 per cent of the total volume, which we have derived from the HZ data set (see above), could not be allocated to a specific category of intermodal traffic. On the other hand the “transit” volumes routed through Croatia differ by 10 per cent, too. To complete the data base, however, we performed estimates based on our own expertise.

One of the main results of this extensive exercise is the overview on the 2007 total intermodal traffic in Croatia and the allocation of volumes of unaccompanied traffic to traffic types (domestic, international, transit) and intermodal market segments (maritime, continental), given in **Figure 2-5** below.

In 2007, the total volume of intermodal traffic in Croatia amounted to 1,013.7 million gross tonnes, of which 1,012.6 million (99,9 per cent) were conveyed on unaccompanied intermodal services. More than three quarters of that volume (784,200 tonnes) was moved in transit through Croatia along the trans-European corridors V (Italy – Hungary) and X (Slovenia – Serbia). Only a little more than 20 per cent of the total intermodal traffic volume are handled (loaded to or from trains) in Croatia. 205,300 tonnes (20.3 per cent) were carried on international services and only 23.100 tons (2,3 per cent) in pure domestic services.

**Figure 2-5: Intermodal rail/road traffic volume in Croatia, 2007**

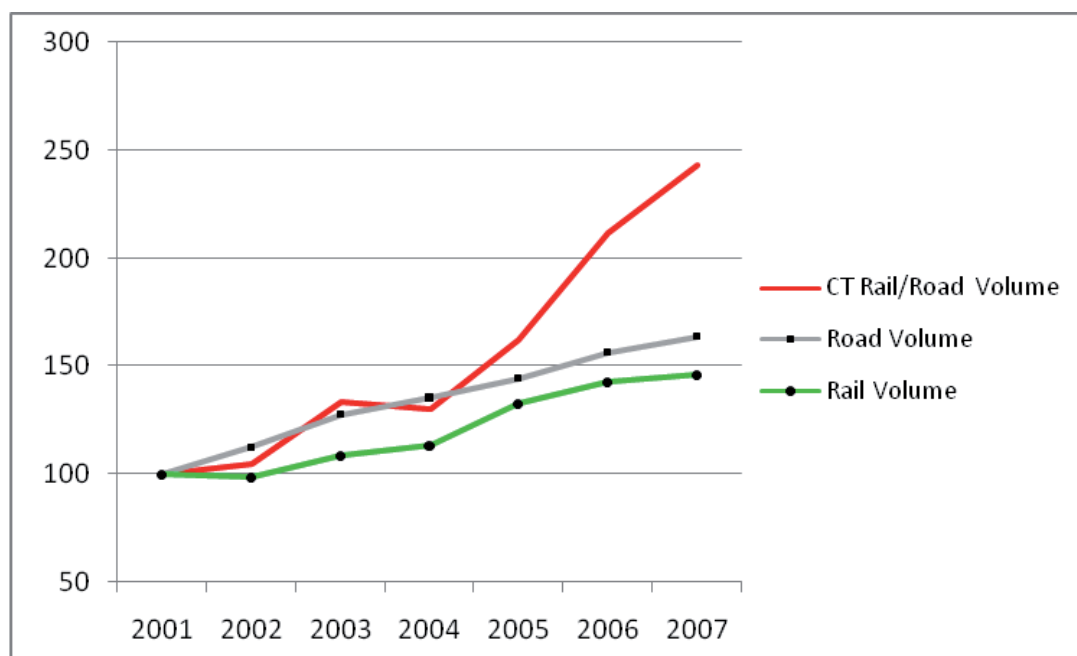
Intermodal market segment		TEU	%	Gross tonnes	%
Unaccompanied traffic		133,800	99.9%	1,012,600	99.9%
Domestic	maritime	2,100	1.6%	23,100	2,3%
	continental	-	0.0%	-	0,0%
	Subtotal	2,100	1.6%	23,100	2,3%
International	maritime	33,600	25.1%	176,400	17,4%
	continental	3,000	2.2%	28,900	2,9%
	Subtotal	36,600	27.3%	205,300	20,3%
Transit		95,100	71.0%	784,200	77.4%
Accompanied traffic		100	0.1%	1,100	0.1%
Total intermodal traffic		133,900	100.0%	1,013,700	100.0%

Source: KombiConsult analysis based on HZ Cargo, railways and operators statistics

Compared to the total of 93 million tonnes of freight transport in 2007 the intermodal rail/road traffic in Croatia can be neglected: It represents about 7,5 per cent of the rail freight transport and only 1,8 per cent of the total road freight transport. Even if the road freight transport figures include local delivery and the large proportion of construction material transported over small distances, only, a further increase of intermodal transport would mean a huge challenge for Croatian intermodal stakeholders.

Intermodal rail/road traffic, however, showed the largest growth rates since 2001, when comparative road data is available (see **Figure 2-6**).

**Figure 2-6: Development of total rail, road and intermodal rail/road volume in Croatia, 2001-2007 (2001 = 100)**



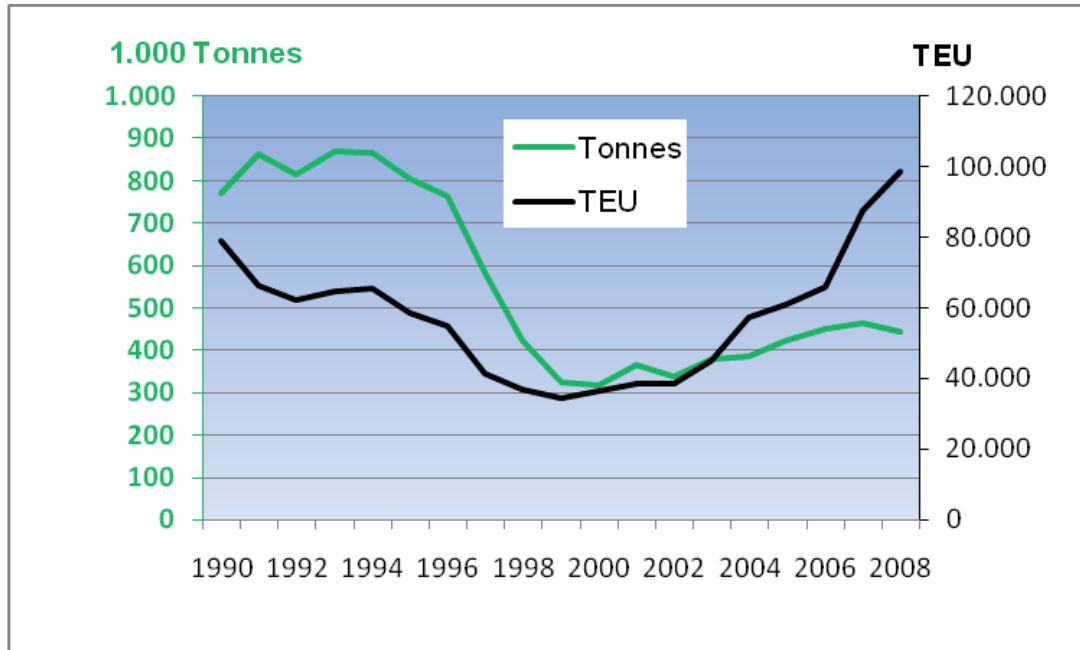
*Source: Central Bureau of Statistics, yearbook 2008, HZ Cargo, KombiConsult analysis*

It is particularly striking, as HZ Cargo's long time series of container transports shows, that the high volumes of container transport measured in tonnes of the mid 1990<sup>th</sup> could not be reached until recently, while the number of transported TEU outreached earlier highs in recent years (see **Figure 2-7**).

These data show two impacts:

- (1) a logistics effect from which specifically lighter cargoes were resulting and the re-disposition of empty containers;
- (2) the effect of the separation of the Balkan countries and the absence of integrated services that needed to be re-established under market conditions.

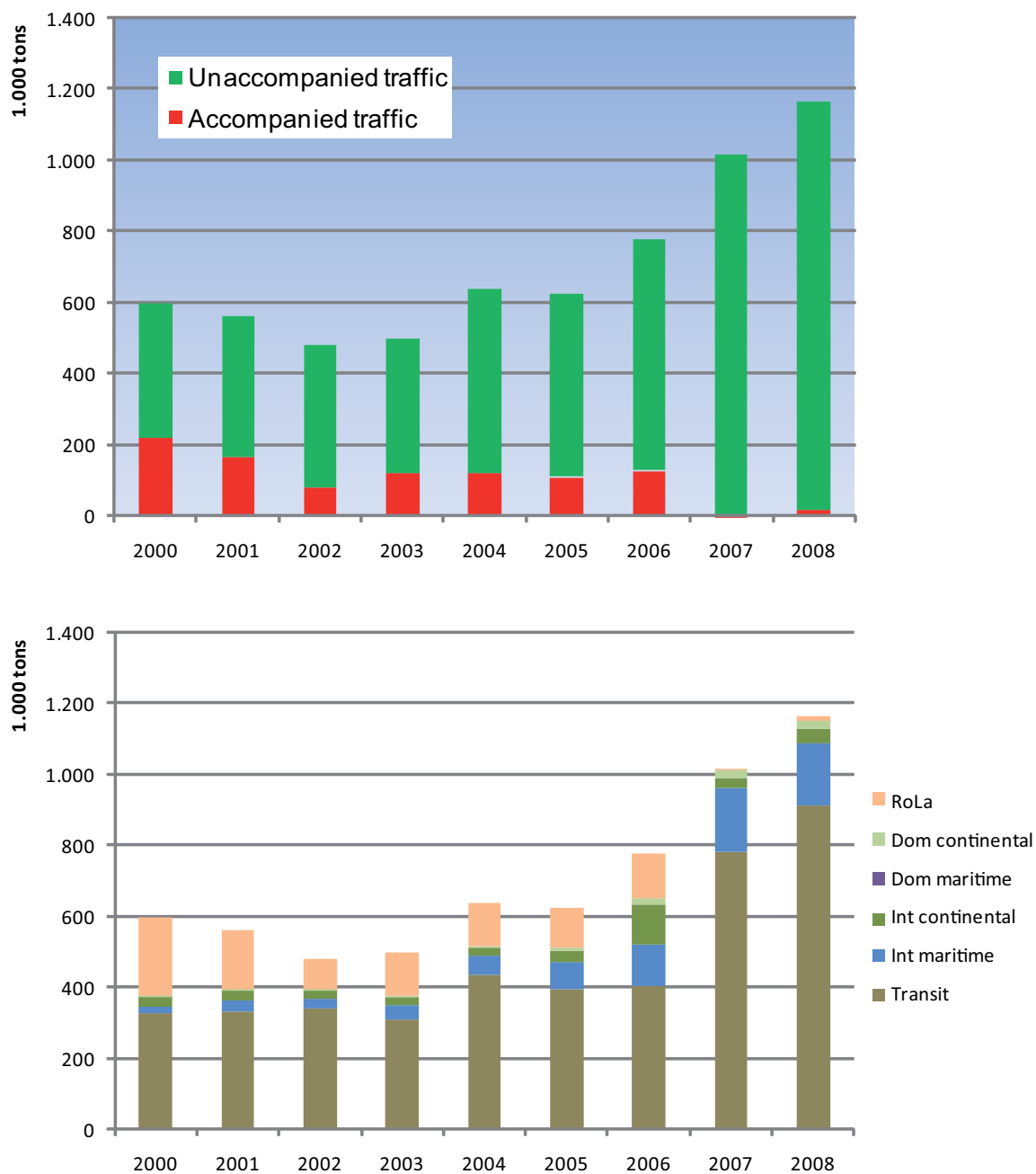
Figure 2-7: Development of “container transport” in Croatia, 1990 – 2008



Source: HZ Cargo, KombiConsult analysis

The development of the different segments of intermodal rail/road transport in Croatia is illustrated in **Figure 2-8**. It shows the increasing importance of the transit flows through Croatia in which HZ Cargo takes the role as hauling railway and no further manipulations are carried out.

**Figure 2-8: Development of intermodal rail/road traffic volume in Croatia, 2000-2008**



Source: HZ Cargo, KombiConsult analysis



## 2.4 - Unaccompanied intermodal traffic

### 2.4.1 - Domestic traffic

In 2007, 2,100 TEU of intermodal units were carried on inland links in Croatia; the total freight accounted for 23,100 gross tonnes. This was an all time high while it dropped below 2,000 TEU in 2008.

Domestic intermodal rail / road traffic in Croatia is only composed of continental transports which are collected / distributed as initial / final leg of an international service via the marshalling yard or intermodal terminal of Zagreb ("gateway"). Domestic maritime transport, that means relations to / from Croatian seaports of Rijeka, Zadar, Split and Ploče to Croatian hinterland origin / destination by rail do not exist, which can be explained by the relative small distances (e.g. Rijeka – Zagreb about 220 km), good motorway connections and low road haulage prices which prevented stakeholders from offering competitive intermodal hinterland services, yet.

**Figure 2-9: Development of domestic intermodal rail/road transport volume in Croatia 2001-2008**

Growth rate to previous year	2001	2002	2003	2004	2005	2006	2007	2008
Domestic	6,8%	32,1%	48,1%	66,9%	43,2%	49,0%	38,2%	-7,9%
Maritime	-	-	-	-	-	-	-	-
Continental	6,8%	32,1%	48,1%	66,9%	43,2%	49,0%	38,2%	-7,9%

Source: HZ Cargo, KombiConsult analysis

When analysing the figures it must however be noted that the high double digit growth rates of the past could not be achieved in the recent year (2008/2007) when the volume declined by 7.9 per cent.

### 2.4.2 - International traffic

The total unaccompanied international traffic in Croatia (excluding transit) accounted for 36,600 TEU or 205,000 gross tonnes respectively in the reference year 2007. The international intermodal Rail/Road in Croatia composes both segments, the maritime and continental transport. In 2008 the maritime transport accounts for 81 per cent of the international CT, while 19 per cent were carried on continental services.

The past development of these segments is quite indifferent. While in the maritime segment steady two digit growth rates could be realised (despite the year 2008/2007 when the volume declined by 2,6 per cent), in the continental segment an almost tripling of the volume in the year 2005/2006 was followed by a dramatic decrease in the following year and a recovery in the last year.

**Figure 2-10: Development of international intermodal rail/road transport volume in Croatia 2001-2008**

Growth rate to previous year	2001	2002	2003	2004	2005	2006	2007	2008
International	19,0%	-12,8%	21,1%	20,6%	38,6%	113,7%	-9,0%	4,5%
Maritime	51,1%	-15,3%	53,8%	37,8%	32,6%	54,9%	54,2%	-2,6%
Continental	-3,4%	-10,0%	-12,4%	-10,5%	55,1%	253,2%	-74,9%	49,9%

*Source: HZ Cargo, KombiConsult analysis*

In Croatia bilateral international traffic operationally is performed to a large extend in single wagon load, since the total quantity of freight and their geographic distribution do not allow a dedicated intermodal shuttle train service, yet.

In this respect, in Croatia, the business model of a block train contract between the intermodal operator and the railway undertaking, which transfers the capacity risk from the railway to the operator is not yet implemented.

According to our investigations the following companies supplied consignments for bilateral international traffic to and from Croatia in 2007:

- Intercontainer-Interfrigo / ICF (Basel),
- Crobombi (Zagreb),
- AGIT (Zagreb),
- Shipping lines and forwarders to a small extend.

**Figure 2-11** gives a breakdown of the bilateral international traffic by transport corridor.

It shows that the neighbouring countries Bosnia-and-Herzegovina, as well as Serbia, next to Germany, as well as the BeNeLux-Countries are the most important countries for international intermodal traffic in Croatia.

**Figure 2-11: International unaccompanied traffic in Croatia by corridor, 2007**

Corridor	TEU
Croatia - Bosnia-and-Herzegovina/Serbia	10,000
Croatia - Germany	9,400
Croatia - The Netherlands	5,000
Croatia - Belgium	5,000
Croatia - Hungary	3,800
Croatia - Slovenia	3,300
Croatia - Other	100
<b>Total</b>	<b>36,600</b>

Source: KombiConsult analysis based on railways and operators statistics

One element of “international” transport is also transit traffic, where 95,100 TEU or 784,200 / 890,000 gross tonnes were transported by HZ Cargo in 2007. The transit shows a great volatility in recent years with a huge increase in the year 2007 compared to 2006, when trains to Turkey were re-routed via Croatia, Serbia and Bulgaria due to the pricing scheme of the Romanian railways.


**Figure 2-12: Development of transit intermodal rail/road transport volume in Croatia, 2001-2008**

Growth rate	2001	2002	2003	2004	2005	2006	2007	2008
Transit	2,2%	2,6%	-9,3%	40,1%	-9,1%	2,7%	93,1%	16,4%

Source: HZ Cargo, KombiConsult analysis

In contrast to the bilateral traffic almost all intermodal transit volume through Croatia was shipped in dedicated intermodal block trains in 2007. According to our survey the following companies provided transit services through Croatia in 2007:

- Adriakombi (Ljubljana),
- Adriatransport (Koper),
- Intercontainer Austria / ICA (Wien),
- Intercontainer-Interfrigo / ICF (Basel),
- Railog (Kelsterbach).



For the corridors through Croatia, which accounted for the largest numbers of shipments in 2007 were the following:

- Austria - Greece,
- Belgium – Greece,
- Austria – Turkey,
- Italy – Romania,
- Slovenia – Bosnia-and-Herzegovina/Serbia,
- Germany/The Netherlands - Bosnia-and-Herzegovina/Serbia.

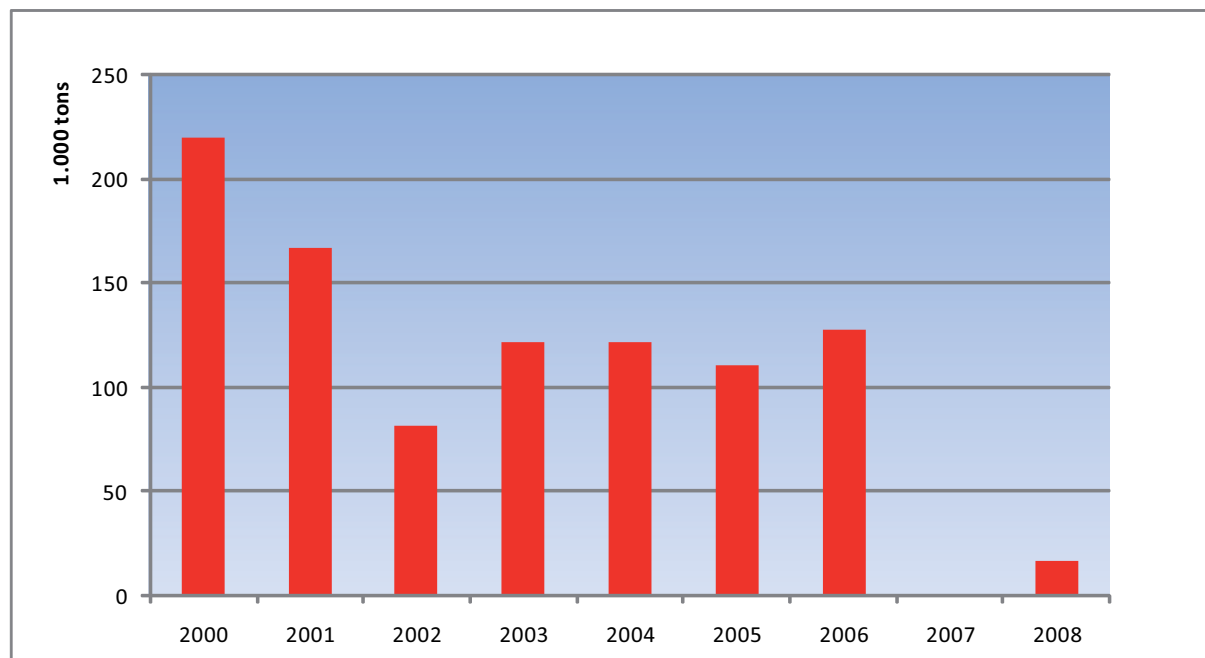
## 2.5 - Accompanied traffic

Accompanied intermodal transport (“RoLa”) has had and still plays an important role on selected South-East European transport lanes since it offers some advantages for the users, mainly:

- Reduction of fuel and other operative costs,
- Avoidance of road tolls,
- Avoidance of night and other traffic bans for heavy freight vehicles,
- Acceptance of resting times of drivers,
- Gain of transit permissions for non EU operators.

In the framework of the accession of further countries to the European Union (Romania, Bulgaria, ...) these advantages were compensated by simplified operating conditions and thus costs on the road so that the RoLa services could be maintained only with an even higher governmental financial support. Obviously the political acceptance of such kind of subvention is limited if it supports foreign drivers, truck transportation is widely accepted or residents have more fundamental concerns than complaining about transiting trucks.

In this respect the share of accompanied intermodal transport rail/road in Croatia declined by about 37 per cent from 18,375 TEU in the year 2000 to almost zero in 2007. These volumes include both, a transiting RoLa-service on the railway line Kotoriba (Hungarian border) – Cakovec (Slovenian border) and an international service between Spacva and Ljubljana (Slovenia) or Wels (Austria) on the corridor X line. The **Figure 2-13** is showing the development of accompanied traffic in Croatia in the last years.

**Figure 2-13: Development of accompanied traffic volume in Croatia, 2000-2008**

Source: HZ Cargo, KombiConsult analysis

In October 2008 intermodal operators Crokombi and Ökombi tried another attempt to re-establish a continuous RoLa service mainly for transiting trucks along the corridor X, between the Croatian town of Vrbanja (Spacva) and Wels in Austria. The newly refurbished RoLa-terminal Spacva is located in the south east of Croatia near the Bosnia and Herzegovinian border.

The service was “interrupted” after two months due to several reasons, among others the economic crisis with the general reduction of transport demand but also the availability of relatively cheap truck transportation resulted in smaller demand than expected.

## 2.6 - Equipment

The utilisation of intermodal transport is also depending on the availability of or access to appropriate equipment such as intermodal wagon and intermodal loading units.

## Intermodal Wagon

- The bulk of loading units are ISO-Containers used for transports to and from the Adriatic ports (Import/Export/Transit) through Rijeka and Ploce (Croatia) as well as Koper (Slovenia) and Trieste (Italy).
- To a much smaller scale swap bodies are used for (international) continental transports.
- Semi-trailers are not used at all (partly in transit) since the pocket wagon are not available and – what is the most important reason - the Croatian terminals are not equipped for handling them properly (see chapter 2.7).
- The loading of complete articulated road vehicles in accompanied combined transport (RoLa) was experimented until 2008, both in transit from Hungary to Slovenia as well as from the Croatian RoLa terminal in Spacva to Ljubljana and Wels (see chapter 2.5).
- Data on the availability / ownership of swap bodies and craneable semi-trailers by Croatian forwarders is not known. Expert interviews show that specific intermodal equipment: articulated road trains for carrying swap bodies as well as craneable semi-trailers are lacking in Croatia as well as many other Westbalkan countries (SEETO Report).

## Intermodal Wagon

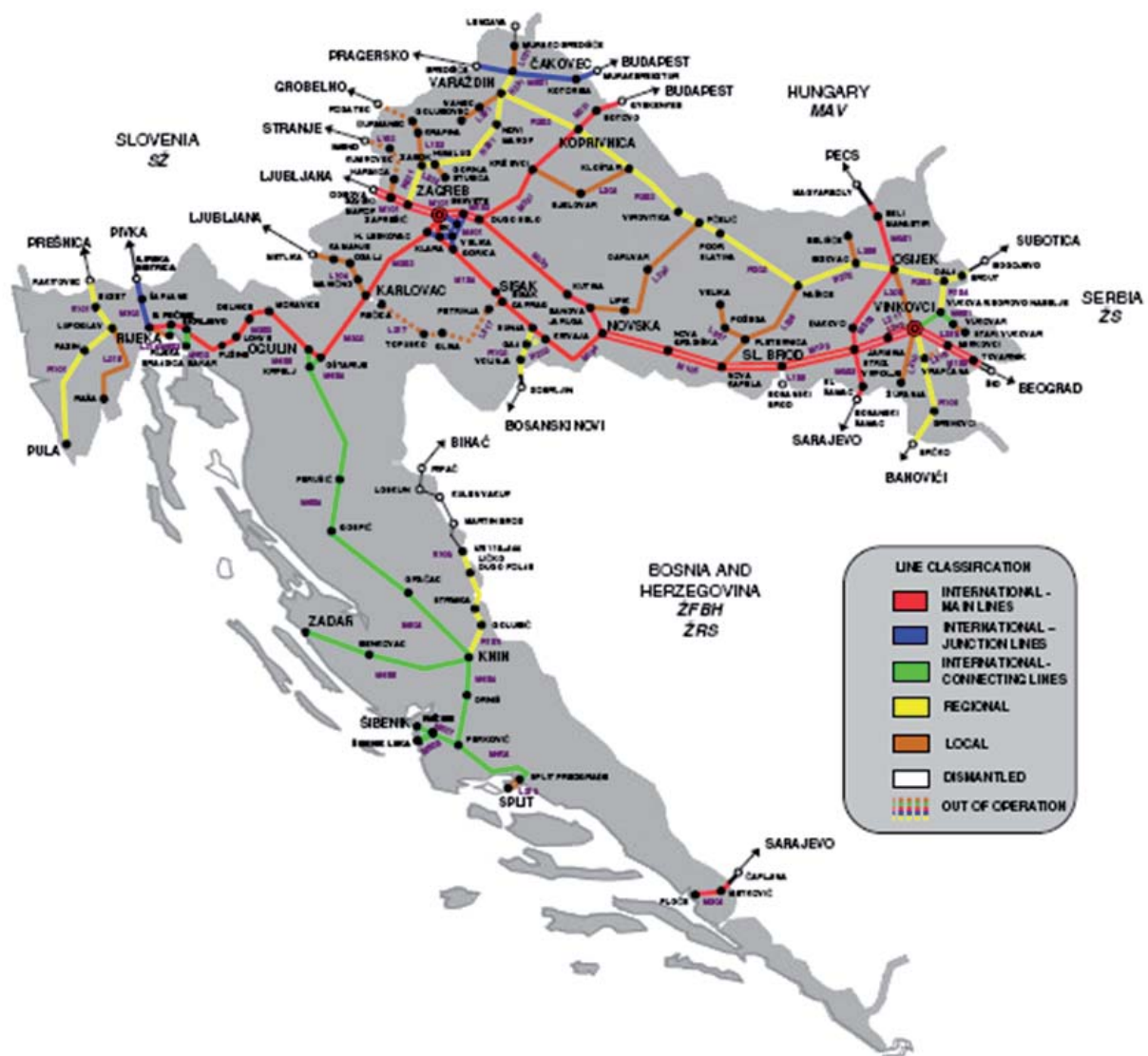
- HZ Cargo possesses wagon type Rgs (300 pieces) and Kgs (200 pieces), which are suitable for carrying containers. However containers have to be lashed since these wagons are not equipped with pins. Swap bodies cannot be carried on these wagons due to the height of the loading platform which is 1240/1260mm respectively. The loading weight (55t) and allowed speed (100km/h) of these wagon types is not very favourable for an efficient intermodal transport.
- Recently HZ has commissioned 40 wagon of type Sgnss and 20 pieces of Lgnss as well as 50 flat wagon for RoLa (Saadkms).
- The use of wagon of foreign railways, operators and leasing companies (e.g. for transit and international transport to/from Croatian relations) are possible if they comply with railway norms.
- Nevertheless the availability of efficient and cost effective wagon is essential for establishing intermodal services and a major obstacle for HZ Cargo to proceed.

## 2.7 - Rail and intermodal terminal infrastructure

### 2.7.1 - Rail network

Relevant infrastructures for intermodal traffic rail/road are the main railway lines, border stations, marshalling yards and CT-terminals in Croatia.

Figure 2-14: Line classification of the Croatian rail network



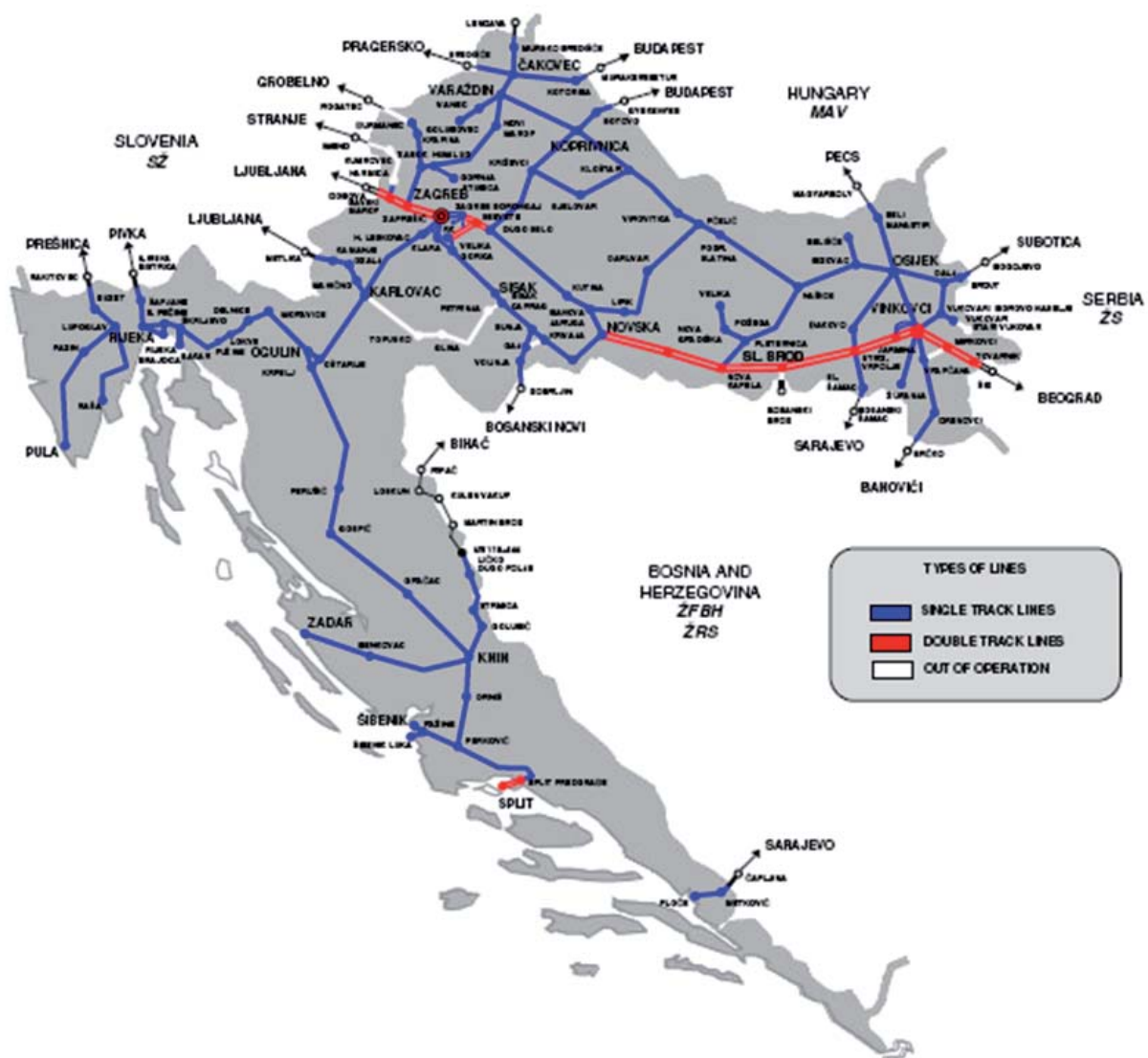
Source: HZ Infrastructure Network Statement 2010



The railway network in Croatia is operated by HZ Infrastruktura which belongs to the state-owned HZ group. The entire normal gauge rail network length is about 2,722 km of which 2,468 km are single and 254 km are double track. About 980 km of the rail lines are electrified:

- 945 km in AC 25 kV/50Hz (the entire corridors Vb and X)
- 35 km in DC 3 kV (the line Rijeka – Sapjane – Pivka, Slovenia)

**Figure 2-15: Types of lines (track) of the Croatian rail network**



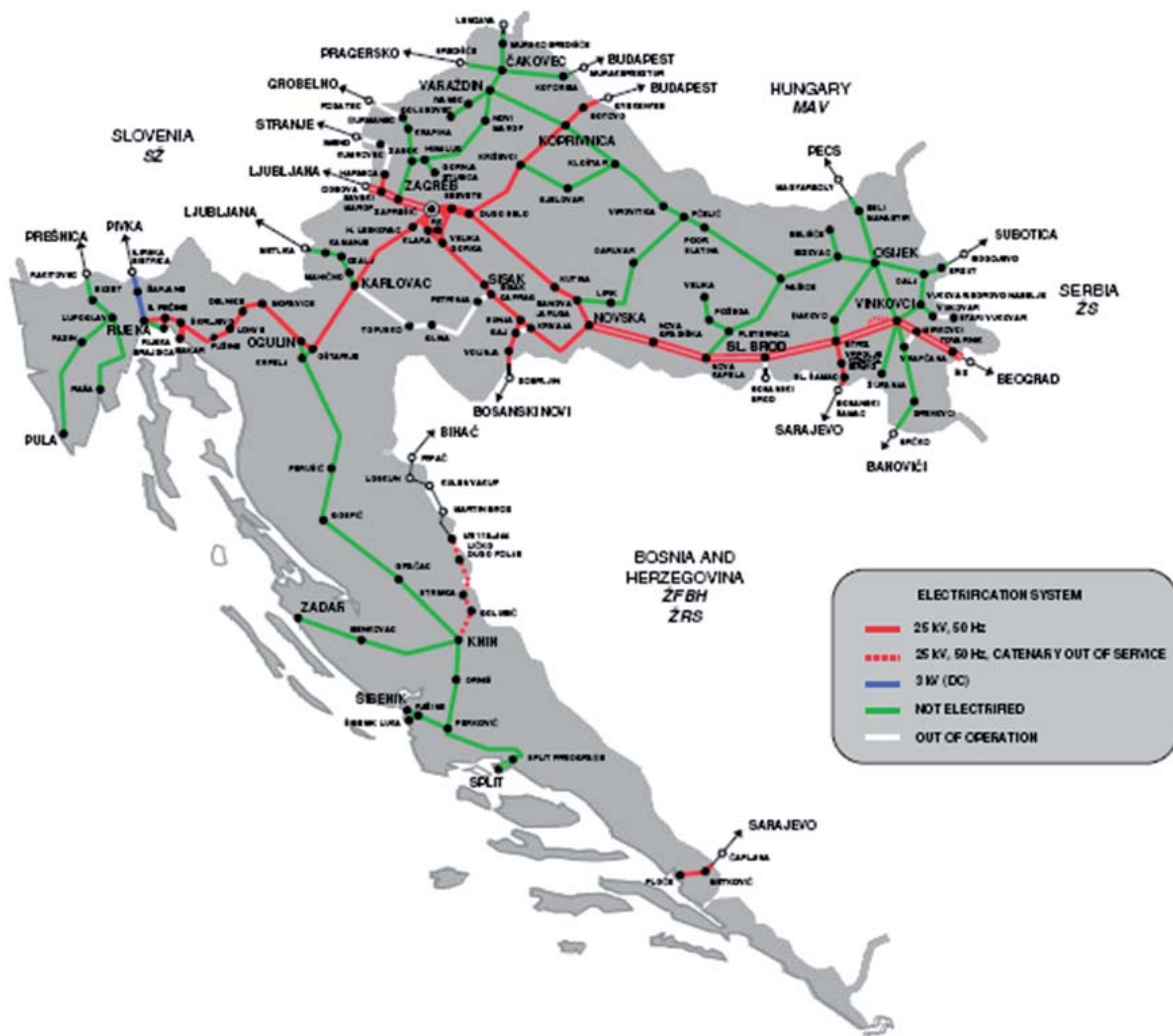
Source: HZ Infrastruktura Network Statement 2010



The loading profiles of the Croatian railway lines are favourable for intermodal traffic since they offer PC80/410 on all sections along the TEN-Corridor X.

Nevertheless, Corridor Vb and in particular the port of Rijeka as well as the Dalmatian connector line have a lower loading profile: PC 52/368 on the worst section between Rijeka and Ogulin. That part will be by-passed by the new double track railway Rijeka – Ostarje line that shall be completed by 2012/13. Also the connector lines north of Zagreb are of smaller loading gauge (PC 72/398), which should be considered when assessing the potential for additional transport flows via the „Krapine“ line to Maribor / Graz.

Figure 2-16: CT loading profiles of the Croatian rail network



Source: HZ Infrastructure Network Statement 2010

Next to the before mentioned physical characteristics also the compliance with AGTC standards and moreover the operational condition of the rail tracks are important to evaluate whether they are suitable to facilitate reliable intermodal transport services.

In the framework of the South East Europe Transport Observatory (SEETO) a “South East Europe Core Regional Transport Network Development Plan” for the time period 2009-2013 has been set up. Although that report composes a thorough analysis of the current infrastructure conditions and investment plans and seeks to harmonize the operational and implementation conditions it is interesting to notice that the section Pivka (Slovenia) – Sapjane – Rijeka (Croatia) and moreover the line Pragersko (Slovenia) - Sredisce - Kotoriba - Cakovec (Hungary) which are important for international rail transports are not included in the analysis. The following **Figure 2-17** shows the characteristics by line section and presents in particular the assessment of the SEETO Observatory on the “track condition”. The term “track condition” in that respect summarizes a couple of infrastructure and operational parameters in a qualitative way with respect to the operational use.

**Figure 2-17: Condition of the Croatian rail network sections relevant for international CT, 2008**

N°	From	To	Length	N° Tracks	Track Condition	Slope [‰]	Train Weight
R 1	Ostarije	Knin	223	1	Good		
*	Sapane	Rijeka		1	*	26‰	1,000 t
Vb	Rijeka	Ostarije		1	Poor	29‰	1,400 t
Vb	Ostarije	Karlovac		1	Medium		
Vb	Karlovac	Zagreb	52	1	Poor		
Vb	Dugo Selo	Botovo (HU)	79	1	Medium	7‰	1,400 t
Vc	Beli Manastir	Osijek	32	1	Medium		
Vc	Osijek	Vrpolje	48	1	Medium		
Vc	Vrpolje	Slavonski Samac (BH)	23	1	Good		

N°	From	To	Length	N° Tracks	Track Condition	Slope [‰]	Train Weight
*	Sredisce	Kotoriba		1	*	4‰	1,800 t
X	Savanski Marof (SL)	Zagreb	15	2	Poor	6‰	1,500 t
X	Zagreb	Dugo Selo	33	2	Poor		
X	Dugo Selo	Novska	84	1	Poor		
X	Zagreb	Sisak	49	1	Poor		
X	Sisak	Sunja	23	1	Poor		
X	Sunja	Novska	34	1	Poor		
X	Sunja	Novska	10	2	Poor		
X	Novska	Vrpolje	119	1	Good		
X	Vrpolje	Vinkovci	31	2	Good		
X	Vinkovci	Tovarnik (SR)	33	2	Very Poor		

\* Not included in SEETO analysis, added after consultation with HZ Cargo.

Source: SEETO, 5 year multi annual plan 2009-2013, HZ Infrastructure Network Statement 2010, KombiConsult analysis

### 2.7.2 - Terminal infrastructure

The Network Statement 2010 of the Croatian rail infrastructure company HZ Infrastructure is listing eight “intermodal and port terminals”, but a thorough analysis and assessment by market parties demonstrates that only four of them are in a shape to be called “CT terminal”, while the other installations (Osijek, Slavonski Brod, Zadar) provide for loading and unloading at a paved track in the railway station or are designated for RoLa-services (Spacva).

Figure 2-18: Location of combined rail/road transport terminals in Croatia, 2008



Source: HZ Infrastructure, HZ Cargo, UIRR, KombiConsult analysis

It is not only the very limited space and age of the equipment that is striking, but also the respective handling capacity of the terminals which is thus very small although appropriate for the current volumes. Semi-trailers can't be transshipped at all even they carry a large percentage of the domestic and international trade. An increasing volume can hardly be achieved with this kind of installations. Nevertheless, with the terminal Zagreb-Vrapce a total annual handling capacity of about 30,000 to 50,000 loading units is offered.

Figure 2-19: Characteristics of intermodal rail/road transport terminals in Croatia, 2007

Terminal	Handling tracks		Handling equipment		Annual handling capacity (LU)		Handling volume 2007		Remark
	N°	Length (m)	Gantry	Mobile	Reported	Calculated	TEU	LU	
Osijek	1	200		1	10,000	8,000	1,500	1,000	Station track
Ploče				2		30,000	5,000	3,300	Seaport
Rijeka Brajdica	1	900		3	-	36,000	16,800	11,200	Seaport
Slavonski Brod	1	200		1	8,750	8,000	1,500	1,000	Station track
Solin (Split)	1	80		1	8,750	3,200	-	-	Station track
Zadar					-	-	-	-	
Zagreb - Vrapce	3	1,712		2	30,000	30,000	16,000	10,700	
Spacva					-	-	-	-	RoLa (closed)
Total					57,500	115,200	40,800	27,200	

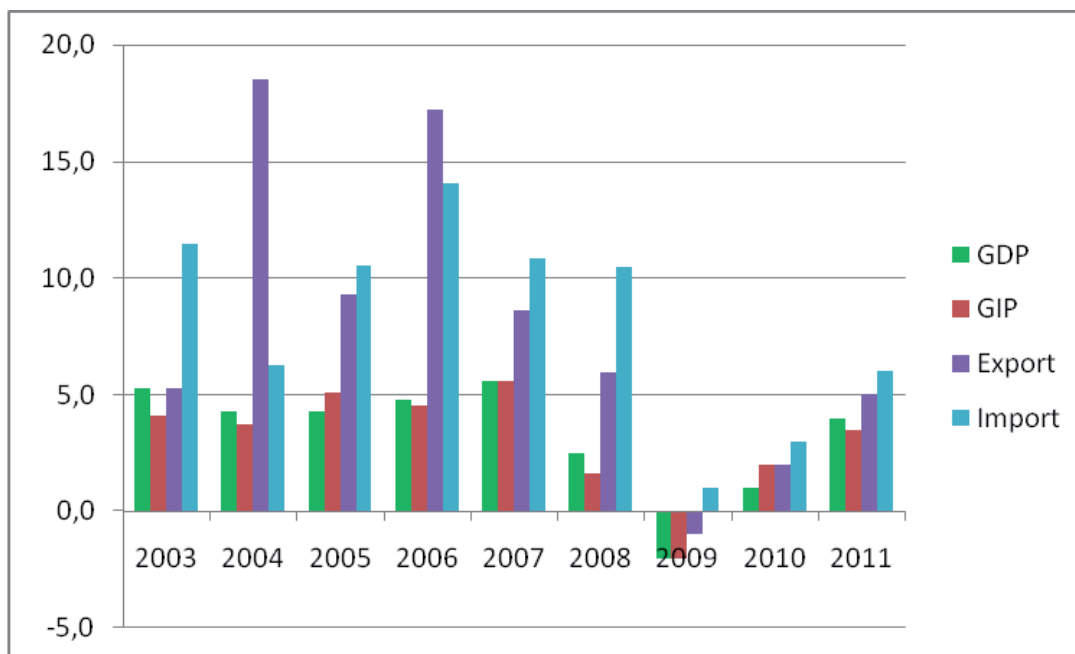
Source: HZ Infrastructure, HZ Cargo, KombiConsult analysis, volumes partly estimated from totals

### 3. EVOLUTION OF INTERMODAL RAIL/ROAD TRAFFIC IN CROATIA BY 2020

#### 3.1 - Recent developments until 2009

Croatia's gross domestic product rose by 87.9 per cent between 2000 and 2007. Due to the current economic crisis it is expected to declining in 2009, but rising again in 2010 and 2011, already, according to the *Vienna Institute for international Economic Studies* that specialises in Eastern European countries. The same applies to the Industrial productio, and import and exports.

**Figure 3-1: Evolution of economic indicators, 2003-2011**



Source: Vienna Institute for international Economic Studies (wiiw), KombiConsult analysis

The impact of these economic developments on unaccompanied intermodal traffic was more than dramatic. However, mostly due to a still good first 8 months of the 2008, the total volumes still grew by 12.8 per cent compared to the previous record year 2007. This was mainly due to an increase of continental international and transit volumes as well as due to the RoLa that operated for two months end of 2008. The intermodal industry in Croatia transported about 150,546 TEU (see **Figure 3-2**).

**Figure 3-2: Unaccompanied intermodal traffic in Croatia by traffic type, 2007-2008**


Intermodal market segment		2007	2008	2008/2007
		TEU	TEU	Growth rate
<b>Unaccompanied traffic</b>		<b>133.505</b>	<b>149.242</b>	<b>11,8%</b>
<b>Domestic</b>		<b>2.099</b>	<b>1.934</b>	<b>-7,9%</b>
<b>International</b>	maritime	33.865	32.970	-2,6%
	continental	2.337	3.503	49,9%
	<b>Subtotal</b>	<b>36.202</b>	<b>36.473</b>	<b>0,7%</b>
<b>Transit</b>		<b>95.204</b>	<b>110.836</b>	<b>16,4%</b>
<b>Accompanied traffic</b>		<b>92</b>	<b>1.404</b>	<b>1422,0%</b>
<b>Total intermodal traffic</b>		<b>133.597</b>	<b>150.646</b>	<b>12,8%</b>

Source: HZ Cargo, KombiConsult analysis

According to the market survey we have carried out the decline of traffic volume generally continued in 2009. Depending on intermodal service provider in the first-half the number of intermodal shipments decreased between 10 and 30 per cent compared to the first six months in 2008. Yet various sources such as operators, railways and terminal reported that they recognized at least a preliminary stop of the downturn trend at the end of the second quarter 2009.

### 3.2 - Projections of national transport policy

Within the Multiannual Indicative Planning Document (MPID) as the strategic document pre-accession of Croatia into the European Union the development axis for the transport infrastructure are laid down. It concluded to undertake those economic activities which are to be stipulated by the provision of adequate and sustainable transport infrastructure with



particular attention to the restructuring and upgrading of the railway system. The expected results of the priority measures are:

- Intermodal competition to be restored,
- Links with the European Union will be improved,
- Level of safety considerable improved,
- Traffic bottlenecks will be reduced,
- Travel times for freight and passengers will be reduced.

Thus the relevant items have been identified in the Countries' and regions' development programme.

### **3.3 - Analysis of impact factors**

The implementation of efficient and sustainable intermodal services generally requires for a “critical mass” of regular shipments from and to a catchment area around an intermodal terminal. Sufficient volumes can be created either through agglomerations of people resulting in a strong demand for consumer goods or when the area provides for major high-scale distribution centres or when it is strongly industrialized, which is due to generating a high level of inbound and outbound movements of industrial products like prefabricates or semi-finished goods or consumer goods, or through a combination of all elements.

Against this background our investigation into the future of intermodal traffic in Croatia particularly has focused on the analysis and evaluation of multiple socio-economic factors such as those mentioned above, which essentially impact on the opportunities for intermodal transport.

Moreover we have examined existing prognoses on road and rail traffic, political, infrastructure and intermodal and rail freight industry-internal factors and evaluated whether they may foster or even boost, jeopardize or impede intermodal services in, with or through Croatia and – if so - to what extent. The conclusions and the key impact factors, on which the quantified forecast of intermodal traffic by 2020 is based (see sections 3.4 to 3.6), are summarized at the end of this section.



### 3.3.1 - Development of road and rail traffic

How can intermodal traffic increase volumes? It can grow by participating in the growth of the entire freight market or by capturing goods currently moved over the road. Statistical data clearly show that, in Croatia, road traffic has been the most dynamic mode during the past decade and raised its market share. Consequently, there is a vast theoretical market potential on international trade lanes. It's however another story if service suppliers are capable of designing a product, which matches customer requirements and is competitive with road. Against this background it is useful to spotlight the expected evolution of the relevant long-distance freight market since it helps to locate the global growth potential of the demand for intermodal services.

According to the results of our inquiries with Croatian authorities there are no official long-term prognoses on goods transport and its modal split for the horizon 2015 or 2020. We analyzed other sources, but the results were not encouraging: early reference years, so that reality has already overtaken the forecasts; non-harmonized data; lack of transparency regarding the assumptions for forecasts.

The only source that appeared to be methodologically clear and suitable for establishing a frame of future freight traffic is *Progrants'* "European Transport Report 2007/2008". It supplies several freight-related performance indicators for the years 2015 and 2020 generated through a trend forecast. This means that recently observed developments of several socio-economic factors were more or less extrapolated and used as inputs into a quantitative transport model. The results for Croatia are presented in **Figure 3-3**. It shows the growth rates for several freight market segments between 2005 and 2015 and 2020 respectively. We used 2005 as reference as this was the last year *Progrants* provided for actual figures, while their 2007 figures were already forecasted.

**Figure 3-3: Prognosis of Croatian freight traffic related to performance (tkm)**

Indicator		Growth rate		Average annual growth rate	
		2015/2005	2020/2005	2015/2005	2020/2005
Domestic traffic		+70,6%	+86,3%	5,49%	4,23%
International traffic	Export	+100,0%	+140,0%	7,18%	6,01%
	Import	+90,0%	+120,0%	6,63%	5,40%
	Transit	+80,0%	+110,0%	6,05%	5,07%
	Subtotal	+90,0%	+126,7%	6,63%	5,61%
Total freight traffic		+77,8%	+100,0%	5,92%	4,73%
Total road freight traffic		+77,6%	+96,0%	5,91%	4,59%
Total rail freight traffic		+75,9%	+106,9%	5,81%	4,97%
Total inland waterway traffic		+100,0%	+133,3%	7,18%	5,81%

Source: Prograns: European Transport Report 2007/2008; KombiConsult calculations

*Prograns* forecasts that the total international freight market will rise by nearly 127 per cent in the period 2005 to 2020. More than proportionate growth rates are expected for the export (+140%) while the import (+120%) and transit of goods (+110%) grows less than proportionate. Since we do not know to what extent a modal shift from road to rail is already been included in *Prograns* data, we consider a further growth potential for intermodal rail/road traffic if appropriate measures are set by the stakeholders.

### 3.3.2 - Population

The size of the population and the regional distribution of population have a major influence on the total freight traffic as well as on the logistic patterns and modal choice in particular with regard to the capability for consolidating volumes.

In 2008, Croatia had a population of 4,437,000 persons. The Swiss-based consultancy *Prograns* has forecasted in its “European Transport Report 2007” that Croatia will lose about 180,000 inhabitants (-4%) by the year 2020.

There are no projections about the likely future distribution of population available so we have to assume that the growth poles included in the official Transport Operational Programme: Zagreb, Osijek, Rijeka and Split, will remain important.

Such a reduction would not considerably influence freight in general and intermodal transport specifically. What is much more important for the potential demand for transport services is the distribution of the population. It is obvious that Croatia's population is very much concentrated in the area of Zagreb and the neighbouring counties. Here live about 25 per cent (1m) of all inhabitants. Almost all other counties in Croatia have a population of not more than 200,000 people (see **Figure 3-4**). They can be characterized as rural areas with a very low population density of 70-80 persons per km<sup>2</sup> or even less. It doesn't come as a surprise that North-East Croatia has the highest density of more than 100 persons per km<sup>2</sup>.

These data prove that Croatia has a strong centre with its capital region but generally features a rather low degree of agglomeration of people.

**Figure 3-4: Population by county, 2007**

County	Croatian name	Size Km <sup>2</sup>	Population	Density Persons/km <sup>2</sup>
Zagreb (city)	<i>Grad Zagreb</i>	640	779.145	1217,4
Split-Dalmatien	<i>Splitsko-dalmatinska</i>	4.524	463.676	102,5
Osijek-Baranja	<i>Osječko-baranjska</i>	4.149	330.506	79,7
Zagreb (county)	<i>Zagrebačka</i>	3.078	309.696	100,6
Primorje-Gorski kotar	<i>Primorsko-goranska</i>	3.590	305.505	85,1
Istrien	<i>Istarska</i>	2.813	206.344	73,4
Vukovar-Syrmien	<i>Vukovarsko-srijemska</i>	2.448	204.768	83,6
Sisak-Moslavina	<i>Sisačko-moslavačka</i>	4.448	185.387	41,7
Varaždin	<i>Varaždinska</i>	1.260	184.769	146,6
Brod-Posavina	<i>Brodsko-posavska</i>	2.027	176.765	87,2
Zadar	<i>Zadarska</i>	3.643	162.045	44,5
Krapina-Zagorje	<i>Krapinsko-zagorska</i>	1.230	142.432	115,8
Karlovac	<i>Karlovačka</i>	3.622	141.787	39,1
Bjelovar-Bilogora	<i>Bjelovarsko-bilogorska</i>	2.638	133.084	50,4
Koprivnica-Križevci	<i>Koprivničko-križevačka</i>	1.734	124.467	71,8
Dubrovnik-Neretva	<i>Dubrovačko-neretvanska</i>	1.782	122.870	69
Međimurje	<i>Međimurska</i>	730	118.426	162,2
Šibenik-Knin	<i>Šibensko-kninska</i>	2.994	112.891	37,7
Virovitica-Podravina	<i>Virovitičko-podravska</i>	2.021	93.389	46,2
Požega-Slawonien	<i>Požeško-slavonska</i>	1.821	85.831	47,1
Lika-Senj	<i>Ličko-senjska</i>	5.350	53.677	10
<b>Total</b>		<b>56.542</b>	<b>4.437.460</b>	<b>78,5</b>

Source: Croatian Statistical Office, KombiConsult analysis

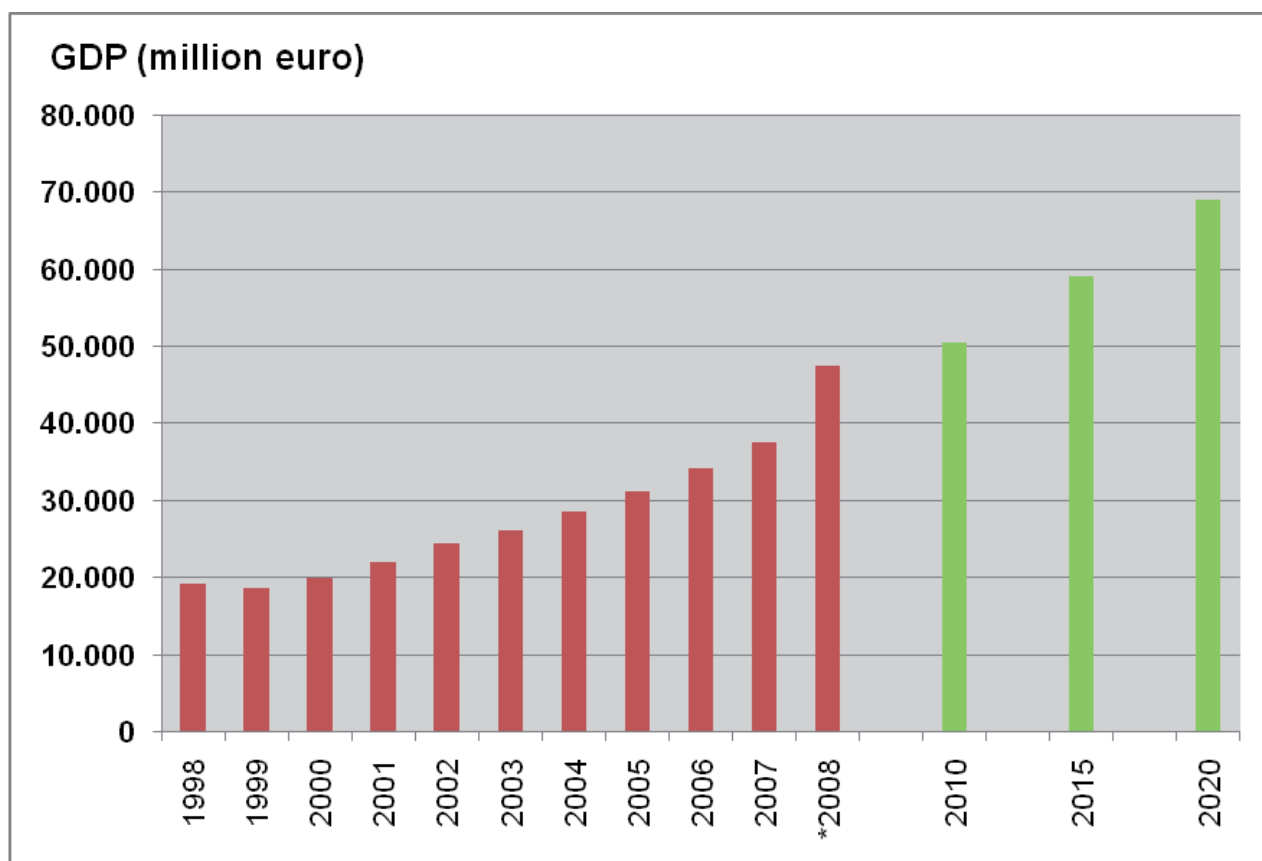
### 3.3.3 - Evolution of gross domestic product

As concerns long-term GDP forecasts we again established our own assessment on the basis of the *Prograns* report. *Prograns* expects that Croatia's real GDP (at 2000 prices) will rise in the period 2005-2015 by 46.4 per cent and in the period 2005-2020 by 59.9 per cent (see **Figure 3-5**). This corresponds to following average growth rates:

- 2005 – 2015: 3.9 %
- 2005 – 2020: 3.2 %

As – unlike *Prograns* - we had access to the *Croatian statistical office* data on the actual evolution of Croatian GDP until 2008 we applied the above growth rates as of the year 2008 and calculated the development until the year 2020 (see **Figure 3-5**).

**Figure 3-5: Evolution and forecast of Croatian GDP (at current prices), 1998-2008, 2010, 2015, 2020**

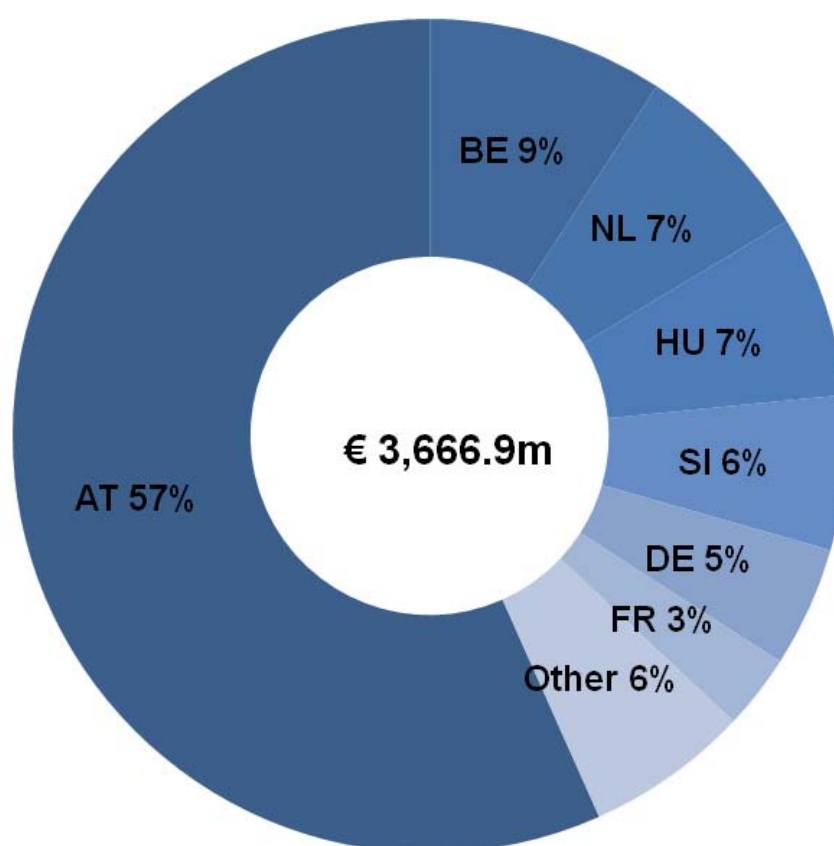


Source: Croatian Statistical Office 1998-2008, *Prograns*, KombiConsult calculations

### 3.3.4 - Evolution of foreign investments

In 2007 the foreign direct investment (FDI) in Croatia totaled to Euro 3,666.9 million. **Figure 3-6** which is showing the distribution by countries of origin and demonstrates the important role of European Union countries, in particular Austria with more than 57 per cent of the direct investments. The FDI have continuously increased in the last years and even continued in the first quarter of 2009 as reports the Croatian National Bank.

**Figure 3-6: Foreign direct investments in Croatia by investing country, 2007**

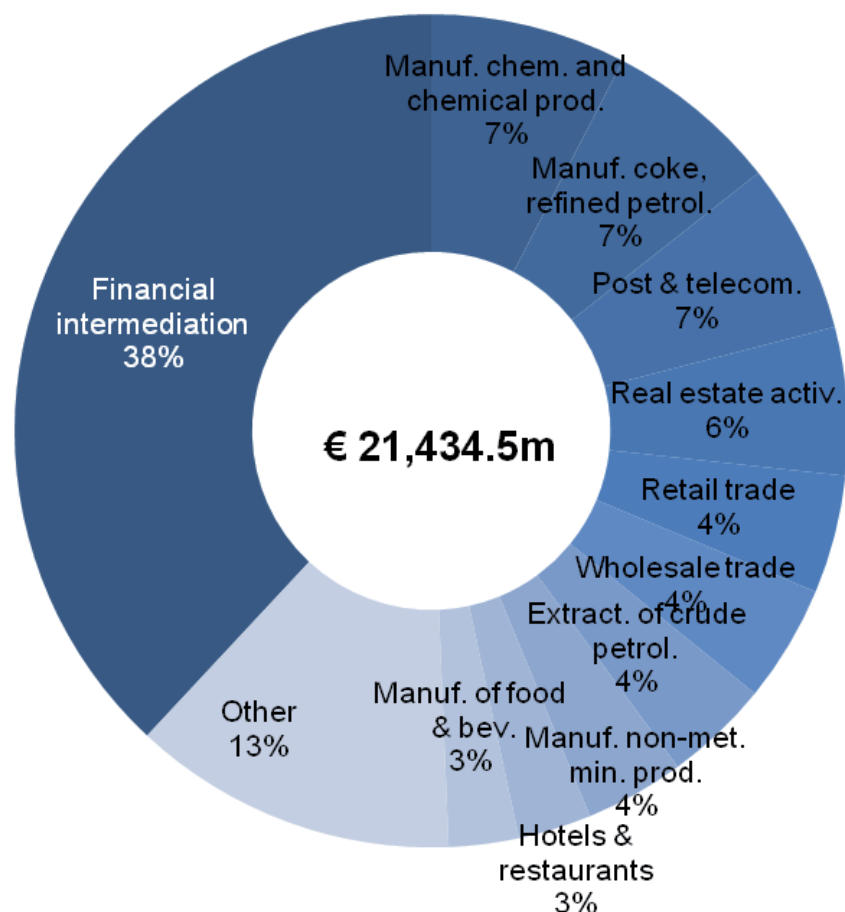


Source: Croatian National Bank (HNB), KombiConsult analysis

Looking to the sectors of interest in the last fifteen years a total of more than Euro 21 billion has been invested by foreign investors in Croatia. The majority of investments were in the financial sector (38 per cent) followed by manufacturing of chemicals and chemical products (7 per cent), manufacture of coke, refined petroleum products (7 per cent), post and telecommunications (7 per cent), real estate activities (6 per cent), retail trade, except

of motor vehicles, wholesale trade and commission trade, extraction of crude petroleum and natural gas, manufacture of other non-metallic mineral products but not to forget hotels and restaurants as well as manufacture of food products and beverages.

**Figure 3-7: Foreign direct investments in Croatia by industry, cumulated 1993-2008**



Source: Croatian National Bank (HNB, KombiConsult analysis)

### 3.3.5 - Evolution of private consumption

In recent years the private consumption was growing. Again using Progrtrans long-term projections the following growth rates are forecasted for Croatia:

- 2005 – 2015: 3.8 %
- 2005 – 2020: 3.1 %

### 3.3.6 - Evolution of external trade

Prograns is using the following data for their long-term projections of exports, imports and external trade that is also supporting a further increase of the transport volumes with and within Croatia.

**Figure 3-8: Evolution of economic indicators 2005 - 2020**


Indicator	Growth rate		Average annual growth rate	
	2015/2005	2020/2005	2015/2005	2020/2005
GPD	46,43%	59,92%	3,89%	3,18%
Private consumption	44,67%	58,00%	3,76%	3,10%
Export	77,17%	109,45%	5,89%	5,05%
Import	62,03%	86,08%	4,94%	4,23%
External trade	68,77%	96,49%	5,37%	4,61%

Source: Prograns: European Transport Report 2007/2008; KombiConsult calculations

### 3.3.7 - Intermodal competition

While the previous sections examined the potential development of the total all-mode including size and structure of trade and transport volume of Croatia's economy, this and the following sections investigate into the opportunities and competitiveness of intermodal traffic in Croatia with regard to road transport.

The Croatian road operators are among the low-cost carriers in Europe. Although their equipment (truck and spare parts) generally is not cheaper than the one of their western European counterparts they can offer considerably lower rates. This is practically only due to smaller labour costs. Considering that, in western Europe, the cost for the driver accounts for about 30 to 35 per cent of the total vehicle cost per day a Croatian driver who receives about 20 per cent of the salary of his western European colleague, is about 5 to 6 per cent cheaper. Given that the margins in road traffic are extremely small this is a tremendous difference leave alone other factors as longer working times.



Against this background this section is intended to analyze how the terms of competition on cost between truck operators and intermodal traffic are likely to develop and whether intermodal services have an opportunity to catch up with road. It highlights the following issues:

- Cost of energy,
- Cost of staff,
- Cost of access to infrastructure,
- Allocation of social cost.

(1) The recent years saw a tremendous increase of energy prices. Particularly the price of oil and its derivatives such as diesel fuel soared. The global economic downturn seems to have stopped a further upward movement and calmed down prices. There is, however, no expert who entertains any doubt that fuel prices will grow again. The debate is only on the question when the next jump will hit the economy and to what extent prices will be skyrocketing.

Even if intermodal transport will not be able to escape a rise of energy prices completely they will not be hit as violently as the diesel-based road transport business. This could be observed during the last oil price rally when the market prices for road traffic virtually exploded. Not only that the electricity supply for electric locomotives, which are overwhelmingly employed on intermodal services from/to and through Croatia, is less dependent on fossil energy than trucks the share of energy cost of total transport cost is also considerably smaller– about 10 versus 30 per cent. Thus in future the comparative cost relationship is likely to change to the benefit of intermodal rail traffic.

(2) For some years the costs of driving staff in road transport have been increasing considerably and improved the competitiveness of intermodal traffic where personnel costs remained rather stable. This development has three reasons:

- In western European countries a shortage of truck drivers in relationship to the demand has arisen. First of all, it results from the fact that the armed forces, which were a “natural” trainer on truck driving licences, have reduced the number of draftees. Secondly, more and more truck drivers don’t want to spend their life on motorways. They prefer jobs in regional or local traffic.



- The accession of the CEE countries to the EU has “saved” the western European road-based logistics because many CEE residents were willing to work as low-cost truck drivers instead being unemployed at home. Yet the more the economy in CEE countries prospered the more truck drivers changed to more pleasant industrial jobs in their country. It seems as if this development doesn’t affect Croatia yet. But if the economy will recover more comprehensively within the next five years we expect that many Croatian drivers might also turn their back to trucks.
- The strongest and most sustainable impact on road cost can be expected from the new EC regulation on drivers working and resting times and the obligatory application of the digital speedometer (“blackbox”). Both measures are due to reducing the effective working time per driver and require from road operators to employ more drivers for the same scope of services. Forwarders estimate that personnel cost in road transport have increased by 10 to 25 per cent depending on the level of compliance with current rules. Considering that drivers’ cost make up about 30 per cent of total road transport cost the market price level is due to rise by 3 to 8 per cent.

(3) The reduction of the effective drivers’ working time in the long run will have another positive effect for intermodal services. It causes that a driver who complies with the regulation, generally will not be capable of performing a round trip on a route of about 300 to 350 km in one shift, loading/unloading included. Even if road operators will elaborate smart operational solutions such as new relay systems of interchanging trucks or drivers, the working time re-gime is likely to lead to a significant increase of transport cost and result in reducing the break-even distance intermodal v road correspondingly.

(4) As regards infrastructure charging road operators still are in a better position than rail freight services. Even if some countries have introduced road tolls for using motorways the level on general is comparatively low. Vehicles are classified into five tolling categories or classes in accordance with the Bylaw on the tolls charged on public roads, and the Decision on motorway toll rates, as approved by the Croatian Ministry of Sea, Transport and Infrastructure. This means that, in Croatia, road operations can be carried out at costs that take into account at least parts of the building and maintenance costs of the roads, exemplary calculations show an average cost of about 5 Euro Cent per truck-km.

On the other side, railway undertakings – and consequently intermodal operators and their customers – have to pay track access fees for the usage of virtually any European network.



In Croatia the track access charges amount to about Euro 3.0 to 3.5 per train-km.

(5) Whereas intermodal service currently are penalized as concerns infrastructure access charging compared to road operations they might considerably benefit from a regime, which ensures that the social costs each mode of transport is causing will be allocated. Any calculation shows that rail is causing much less social costs per tonne-kilometre as road with regard especially to air emissions and non-covered costs of accidents.

Our analysis provides evidence that two of the major cost drivers of road freight transport, fuel and personnel cost, are due to rise noticeably in the next years. If the plans on allocating social cost to causers were enforced in due time intermodal services could gain an additional benefit and thus could compensate – at least partly – for the cost disadvantage in infrastructure access charging systems. In total we expect that in contrast to the past 20 years that saw a continuous decline of market prices, the level of road freight rates will increase by a mean annual rate of 1.5 to 2.0 per cent by 2015. If authorities, however, felt that the transport industry is not doing enough for reducing its carbon dioxide and ecological footprint they might even tighten their measures and increase the “price” on road traffic.

### **3.3.8 - Sustainable logistics**

The climate policy, which is responding to the threats of a change of the world climate, may become a key leverage for shifting shipments from road to more environmental-friendly supply chains, of which intermodal traffic can particularly benefit.

During our market survey we have identified several companies, which are about to examine how they could reduce the ecological footprint of their logistics systems. What is remarkable or even spectacular is that it is not only the chemical industry, which is rail inclined anyway, but other industries, which, to date, were comparatively “road-minded” and were virtually keen to stand away from rail.

Since recently several major European wholesalers and retailers are driving sustainable, “green” logistics. They have started to examine where, in their own logistical system, they could reduce the environmental impact of their supply chain for foodstuffs and non-food consumer goods. But even more so they are requesting from their suppliers to contribute to this objective. We learnt that particularly the big producers of food and non-food consumer goods have understood the message. It has immediately become obvious that the majority

of them is looking for solutions where they could shift current road-based tonnage to intermodal services. They are analyzing which of their trade lanes corresponds to existing intermodal services, and if there aren't any, they then expect intermodal operators to devise an appropriate supply.

What is suddenly driving these industries to care for the climate impacts of their logistics and transport? According to our analysis the following influences are key for this move:

- The major driver of green logistics is economics. The companies anticipate that in the near future social costs will be allocated to causers fully or partly. This will definitely make their road-based operations much more expensive. So they are looking for more cost-efficient alternatives, which they assume can deliver a comparable service level. And this is intermodal traffic.
- Wholesalers and retailer have observed changed consumer values and recognized that the revenues from biologically produced products are increasing more than the average even if their share is still modest – less than 10 per cent. Customers that buy those products are a minority but they are an “avant-garde” and do influence the public opinion. For the owners of the supermarkets it is clear that these customers will at one time also require for a “politically correct” transport of biological products. The companies affected try to anticipate this development by restructuring parts of their logistics.
- Finally, more and more shareholders ask the management of corporation what they are going to do to respond to the challenges of climate change.

If the intermodal industry responds appropriately to the requirements of shippers concerned of their ecological footprint and ensure reliable and cost-efficient service we expect that climate policy will effectuate a tremendous push for intermodal traffic and raise volumes. According to our findings both shippers and intermodal operators will be interested to do the first steps on western European corridors. Provided that they are successful we anticipate that shipments from and to Croatia may be integrated in the second stage. The corridors with Croatia provide for several favourable conditions: They have a good rail infrastructure and involve long transport distances, which allow for recording large environmental savings effects.

### 3.3.9 - Port development

Croatia is in the lucky position to have a direct access to the Adriatic sea by seaports Rijeka, Zadar and Ploče with respect to freight transport.

The following Figure is showing the existing container terminal in the port of Rijeka (“Brajdica”) which is operated under concession of the Port Authority by the private firm “Jadranska vrata”. The rail containers are handled on a 900 m track on the land side of the terminal.

**Figure 3-9: Birds-eye-view to the Port of Rijeka container terminal**



*Source: Port Rijeka Authority, KombiConsult analysis*

Maritime container traffic developed with steady two-digit growth rates over the past years. Reasons are the growth of the world economy and the integration of the Eastern European countries in transcontinental trade flows after the fall of the iron curtain and the end of the war on Balkan.

The total volume of container traffic of Rijeka was almost 170.000 TEU in 2008.

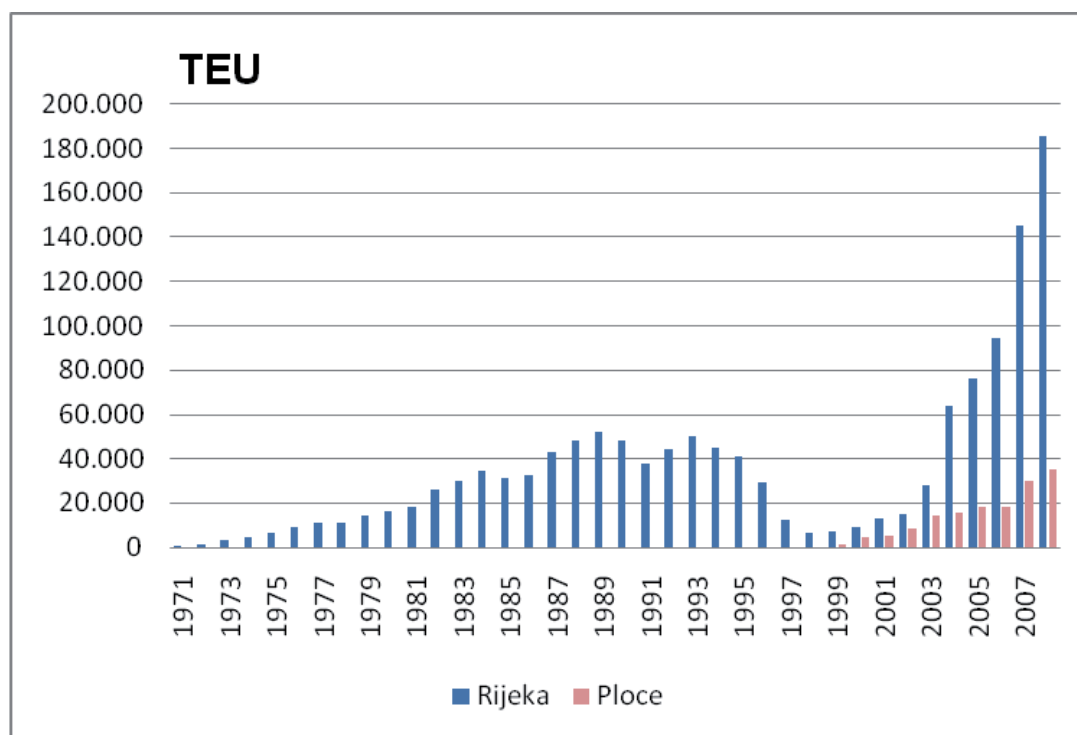
With a loan of the Worldbank and financial support from the state the Porto of Rijeka Authority is currently implementing the “Rijeka gateway II” project that aims to separate the trade and housing areas in the old town, allow a positive development for both currently conflicting “users” and increase the capability for cargo handling.

The most recent project composes of three components: 1. the port development component, 2. the port service enhancement, and 3. Project implementation.

(1) The port development component aims at extending the existing “Brajdica” container terminal by 300 m with a water depth of 14,5 m, increasing its capacity by 200.000 TEU to about 350.000 TEU; The construction of a new container terminal at the “Zagreb” pier capable to accommodate post-panamax container vessels, with a capacity of 225.000 TEU to be constructed from 2010 to 2014 according to 2008 Worldbank information). The concessionaire for each terminal will finance and provide superstructure and equipment.

(2) The port service enhancement aims at providing support for concessioning, equipment and technical services, while the third component provides support to implement the project administratively. The entire volume is US-\$ 88 million. Based on the port development Masterplan update, that formed the reasoning for the Worldbank to donate the project, the container throughput of the Port of Rijeka is expected to reach 355.000 TEU in 2015 and 673.000 TEU by 2020 in “a medium traffic scenario”.

**Figure 3-10: Development of the container traffic of the Port of Rijeka and Ploce, 1971-2008**



Source: Port Authorities, HZ-Cargo, KombiConsult analysis





Adriatic port operators in Trieste, Koper and Rijeka claim to having benefited also from recent (2007/8) congestion in North European ports so that trade companies have looked for bypasses for entering the European hinterland.

In addition the port operators argue with the shorter transit time for Asian goods if they were transported via the „Southern Gateways“ into Europe rather than the traditional Northern ports.

The port of Rijeka has started an investment programme to modernize and expand the ports infrastructure. However, the port is trapped by mountains which hamper the access by road and rail. Nevertheless the railway line to Zagreb is being modernised and shall be completed by 2012/13.

In **Zadar**, further south on the Adriatic coast, another Croatian port will be expanded, among other with funds of the EIB and German Kfw-bank but mostly for (passenger) ferry services and cruise ships.

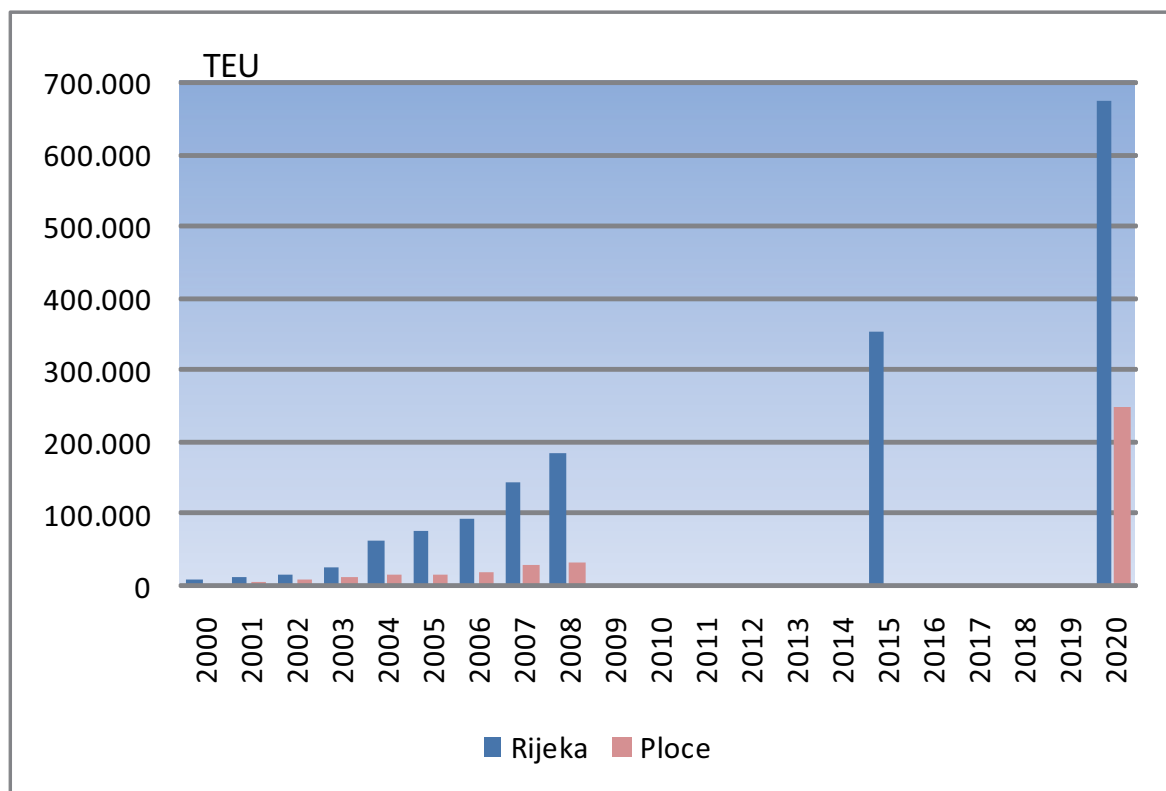
The port of **Ploče** is not directly connected to the rest of Croatia's mainland by rail. Its hinterland transport is thus predominantly (98 %) oriented along the trans-European corridor Vc to Bosnia and Herzegovina. In 2008 the total maritime container volume was 35,163 TEU of which the rail share was 22 % (7,686 TEU). The growth rate of container handling was 16 % (2008/2007). The Port Authority is currently performing to construct a new container terminal that is likely to be completed in the first quarter of 2010. The project consists of the stepwise implementation of the following items:

- dredging of the access channel to a depth 13.8 meters as well as all necessary land reclamation works;
- the construction of at least 280 meters quay wall at the Terminal site with a depth of 13.8 meters and a terminal area of approximately 40,000 m<sup>2</sup> (including approximately 30,000 m<sup>2</sup> of Storage Area) as well as the installation of paving, buildings, workshops, and all other elements required for the Terminal, to become fully functional and operational, as well provision of Terminal Equipment comprising at a minimum of two mobile harbour cranes for handling of containers, related yard handling equipment and rolling stock;
- a STS gantry crane shall be constructed, installed, tested and commissioned for handling of containers at the Terminal after the traffic will reach 60-90,000 TEU;

- construction and paving of an additional 40,000 m<sup>2</sup> of usable yard space after reaching 90,000 TEU;
- development and construction of seventy thousand (70,000) m<sup>2</sup> of the stacking area and all required infrastructure after the 150,000 TEU of annual throughput;
- a further extension of the quay wall of approximately 150 m as well as approximately 80,000 m<sup>2</sup> of stacking area behind this quay wall including all required infrastructure after 250,000 TEU.

The Project is also financed by the support of the Government of the Republic of Croatia and by loan from the World Bank.

**Figure 3-11: Development of the transshipment volume of Rijeka and Ploče, 2000-2008, 2015, 2020**



Source: Port of Rijeka Authority 2009, HZ-Cargo 2009, Port of Ploče 2009, Worldbank 2008

The port authorities of both, Rijeka and Ploče have, supported by the Croatian government established and extension programme for their port facilities which is financed partly from a loan of the Worldbank. These extension programmes foresee to expand the seaside and

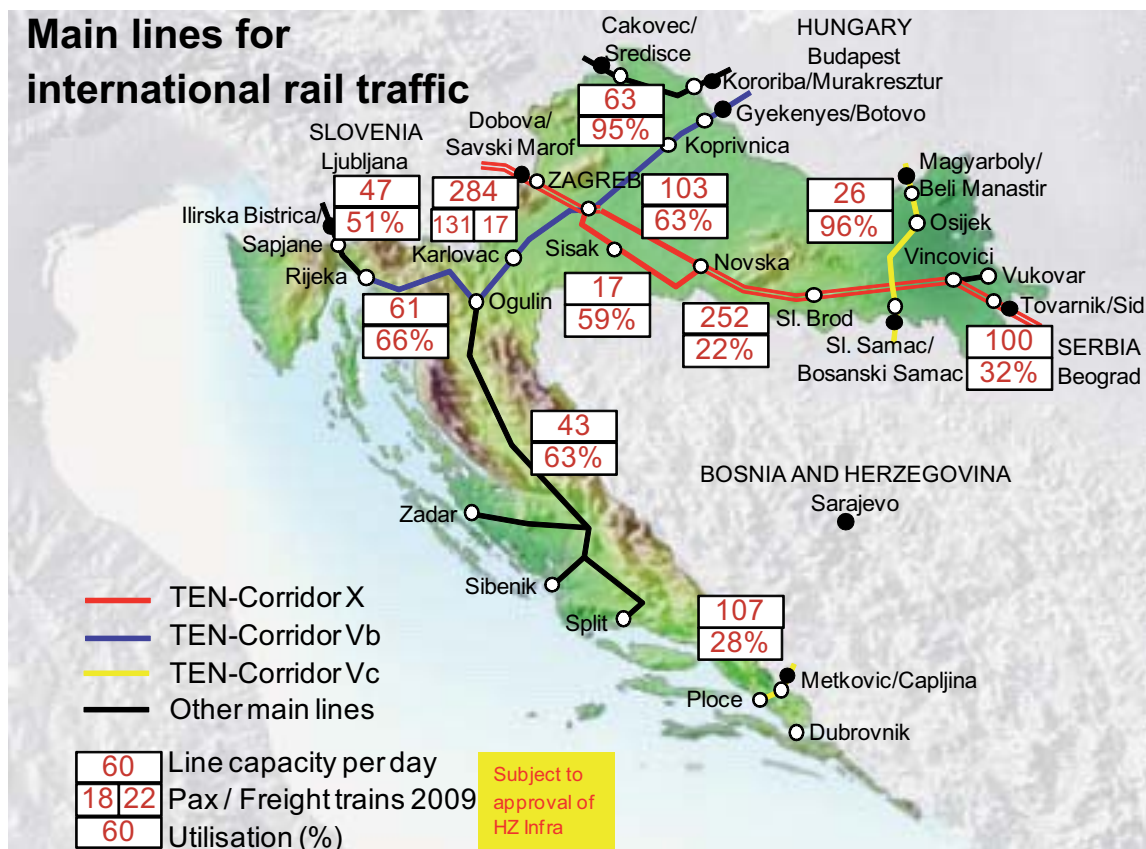
landside handling capacity in considerable steps in line with the real market requirement by almost 4 times in Rijeka to a total transshipment capacity of 670,000 TEU by 2020, and by more than 7 times in Ploce to a total transshipment capacity of 250,000 TEU by 2020.

It can be expected that both parts will act as secondary or feeder ports where no further transshipment will take place but all containers will be shipped by land transport. Given the current or aimed at railshare of approximately 40 % and a use of the installed capacity of 75 % we could expect an intermodal traffic of about 277,000 TEU annually. Assuming a normal utilisation, that would lead to about 7 pairs of trains by day from both ports together.

### 3.3.10 - Rail infrastructure and terminal development

The following map is showing the main lines and their occupation by passenger and freight trains (2009 time table).

Figure 3-12: Occupation of the Croatian rail network, 2009



Source: KombiConsult analysis



Already in 2008 the SEETO Observatory claimed the core rail network bottlenecks to be located on Corridor X sections Savski Marof (Slovenian border) and Zagreb as well as on the section Zagreb - Dugo Selo, where the corridors V and X are intersecting and the two tracks have to perform also urban commuter trains of the Zagreb region. The total number of trains on these sections were reported 148 and 189 respectively. Only 17 respectively 36 were freight trains.

**Figure 3-13: Trains on the most critical rail sections in Croatia, 2009**

Station	Station	Length (km)	Tracks	Passenger Trains	Freight Trains	Total Trains
Savski Marof	Zagreb	27	2	131	17	148
Zagreb	Dugo Selo	33	2	153	36	189

Source: SEETO, 5 year multi annual plan 2009-2013, KombiConsult analysis

Due the importance of the transit rail traffic for Croatia it is not only the own network capacity which influences the further growth of intermodal traffic, but also the performance of the neighbouring railway networks such as in Serbia as regards Corridor X and Hungary with respect to corridor V. SEETO MAP 2009-2013 reports that in particular in Serbia actual speeds do not exceed 50 % of the design speed, and that thus the reliability of rail freight services is reduced. The Multi-annual Programm foresees a couple of rehabilitation and new building measures listed in **Figure 3-14**.

**Figure 3-14: Condition of the Croatian rail network sections relevant for international CT**

N°	From	To	Length	Intervention Type	Estimated cost [million Euro]
Vb	Rijeka	Zagreb	269	New Line	627
X	Savanski Marof (SL)	Zapresci (Zagreb )	27	Rehabilitation	23,3
X	Dugo Selo	Novska	81,3	Upgrade	135
X	Okucani	Novska	19	Rehabilitation	38,5

Source: SEETO, 5 year multi annual plan 2009-2013, KombiConsult analysis

**Figure 3-15: Main improvement works of the Croatian rail network sections relevant for international CT**



Source: SEETO, 5 year multi annual plan 2009-2013, KombiConsult analysis

### 3.3.11 - Evolution of intermodal industry

The previous sections have presented evidence that influences external to the intermodal industry are expected to create an additional large market potential for intermodal services in a medium-and long-term perspective. But already today and even more so once the Croatian economy is on a path of recovery the volumes of external trade and long-distance freight traffic offer ample opportunities for placing services. What is necessary to be competitive with Croatia's low-cost road carriers now and in the future are cost-efficient and reliable services.

The question is if the intermodal industry will and can develop capabilities, strategies and instruments to improve its competitiveness and what conditions are beneficial to this end. We have analyzed the industry and drawn our conclusions on its likely evolution as follows:

(1) The freight volumes are concentrated to a very large extent in the Zagreb area. Traffic flows are increasingly balanced east-west. Such framework conditions facilitate the implementation of - multi-frequency - point-to-point intermodal block train services.

(2) However, it will be necessary to establish at least additional state-of-the-art terminals such as Vrapce in the Zagreb area in order to ensure a fast and cost-efficient service to customers.

(3) With the full implementation of the European legislation in the transport (rail) sector in conjunction with the accession process that has recently got momentum when Slovenian and Croatian governments have agreed to continue solving the border territorial conflict, competition in the intermodal industry on the operator and railway level will be introduced also in Croatia. Croatia will become interesting for transiting railway undertakings and railways and intermodal operators which may access the countries' seaports of Rijeka and Ploče. This should contribute to improving service quality and productivity and developing new markets and trade lanes. Like in the Slovenian Koper the ports could initiate services to their respective hinterland.

(4) In order to foster intermodal services on routes beyond Croatia to the West-Balkan States, which don't provide for full-trainload volumes from the start, it is required to establish hub-based rail production systems (gateway services). Starting with the relatively low volumes such a system should combine domestic and international services, which are physically crossing in the area of Zagreb, where they could be merged with local volumes for the agglomeration (county and town of Zagreb). For this reason we expect that intermodal operators will establish a hub in the Zagreb area to achieve economies of scale on their train services. Such a hub would be suitable for serving the following trade lanes:

- Between west and southeast Europe: Bosnia-and-Herzegovina, Serbia, Greece
- From the port of Rijeka: Austria, Hungary, Budapest in particular, Bosnia-and-Herzegovina, Serbia

The prerequisites for such a hub terminal are amongst others sufficient interim storage area, competitive handling and interim storage rates, flexibility, and the capability to compensate for operational deficits of others e.g. delays caused during the rail trip.

### 3.4 - Evolution of domestic intermodal rail/road traffic by 2020

It is virtually impossible to forecast Croatia's domestic traffic neither to next year nor to 2020. Given the geo-economic conditions there are not many opportunities to establish road-competitive domestic services. Therefore the demand for carrying an intermodal shipment on a domestic line will remain extremely volatile and dependent on the decisions of individual companies. Those decisions can't be forecasted in the framework of such a global assessment.

We expect that – just like today - one part of the volume will be sourced from loading units re-forwarded after or prior to an international movement and the other part from the carriage of empty containers. With respect to our prognosis that the international container hinterland traffic between seaport and Croatian inland terminals will more than double by 2020 (see section 3.5) we assume that the domestic intermodal traffic, whose volume correlates with international traffic, will grow at nearly the same rate and volume rise to 5,400 TEU. This corresponds to an increase by 157 per cent compared to the year 2007.

A major impact may result from Croatia's own seaports at Rijeka and Ploce, which have planned infrastructural improvement projects and which may also lead to an increase of the intermodal rail volume in their domestic hinterlands, in particular, if an appropriate production form, e.g. via a gateway terminal in Zagreb can be established. The development of these transports is however depending also on the completion of works in the ports and of the new railway line that will decrease the rail mileage Rijeka – Zagreb considerably.

### 3.5 - Evolution of international intermodal rail/road traffic by 2020

In order to assess the development of the international volume of intermodal traffic of the countries involved in this study we analyzed every relevant trade lane between two catchment areas whether, by 2020, it may provide for a potential, which:

- First of all, is sufficiently high to enable implementing a regular full-trainload (FTL) intermodal service, e.g. a direct or shuttle train;
- Secondly, we considered to be suitable for being captured by an intermodal service featuring an appropriate service profile.

For those trade lanes, which matched both requirements, we “designed” a distinctive profile for an intermodal service particularly including the following items:

- The total train capacity;
- The average capacity load factor;
- The weekly and annual frequency of the service.

The inputs are mainly based on our expertise of current services on the trade lane in question – if there is a service – and the general economic conditions of intermodal trains, the forecasted goods and logistics patterns and the infrastructure parameters on the freight corridor by 2020. Through this comprehensive exercise we were able to determine the 2020 amount of intermodal shipments (in TEU) for each trade lane. These results were assigned to the corresponding country-to-country couple. The consolidated volume of all trade lanes between two countries delivers the total bilateral intermodal traffic volume as presented in **Figure 3-16**.


It goes without saying that this approach doesn’t and couldn’t take into account the possibility that, operationally, a part or even the total of shipments will be moved on gateway services. In such a case, these volumes would statistically be allocated to other bilateral links than the “original” trade lane of the goods concerned.

Intermodal traffic on bilateral intermodal services with Croatia is expected to improve by 462 per cent in the period between 2007 and 2020. Even if the growth rate may appear impressive, one has to take into consideration the absolute figures: The total amount of shipments will rise from 36,600 TEU to 205,700 TEU (see **Figure 3-20**). That volume corresponds to about 10 daily trains (5 relations).

**Figure 3-16: Bilateral international unaccompanied intermodal traffic by corridor, 2007/2020**

Croatia from/to	2007			2020			% change on total
	Maritime	Continental	Total	Maritime	Continental	Total	
Austria		65	65	26.000	21.600	47.600	73131%
Belgium	5.000		5.000	-		-	-100%
Bosnia-and-Herzegovina			-	9.750		9.750	n.a.
Germany	9.000	400	9.400	37.500	-	37.500	299%
Hungary	3.800		3.800	32.500		32.500	755%
Serbia	10.000		10.000	32.500		32.500	225%
Slovenia	800	2.521	3.321	35.000	10.800	45.800	1279%
The Netherlands	5.000		5.000	-		-	-100%
Total	33.600	2.986	36.586	173.250	32.400	205.650	462%

Source: KombiConsult analysis



The two main intermodal market segments will develop distinctively. While container hinterland traffic will “only” increase by 416 per cent the volume of freight shipped on continental services is forecasted to increase from 3,000 TEU in 2007 to 32,400 TEU by 2020. Based on our findings on the evolution of Croatia’s external trade and the terms of competition between intermodal and road continental intermodal traffic is expected to grow particularly strongly on trade lanes with the following countries:

- Austria, both maritime and continental (to and from Croatian seaports)
- Germany, both continental and maritime (to and from German seaports)
- Hungary
- Serbia and Bosnia-and-Herzegovina
- Slovenia (where Gateway services to other Western European countries such as Italy can be realised)

Intermodal **transit** through Croatia is going to soar in the years to come. It will more than quadruple from 95,100 TEU (2007) to 401,400 TEU (2020). The main reason for this development is that we expect that the bilateral intermodal traffic between western European countries, and the Slovenian port of Koper, on one hand, and Bulgaria, Serbia, Greece and Turkey, on the other hand, will grow substantially (see **Figure 3-17**).

There are more details in the other country reports on bilateral intermodal trade lanes, which they are involved in.

At first sight the total absolute and relative increase of the transit traffic may appear to be not realistic. But the following aspects should be taken into account:

- Within two years from 2005 to 2007, intermodal transit through Croatia has had almost quadrupled once.
- The transit traffic serving primarily continental trades was much less hit by the current economic crises than the international maritime traffic.
- We do expect a considerable increase of external trade between the old and new EU Member States as well as with Turkey.
- Each of the corridors, on which we assume intermodal traffic will grow strongly, has very long rail-oriented transport distances and is due to providing for more than a daily full-trainload point-point freight potential.

Just like today, continental cargo will dominate the transit traffic by 2020. The volume of this market segment will grow by 239 per cent from 86,600 TEU (2007) to 293,900 TEU (2020). The growth rate of container hinterland services through Croatia is expected to be even higher (1,165 per cent). But this is a statistical effect. The market segment only accounted for 8,500 TEU in 2007, and it is estimated to rise to 107,500 TEU by 2020. The total transit will thus raise by 358 per cent from 95,100 TEU to 401,400 TEU by 2020 (see **Figure 3-18**).

**Figure 3-17: Unaccompanied intermodal traffic in transit through Croatia by corridor, 2007/2020**

Transit Corridor		2007	2020	% change
Austria	Greece	38.732	31.500	-19%
Austria	Turkey	12.454	50.400	305%
Belgium	Greece	14.675	23.400	59%
Bosnia-and Herzegovina	Slovenia	180	2.250	1150%
Bulgaria	Slovenia		16.200	n.a.
France	Greece	585	-	-100%
Germany	Greece		23.400	n.a.
Germany	Greece	2.958	23.400	691%
Germany	Serbia	5.000	37.500	650%
Germany	Turkey		25.200	n.a.
Italy	Romania		21.600	n.a.
Romania	Slovenia	341	41.300	12011%
Serbia	Slovenia	6.957	56.600	714%
Slovenia	Turkey	-	27.000	n.a.
The Netherlands	Serbia	3.500	-	-100%
Other		9.747	21.600	122%
Total		95.129	401.350	322%

Source: KombiConsult analysis

### 3.6 - Evolution of total intermodal rail/road traffic by 2020

The following **Figure 3-18** shows the total picture of the development of intermodal transport in Croatia 2020/2007. According to our projection the total volume of unaccompanied intermodal transport will grow to about 612,500 TEU.



**Figure 3-18: Unaccompanied intermodal traffic in Croatia, 2007/2020**

Intermodal market segment		2020	2007	Total growth	Annual growth
<b>Unaccompanied traffic</b>		<b>612.500</b>	<b>133.800</b>	<b>358%</b>	<b>12,4%</b>
<b>Domestic</b>	maritime	5.400	2.100	157%	7,5%
	continental	-	-	n.a.	n.a.
	<b>Subtotal</b>	<b>5.400</b>	<b>2.100</b>	<b>157%</b>	<b>7,5%</b>
<b>International</b>	maritime	173.300	33.600	416%	13,5%
	continental	32.400	3.000	980%	20,1%
	<b>Subtotal</b>	<b>205.700</b>	<b>36.600</b>	<b>462%</b>	<b>14,2%</b>
<b>Transit</b>	maritime	107.500	8.500	1165%	21,6%
	continental	293.900	86.600	239%	9,9%
	<b>Subtotal</b>	<b>401.400</b>	<b>95.100</b>	<b>322%</b>	<b>11,7%</b>
<b>Total intermodal traffic</b>		<b>612.500</b>	<b>133.800</b>	<b>358%</b>	<b>12,4%</b>

*Source: KombiConsult analysis*

These figures include transit traffic between Western Europe and Central and Eastern European countries that could be routed through Croatia along transport corridor X. It should however be noted that this routing is one alternative amongst other. In the European FP6 project CREAM we have analysed these alternatives which are:

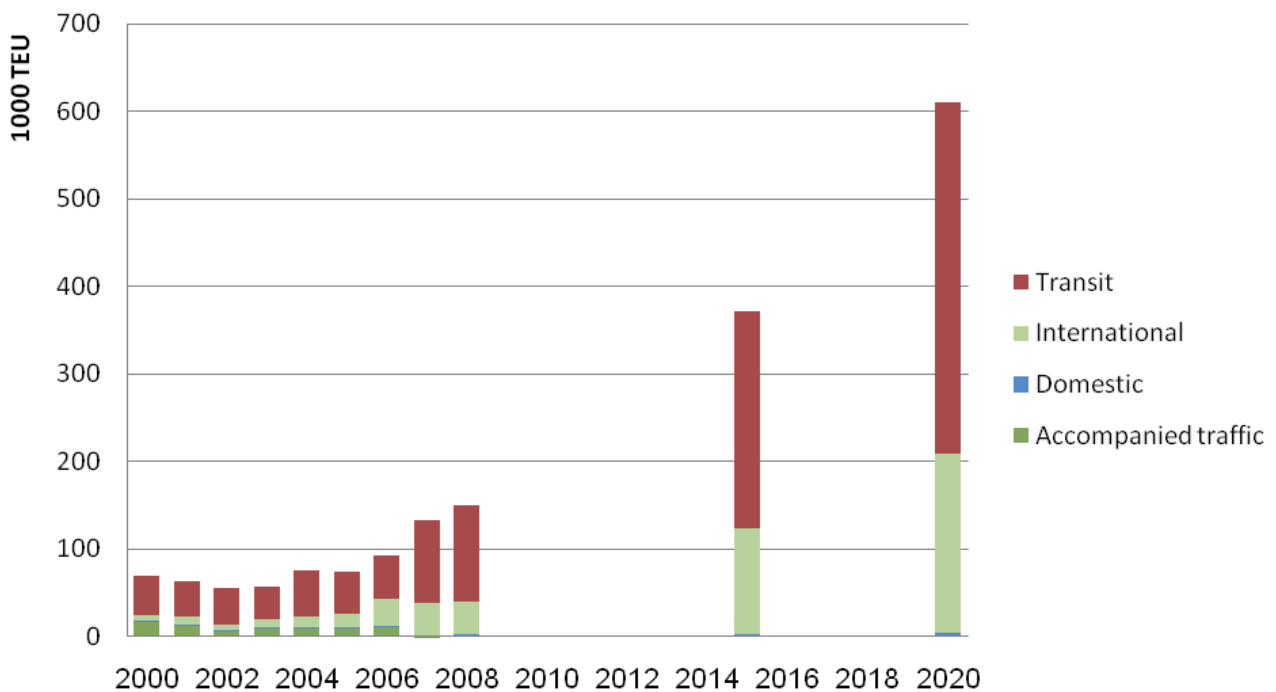
- An intermodal road – sea connection using ferries from e.g. the port of Trieste to Greece and Turkish ports;
- An intermodal rail / road service along corridor IV: Hungary, Romania, Bulgaria, Turkey;



- An intermodal rail / road service along corridor X: Slovenia, Croatia, Serbia, Bulgaria, Greece/Turkey.

The modal choice for Western as well as Turkish truckers between these routings is very much depending in the reliability and the price of the rail product, and it can hardly be predicted whether the infrastructures managers and railway undertakings will be continued to improve the service level considerably to compete with the pure truck transportation and the respective alternative routings.

**Figure 3-19: Unaccompanied intermodal traffic in Croatia, 2000-2008, 2015, 2020**



Source: KombiConsult analysis

The total (or annual) growth rates expressed in per cent might be surprising but the increase in absolute figures should be assessed in the light of the currently underdeveloped intermodal transport in Croatia, the relation to international road transport and the envisaged measures to further strengthen the intermodal industry.



## 4. IMPACT OF EVOLUTION OF INTERMODAL TRAFFIC ON INFRASTRUCTURE

### 4.1 - Impact on rail network capacity

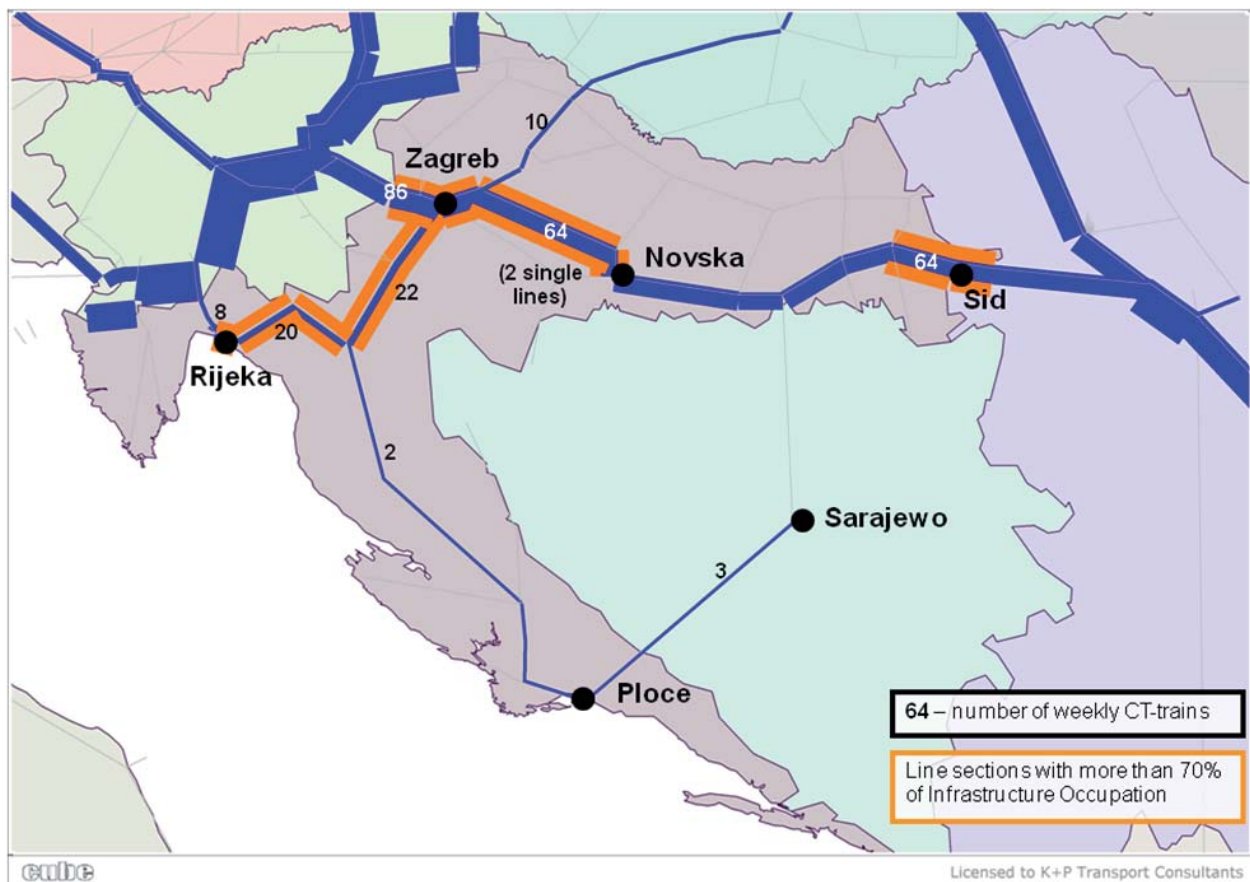
The **Figure 4-1** shows the approximate assignment of the 2020 transport programme of block train services from/to and through Croatia determined by our assessment of the evolution of unaccompanied intermodal traffic on the Croatian rail network. Since we expect that the majority of intermodal shipments will be carried on international trains between Croatia and the European countries of Germany, Hungary and Slovenia on the one hand and Romania, Bulgaria, Turkey and Greece on the other hand, the rail lines via Croatia which are part of the Corridor V and X will have to bear the highest load of bilateral intermodal trains.

Due to this substantial growth of intermodal trains until 2020 we basically anticipate major capacity constraints on the Croatian network also taking account of other freight and passenger trains. Considering the slow implementation of several capacity enlargement works, to be completed by the year 2020 the latest, the situation will however not significantly change compared to the existing state (see section 2.7.1). Nevertheless, even if the large scale measures will be implemented parts of the network will still suffer from bad operating conditions due to not sufficiently financed railway infrastructure development: maintenance on the entire network, east-west line linking the port of Rijeka to the Hungarian border, single lines south of Zagreb in particular Dugo Selo and Novska, which will remain bottlenecks.

However, as explained in previous sections, the routing of, in particular transit trains to/from Western European sources/destination to Greece, Serbia, Romania, Bulgaria and Turkey is not only dependent on the timely completion of Croatian rail infrastructure projects, border crossing procedures but also the behaviour of neighbouring countries' intermodal stakeholders at large.

This statement is basically confirmed by the ERIM 2020 study, which sees also these sections of the Croatian rail network employed by an average of 70 per cent or more by 2020. Yet it should be qualified that this does mean that there will be sufficient capacities on general but not necessarily at the time-window required from the intermodal service supplier and its customers.


**Figure 4-1: Assignment of intermodal trains on the Croatian rail network, 2020**



Source: K+P Transport Consultants

## 4.2 - Impact on terminal capacity

By the year 2020, intermodal terminals in Croatia will need a transshipment capacity for an annual volume of 211,100 TEU in unaccompanied traffic. This is the consolidated volume of the expected intermodal shipments on domestic and bilateral international services and



corresponds to 34.5 per cent of total intermodal traffic in Croatia in 2020, amounting to 612,500 TEU. Only these two market segments affect terminals located in Croatia since we assume that transit shipments will be carried between terminals in other countries and basically not handled at Croatian sites in the framework of gateway or hub systems.

In order to determine the handling capacity required to process the transport volume of 612,500 TEU it is necessary to translate the amount of TEU in number of loading units (LU). Loading units are the objects, which terminals physically lift, and therefore the appropriate calculation parameter.

In this respect we need to distinguish maritime from continental traffic since the mix of loading units is expected to be quite different. Based on observable trends we expect that, by 2020, on container hinterland services with Croatia one loading unit will correspond to 1.6 TEU.

Current continental intermodal services are strongly focused on the chemical industry and therefore move a large amount of 20' (1 TEU) and 30' (1.5 TEU) tank and bulk containers. 45' units used for continental trades between Austria and Greece in 2007 were carried in transit through Croatia, only. For this reason, the TEU-loading unit ratio is comparatively low, lower than on maritime services. We, however, expect that over the next decade intermodal operators will be successful to capture general cargo freight markets, as explained in chapter 3. Then we will see a significant change of the pattern of loading units employed. To carry general cargo such as foods dry cargo domestic containers, semi-trailers and swap bodies are required. An equivalent of a full truckload of such a continental intermodal shipment corresponds to on average of 2.3 TEU. We determined a 1.8 TEU-LU-ratio as the weighted average of dry cargo and bulk units.

An increase of the international and domestic intermodal traffic volume does not equally influence the terminal capacity. While the transit traffic does not need terminal capacity at all, international consignments require one terminal call in Croatia and domestic transports requires two terminal calls in Croatia. Given the proportion of international services to/from the terminal in the ports of Rijeka and Ploče as major sources of handling, need the total required handling capacity has been calculated on the estimated growth of intermodal rail/road traffic volume (see **Figure 4-2**).

**Figure 4-2: Conversion of TEU-related intermodal volume into loading units (LU) in Croatia, 2020**

Market segment	Volume 2020 (TEU)	TEU/LU ratio	Volume 2020 (LU)	Handling ratio	Handling 2020 (LU)
Domestic	5.400	1,60	3.400	2	6.800
International Maritime	173.300	1,60	108.300	1	108.300
International Continental	32.400	1,80	18.000	1	18.000
Transit	401.400	1,80	223.000	0	0
<b>Total</b>	<b>612.500</b>		<b>352.700</b>		<b>133.100</b>

Source: KombiConsult analysis

The exercise shows that by 2020 Croatian intermodal terminals will require for a handling capacity for 133,100 loading units to be able to process the expected transport volume of 612,500 TEU.

Within the **Figure 4-3** we have estimated the handling need by terminal area by 2020. The table includes the current (2007) handling capacity provided by existing terminals in Croatia and the anticipated capacity by 2020 for the same transport area.

Since most of the Croatian terminals are very small and technically outdated (age of equipment, lack of storage space, lack of fencing and security control) we could not only identify an additional need of capacity in the port and in Zagreb, but also a severe replacement need.

According to our finding a terminal in the area of Zagreb should be able to offer at least 50,000 loading units per year. In the area of East Croatia. Most probably Osijek or Slavonski Brod a terminal shall be foreseen to capture maritime cargoes related to the Croatian seaports.

**Figure 4-3: Estimation of handling need (loading units – LU) in Croatia by terminal, 2007/2020**

Terminal	Handling capacity	Capacity Need	Additional Need
	2007	2020	2020
	LU	LU	LU
Osijek	8.000	4.000	
Ploce	30.000	15.000	
Rijeka Brajdica	36.000	60.100	+ 24.100
Slavonski Brod	8.000	4.000	-
Solin Luka (Split)	3.200	-	-
Zadar	-	-	-
Zagreb - Vrapce	30.000	50.000	+ 20.000
Spacva	-	-	-
<b>Total</b>	<b>115.200</b>	<b>133.100</b>	<b>+ 44.100</b>

*Source: KombiConsult analysis*


## 5. RECOMMENDATIONS ON INTERMODAL STRATEGY

(1) The key success factors for **continental intermodal services** from/to Croatia and in transit with South-East European countries are as follows:

- Upgrade rail infrastructure to increase operational speed and reduce travel time in particular on corridor X (Ljubljana) – Zagreb – Tovarnik - (Belgrade),
- Time-schedules geared to the movement of consumer goods: buffer time in departure but early morning arrivals,
- 95% rate of punctuality in arrival,
- Consistency,
- Cost-efficient service,
- Processing at intermodal terminals that are recognised as such (see item 8, below) to ensure efficient round trip schedules for trucking companies.

(2) The key success factors for **container hinterland services** from/to Croatia are as follows:

- Facilitate “Rijeka Gateway Project” to increase its handling capacity on the sea- and landside (rail terminal),
- Realise the new railway line Rijeka – Karlovac – Zagreb to reduce travel time and raise capacity,
- Increase share of rail in hinterland connections by shuttle services with Croatian seaports to major hinterland connections: Rijeka – Zagreb – Graz (Austria), Rijeka - Zagreb – Budapest (Hungary), Ploče – Sarajevo (Bosnia-and-Herzegovina) – Belgrade (Serbia),
- Control and management of port-to-door chain,
- Flexibility: preparedness for additional trains; trucking container over the road,
- Cost-efficient service,
- Empty container depot at competitive rates.



(3) The market potential on trade lanes from/to and through Croatia is sufficiently high that intermodal operators in co-operation with railway undertakings should be able to **industrialize intermodal production** and thus realize major productivity gains, which in turn contributes to improve competitiveness with road:

- Standardization of processes and technology,
- Employment of efficient rail production systems: shuttle systems between gateway terminals,
- Advanced interface management,
- Commitment to reliable and consistent services.

(4) Catch the opportunities given by a “**climate policy**”. This argument, in Croatia, comes along with the need for environmental protection and facilitating tourist traffic to/from and along the Adriatic coast, where heavy truck traffic may be seen as a burden for the development and intermodal rail/road transport can be used to relieve the congested roads

(5) Seamless international intermodal services:

- Interoperability,
- Synchronization of processes between railways and operators,
- Data interchange; tracking of shipments.

(6) State shall ensure **level playing field** between road and rail:

- Harmonised infrastructure access charging for road and rail,
- Improve border crossing procedures to reduce processing time by one common border station and working times synchronised between state authorities (border police, customs), infrastructure managers and railways working related to train time table,
- Encourage competition with road rather than competition on rail (also towards other routings, e.g. corridor IV Wien – Budapest – Belgrade).



(7) On the basis of information and experience of European countries, the development of intermodal traffic will require **incentive measures** undertaken by the state, consisting of the following:

- tax exemption / tax reduction or favourable credits when purchasing means of intermodal traffic (intermodal wagon, craneable semi-trailers, swap bodies),
- exemption from various traffic bans on transport of loading units by road vehicles from and to terminals,
- investment policy in the sector of intermodal traffic, e.g. intermodal terminals, which is very important for successful development, because initial investments in the development of intermodal traffic are large and only a process with well-planned material and organizational concept can yield good results.

(8) Develop CT-Terminal Zagreb–“Vrapce” as a gateway terminal to from Croatia, rather than hoping to spread traffic in multiple other terminals in the Country.



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Sandra Géhénot  
Tel: +33 (0) 1 44 49 20 84  
Fax: +33 (0) 1 44 49 20 79  
[www.uic.org/diomis](http://www.uic.org/diomis)  
e-mail: [gehenot@uic.org](mailto:gehenot@uic.org)



International Union of Railways  
16, rue Jean Rey - F 75015 Paris  
Tel: +33 (0) 1 44 49 20 20  
Fax: +33 (0) 1 44 49 20 29  
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