



D.T1.2.3

MARKET POTENTIALS FOR RAIL FREIGHT TRANSPORT - KIP

Work paper

**Final
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1. Introduction

The “Market potential analysis for rail freight transport” was prepared based on the common Methodology for analysis of market potentials for rail freight transport (D.T1.2.1) by each project partner for their respective region. This particular market potential analysis for rail freight transport was written by KIP for the entirety of the Republic of Croatia.

The railway networks and services, logistics market, market condition and industrial structure and clusters are all described in chapter 2 of the Market potential analysis for rail freight transport. These descriptions refer to the analysis made in the regional baseline study. Chapter 2.1 describes the railway network, infrastructure and railway transport operators, chapter 2.2 focuses on the logistics market, which includes describing Croatia’s modal split, developments in the modernisation of the railway infrastructure, such as the electrification of railways. It also provides data related to amount of goods transported by rail in Croatia, lists intermodal facilities in Croatia, goes through the developments planned in the Transport Development Strategy of the Republic of Croatia 2017-2030, and more. Chapter 2.3 lists the policy documents on the national and regional level, as well as projects in preparation or already in implementation regarding rail freight in Croatia. Chapter 2.4 focuses on Croatia’s main industries and analyses for which of those is using rail freight suitable.

This document is concluded with a summary and recommendations for the potentials and opportunities for rail freight services in the region.

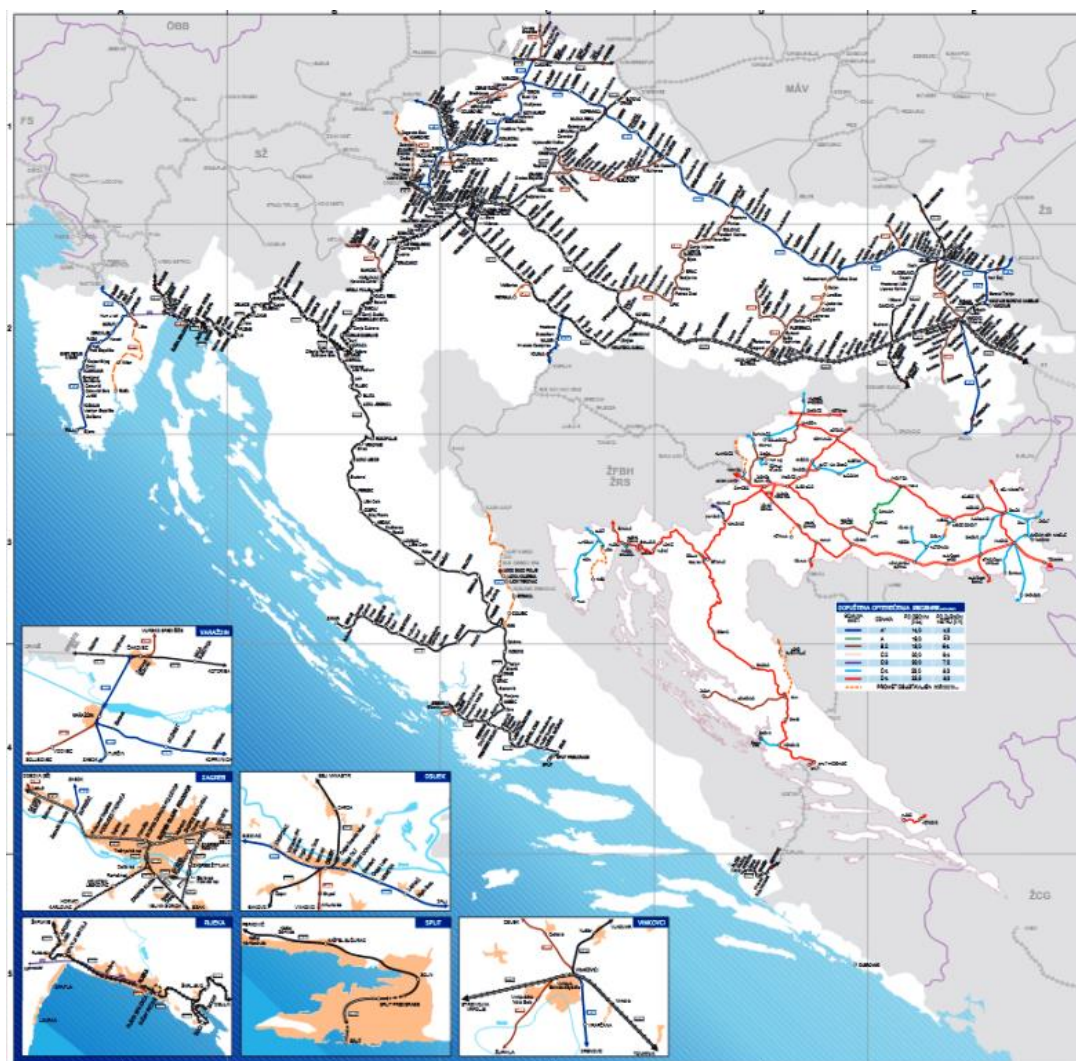
2. Status quo Analysis of Market Potential

2.1. Analysis of regional rail network and services

The railways system of the Republic of Croatia includes the principle of the separation of railway transport and infrastructure as is instructed by the EU. The single state operator of Croatian railways is HŽ Holding L.T.D., which is further divided into HŽ Passenger Transport L.T.D., HŽ Cargo L.T.D. and HŽ Infrastructure L.T.D.

The Croatian railway infrastructure is a public good in general use owned by the Republic of Croatia, which can be used under equal conditions by all interested railway undertakings. Railway infrastructure management is an activity of public interest, the performance of which requires a license for railway infrastructure management and a safety decision for railway infrastructure management. As an infrastructure manager in the Republic of Croatia, the company HŽ Infrastruktura L.T.D. builds and invests in railway infrastructure, takes care of its maintenance and modernization, manages the safety system, provides access and allocates infrastructure capacity to all railway undertakings that meet the legal requirements, determines fees for the use of infrastructure capacity, prepares and publishes timetables and organizes and regulates railway transport. HŽ Infrastruktura publishes annual Network Statements which contain general information, access conditions and a description of the railway infrastructure, procedures and conditions for the allocation of infrastructure capacity, a description of the services and a description of the method for calculating the charges for the use of the railway infrastructure.¹ HŽ Infrastructure L.T.D. organizes and regulates traffic and is in charge of maintaining and building railway infrastructure. Its activities, in accordance with the Law on Railways, are financed from the state budget. HŽ Passenger Transport is a public passenger transport operator. The main objective of the company is a sustainable labor market with minimal state budget support for lines that are of public interest and whose revenues do not cover costs. HŽ Cargo is a freight transport operator whose aim is to conduct sustainable market operations in a liberalized market, without subsidies from the state budget.² Along with HŽ Cargo L.T.D. there are several other rail freight service providers operating in Croatian territory. Those include: Rail Cargo Carrier - Subsidiary Croatia; Rail&Sea L.T.D.; Transagent Rail L.T.D; ENNA PPD Trans; Train Hungary - Subsidiary Zagreb; Eurorail Logistics L.T.D.³

Picture 1: Railway infrastructure of Croatia



Source: hzinfra.hr/wp-content/uploads/2020/01/HZ_railmap_A0_600dpi_WEB_17012020.pdf

Table: Locomotives and wagons in Croatian railway transport in 2018

Type of locomotive/wagon	Unit of measure
Electric locomotives (number)	135
Diesel locomotives (number)	165
Total locomotives (number)	298
Goods wagons (number)	5326
Capacity of goods wagons (tonnes)	285,788

Source: dzs.hr

Croatia is a part of the TEN-T core network, belonging to the Mediterranean corridor with its two main railway points being Rijeka and Zagreb. The TEN-T Mediterranean corridor combines components of all transport modes - road, rail and maritime modes (Through Rijeka), and connects them to major traffic hubs. Zagreb serves as a link from Italy and Slovenia to Hungary and the north-eastern parts of Europe; and Rijeka serves as a port connecting rail and maritime transport.² The main priorities of the railway sector are focused on modernizing the remaining parts of the TEN-T network lines in accordance with their functionality, and increasing the sustainability of the railway network by reorganizing the sector, improving maintenance efficiency, reducing environmental impact and introducing measures to increase railway safety and interoperability.⁴

Picture 4: Main Croatian network nodes within the Mediterranean corridor



Source: lukarijeka.hr/en/geographical-position/

The main railway operator - HŽI is 100% owned by the Republic of Croatia. HŽI controls 2,617 kilometres of railway network in length across the country. 2363 kilometres of 2617 are single track railways, and 254 of double track railways. The first of the double track railways starts at the railway hub Zagreb, goes through Zaprešić, Savski Marof and Dobova into Slovenia towards Ljubljana. The second double track railway goes from Novska, through Nova Gradiška, Nova Kapela-Batrina, Slavonski Brod, Striz. Vrpolje, Vinkovci, Tovarnik and Šid into Serbia towards Belgrade. The third and final double track railway is the shortest one in Croatia, going from Spil's suburbs towards Split.²

Table: Total length of railway lines by type of line in Croatia in 2018

Type of line	Amount in km's
Single track	2363
Double Track	254
Electrified lines	970
Total	2617

Source: dzs.hr

There are 19 Border stations, 9 of which are with Slovenia (The Buzet station is exclusively used for passenger trains, Lupoglav is used for freight trains, and the rest are combined), 3 are with Hungary, 2 with Serbia, and 5 with Bosnia and Herzegovina. Part of the Croatian railway network also belongs to the Mediterranean railway freight corridor 6 (RFC6) connecting Spain, France, Italy, Slovenia, Croatia and Hungary. RFC6 connects around 90 terminals and 9 sea ports across a line distance of over 7000 kilometres. RFC6 belongs to the TEN-T railway network which was created in order to achieve reliable and high-quality rail freight services which would allow rail transport to compete with other modes of transport, especially road transport. HŽI is also a fully-fledged member of the RailNetEurope. Members of the RNE use the Path Coordinations System, Charging Information System and Train Information System, each of them contributing to the main goal of RNE, which is creating a common network for European railway operators in order to make international business as easy as possible.²

The railway infrastructure in Croatia is also connected with the railways in ports. Those ports are: Bakar, Bibinje, Osijek Donji grad, Ploče, Pula, Rijeka, Rijeka Brajdica, Sisak, Slavonski Brod, Solin, Split, Šibenik, Vukovar and Zadar. The port of Rijeka is the largest port in Croatia, and its impact is immediate on all traffic modalities. The port handles large amounts of cargo, including containers, ore, sawn timber, grain, phosphate and crude and refined petroleum products. In 2018, a total turnover of 13.4 million tonnes of cargo was achieved. The advantage of the northern Adriatic ports stems from the shortest maritime connection between Europe and the Middle and Far East. As the Adriatic Sea is the deepest recessed part of the European mainland, it is precisely the Northern Adriatic that is the part of Europe that gives Central European countries the closest access to the world's sea.²

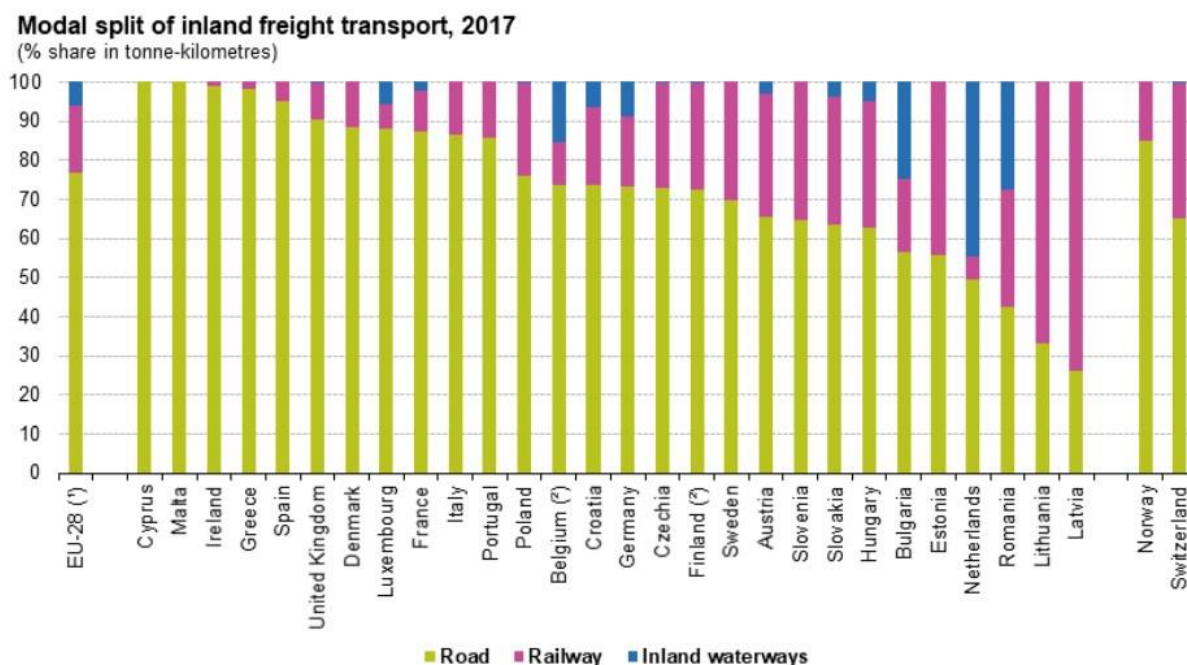
Croatia's railway system has over 500 train stops across the country for passenger transport and over 200 stops for receiving, storing, preparing, handling and shipping various types of cargo. The entire network operates an average of about 630 passenger and 115 freight trains per day. HŽI does not operate any commodity terminals. However, HŽI enables the use of all railway stations and freight forwarding facilities, where loading, unloading and transshipment of cargo is possible to all railway undertakings in a non-discriminatory manner and at their request.²

HŽI does not operate any goods terminal. However, HŽI enables the use of all railway stations and freight forwarding facilities in which it is possible to load, unload and tranship freight to all railway undertakings in a non-discriminatory manner and at their request. The formation of freight trains as well as maneuvering can be performed in all railway stations with technical and technological possibilities. Freight wagons are garaged mainly on special tracks for garaging excess freight wagons in marshalling yards and some other larger stations. Stations in which this is possible are: Čakovec, Karlovac, Koprivnica, Knin, Moravice, Ogulin, Osijek, Rijeka, Slavonski Brod, Solin, Vinkovci, Zagreb Ranging Station.²

2.2. Analysis of the logistic market (Development and Trends)

Croatia's freight transport relies mostly on Road transport with over 70% of all freight being transported by road since 2011, and has remained very similar percentage-wise since 2008. Railways are the second most used transport mode, averaging around 20% of all freight transport in Croatia since 2008. Inland waterways are the least represented mode of transport for transporting freight. Percentage-wise, Croatian modal split of inland freight transport is almost the same as the EU-28 average.

Graph: Modal split of inland freight transport across Europe in 2017



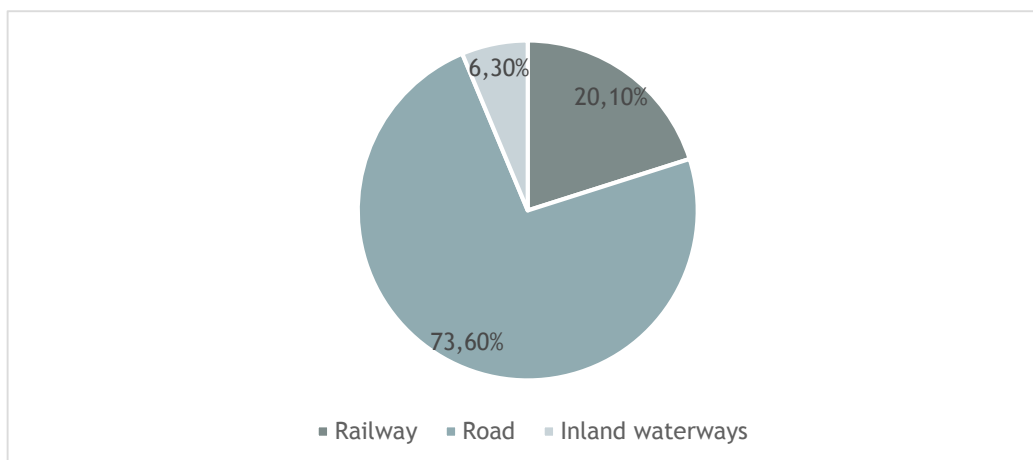
Note: Figures may not add up to 100% due to rounding.

(*) EU-28 includes rail transport estimates for Belgium, road freight transport for Malta and inland waterways transport for Finland.

(*) Estimates.

Source: Eurostat (online data code: tran_hv_frmod)

Graph 8: Modal split of freight transport in Croatia in 2017



Source: ec.europa.eu/Eurostat

Table 6: Modal split of freight transport in Croatia from 2008 to 2017 (in percentages)

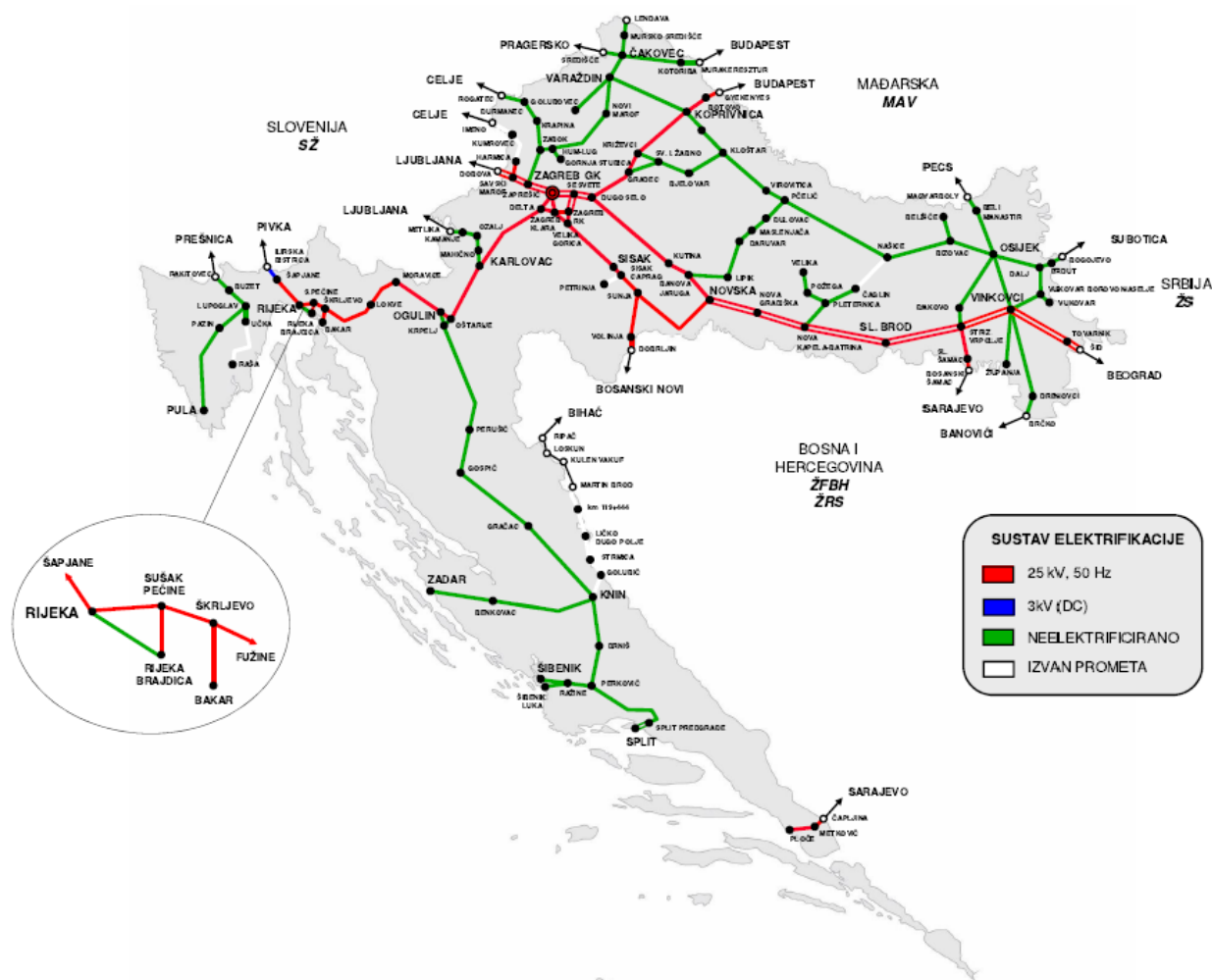
Year	Roads	Railways	Inland waterways
2008	71,7	22,6	5,7
2009	71,8	22,1	6,1
2010	69	22,8	8,2
2011	71,2	22,4	6,4
2012	70,5	22,2	7,3
2013	72,9	19,8	7,3
2014	72,7	20,4	6,9
2015	72,9	19,4	7,8
2016	76,3 estimated	16,4 estimated	7,3 estimated
2017	73,6	20,1	6,3

Source: ec.europa.eu/Eurostat

The railway infrastructure managed by HŽI is constantly being renewed and modernized in order to increase the quality of service to its users. This means that there are lots of works planned for the modernization and construction of railway infrastructure. The possibility of realization of the planned works will depend on the amount of financial resources allocated by the Republic of Croatia each year from the state budget and on other sources of financing. As of now, investments with a total worth of 3,5 billion € are planned. A 258 million HTK investment was made into constructing and opening the first new railway line in Croatia in 52 years, that railway line being Sveti Ivan Zabno - Gredec, opened at the end of 2019. By 2030, Croatia should have up to 681 kilometres of double-track lines and 1,022 kilometres of electrified lines in operation. At this point in time, 980 kilometres of the 2,617 kilometres of rails are electrified. The picture below gives a clearer view of the railway electrification system in Croatia. The red lines and blue lines represent electric

railways, green are non-electric, and white are the railways that are no longer in use. The red lines represent 25 kW, 50Hz railways, and blue lines represent 3kV railways.²

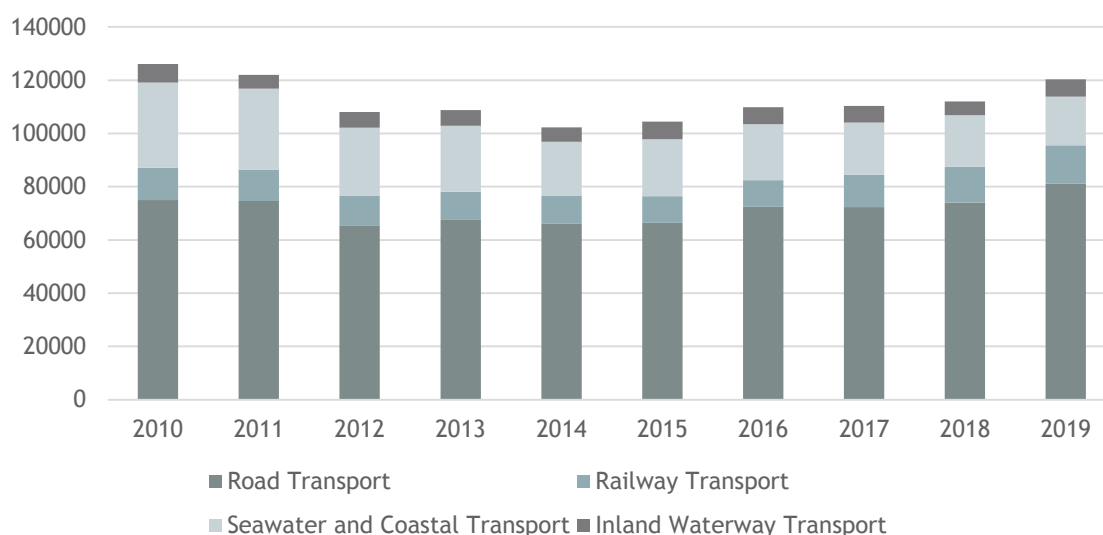
Picture 1: Railway electrification system in Croatia



Source: HŽI Network Report 2019

Graph 1: Transport of goods by modes of transport in thousands of tonnes

Transport of goods by modes of transport in thousands of tonnes



Source: Created by the author based on data from dzs.hr

Table: Operation of railway vehicles in railway transport in Croatia

Year	Total locomotive (tractive) kilometres (in thousands of km's)	Out of which - freight train kilometres (in thousands of km's)	Total gross tonne-kilometres hauled (in mil. km's)	Out of which - freight gross tonne-kilometres hauled (in mil. km's)
2010	27,613	6,782	8,147	5,343
2011	26,664	6,221	7,806	5,049
2012	24,623	5,526	7,217	5,556
2013	22,228	5,208	6,854	4,463
2014	20,559	4,947	6,601	4,328
2015	21,145	4,833	6,511	4,251
2016	20,804	4,464	6,696	4,338
2017	21,014	5,819	7,239	4,923
2018	20,103	4,994	7,315	5,123

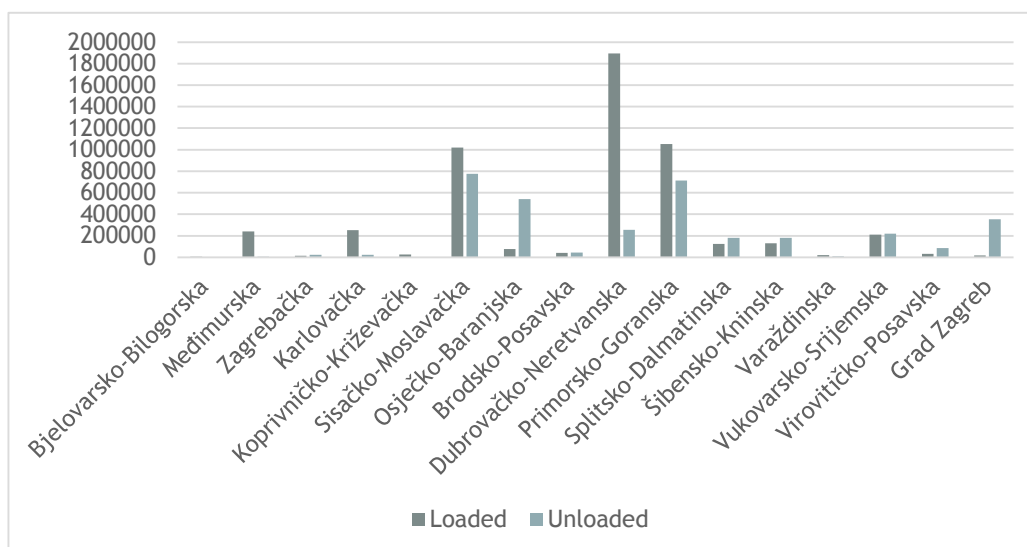
Source: dzs.hr

Table 1: Total amounts of goods (in thousands of tonnes) transported by railway in Croatia (2010 - 2018)

Year	National	International	Total
2010	1,996	10,207	12,203
2011	2,167	9,627	11,794
2012	2,049	9,039	11,088
2013	3,395	7,266	10,661
2014	2,857	7,532	10,389
2015	3,037	6,902	9,939
2016	2,850	7,135	9,985
2017	3,194	8,984	12,178
2018	3,239	10,205	13,444

Source: dzs.hr

Graph 6: Loading and unloading of goods in tonnes in railway transport by Croatian county in 2018



Source: Created by the author based on data from dzs.hr

Table: Loading of goods (in tonnes) in railway transport in select places within Croatia

Place	2010	2011	2012	2013	2014	2015	2016	2017	2018
Belišće	12,243	10,888	9,319	790	455	-	621	165	-
Bjelovar	22,685	21,484	16,191	4,935	9,697	8,000	4,820	7,099	5,086
Čakovec	11,330	7,766	5,560	4,071	7,809	5,602	3,834	4,857	3,128
Ivanić-Grad	39,643	24,898	15,193	14,799	14,732	19,460	15,327	14,739	7,483
Karlovac	43,793	57,187	12,447	15,761	36,162	21,083	19,048	19,991	18,080
Koprivnica	242,976	513,231	510,266	638,786	323,735	252,415	104,933	16,357	27,254
Kotoriba	4,806	5,933	7,040	7,862	14,215	5,475	2,739	1,721	235,743
Kutina	685,935	724,976	505,950	489,830	609,599	705,107	587,271	673,680	544,187
Našice	5,798	8,851	9,847	4,578	3,096	1,222	1,434	10,189	10,654
Nova Gradiška	12,277	16,723	16,476	7,495	13,031	9,406	6,230	3,975	5,800
Ogulin	53,060	54,297	29,660	37,908	31,512	31,193	17,660	209,955	233,719
Osijek	151,341	108,542	60,423	51,923	94,943	55,429	74,645	73,423	65,843
Pula	22,055	28,081	11,894	987	-	-	-	-	-
Ploče	1,689,053	1,830,288	788,674	1,151,747	1,702,691	1,781,264	1,608,155	1,117,883	1,895,657
Rijeka	907,540	1,155,197	755,596	624,358	844,906	754,004	550,102	811,083	1,053,472
Sisak	715,584	436,876	299,541	251,016	423,700	429,304	296,121	189,098	475,496
Slavonski Brod	47,025	26,286	24,227	37,679	38,930	30,828	37,470	43,076	31,119
Split	284,182	269,030	168,098	159,241	149,906	136,816	178,070	174,580	125,611
Šibenik	294,093	260,216	109,202	107,434	123,259	208,680	121,756	164,816	130,717
Varaždin	85,115	91,986	47,853	42,281	29,236	24,555	25,029	23,062	20,703
Vinkovci	17,334	19,656	16,604	36,056	25,198	15,517	6,716	3,047	63,697
Virovitica	92,315	60,299	69,968	37,545	31,290	25,138	58,457	77,900	30,980
Vukovar	71,636	83,038	104,017	61,490	85,056	71,190	92,779	77,118	148,104
Zadar	207,615	78,001	47,430	7,127	5,628	1,547	33	-	-
Zagreb	318,683	153,440	81,305	92,242	92,156	81,307	50,151	67,188	17,941
Zaprešić	5,872	6,080	2,622	4,713	4,540	4,813	1,902	3,093	6,443
Županja	79,633	43,118	41,544	9,740	10,177	8,752	24,017	71,443	49,364

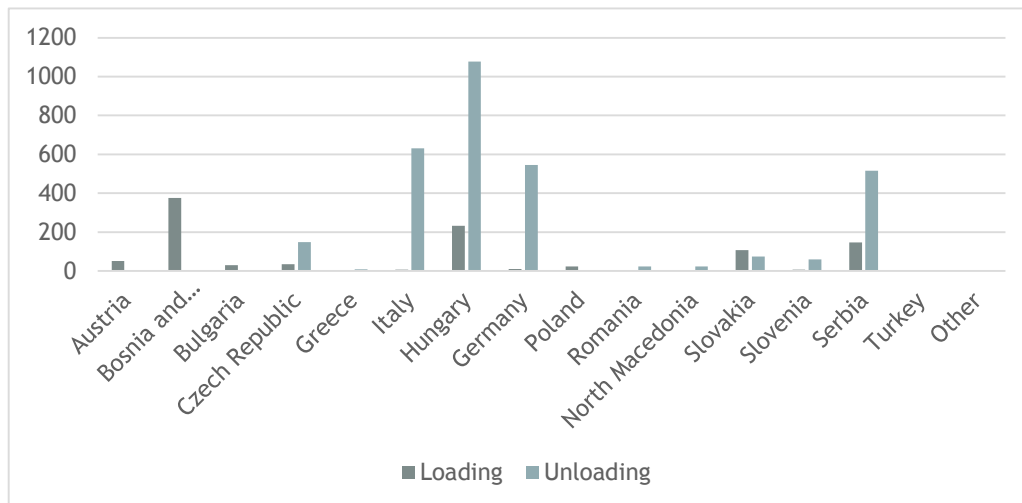
Source: dzs.hr

Table: Unloading of goods (in tonnes) in railway transport in select places within Croatia

Place	2010	2011	2012	2013	2014	2015	2016	2017	2018
Belišće	17,380	21,761	8,508	2,378	1,916	1,247	9,465	121	-
Bjelovar	5,532	3,105	593	689	784	509	224	2,368	1,427
Čakovec	11,586	7,444	9,222	18,995	18,362	9,867	2,895	4,080	1,192
Ivanić-Grad	22,376	9,140	11,596	16,546	15,991	14,402	9,443	21,558	15,133
Karlovac	14,222	13,849	3,969	3,829	2,992	2,670	1,480	2,307	1,241
Koprivnica	17,700	25,839	72,283	90,826	88,377	33,019	16,443	2,222	2,215
Kotoriba	7,119	14,282	11,218	12,928	7,965	2,632	4,956	5,971	5,513
Kutina	295,423	271,500	124,160	112,330	161,086	165,519	126,376	174,248	161,673
Našice	1,899	39,492	29,237	16,513	18,403	11,192	30,096	56,511	63,096
Nova Gradiška	5,486	37,979	18,653	13,097	13,790	13,048	9,758	14,075	18,665
Ogulin	13,137	7,366	7,671	20,493	18,485	17,043	6,503	8,102	20,864
Osijek	379,276	344,912	262,730	306,378	315,630	325,659	249,333	214,928	478,850
Pula	28,851	9,326	3,812	670	-	-	-	-	-
Ploče	524,580	488,987	329,288	287,615	246,176	230,105	312,937	219,203	253,891
Rijeka	1,132,224	1,063,748	857,006	962,851	884,443	824,091	714,336	743,558	712,446
Sisak	361,124	215,067	126,677	181,153	182,073	201,386	234,798	458,373	615,099
Slavonski Brod	113,508	83,813	36,670	30,372	21,683	21,960	21,009	19,125	25,157
Split	491,726	349,524	267,239	234,250	202,006	188,452	266,202	130,356	179,579
Šibenik	341,355	348,895	173,527	209,749	202,882	202,532	288,895	282,578	180,811
Varaždin	36,281	34,579	20,911	7,882	5,869	7,752	9,436	8,685	7,294
Vinkovci	17,268	12,152	5,794	11,362	10,602	12,331	16,520	45,189	55,415
Virovitica	222,365	229,382	162,602	112,770	80,104	81,136	163,344	207,666	86,600
Vukovar	112,886	79,234	191,813	133,262	114,742	106,901	135,791	137,244	163,391
Zadar	315,767	117,282	60,716	34,483	16,970	9,902	1,812	520	2,021
Zagreb	712,746	738,851	486,529	480,199	409,685	395,388	290,868	307,319	352,461
Zaprešić	24,123	29,529	17,398	26,345	18,775	9,247	1,494	10,979	7,169
Županja	8,219	38,304	39,490	5,136	4,858	6,842	2,909	10,611	5,048

Source: dzs.hr

Graph 7: International railway transport of goods in 1000's of tonnes by country of loading/unloading in 2018



Source: Created by the author based on data from dzs.hr

Due to the topography of some railway sections and the wind intensity to which they are exposed, there are restrictions on the operation of rail transport in terms of wind intensity on the following railway sections:

M202 Zagreb Gk - Rijeka on the Moravice - Rijeka segment; M604 Oštarije - Knin - Split on the Gračac - Knin segment.²

Towing trains with multiple locomotives adjacent to one another must not be carried out on the following sections of track: L103 Karlovac - Kamanje - DG on the Kamanje - DG segment; L204 Banova Jaruga - Pčelić on the Banova Jaruga - Sirač and the Daruvar - Đulovac segments. Train suppression is permissible on all railway sections except the following railway sections:

Table 3: Railway sections on which train suppression is not allowed

Railway	Railway stock on which suppression is not allowed
M402 Sava - Zagreb Klara	Zagreb RkSs - Zagreb RkPs
M405 Zagreb ZK - Trešnjevka	Zagreb Zk - Trešnjevka
M602 Škrljevo - Bakar	Škrljevo - Bakar
M603 Sušak - Rijeka Brajdica	Sušak-Pećine - Rijeka Brajdica
R106 Zabok - Đurmanec - DG	Krapina - Đurmanec - DG
R201 Zaprešić - Čakovec	Budinščina - Turčin
R202 Varaždin - Dalj	Đurđenovac - Našice
L201 Varaždin - Golubovec	Lepoglava - Golubovec
L204 Banova Jaruga - Pčelić	Pakrac - Pčelić
L205 Nova Kapela - Našice	Čaglin - Našice
L207 Bizovac - Belišće	Valpovo - Belišće

Source: HŽI Network Report 2019

As mentioned before, the railway infrastructure is connected with the railways in ports of Bakar, Bibinje, Osijek Donji grad, Ploče, Pula, Rijeka, Rijeka Brajdica, Sisak, Slavonski Brod, Solin, Split, Šibenik, Vukovar and Zadar. The port of Rijeka is the largest port in Croatia, and its impact is immediate on all traffic modalities. The port handles large amounts of cargo, including containers, ore, sawn timber, grain, phosphate and crude and refined petroleum products.² Port of Ploče is one of the main strategic Croatian ports for transshipment of almost all types of goods in international maritime transport, as it is located on the southern part of the Adriatic coast, between Split and Dubrovnik, as the door of Corridor 5c, which is part of the pan-European network of transport corridors.^{5,6} The Port of Šibenik has access to transshipment, transport and storage machinery as well as the necessary railway, road, electrical and telephone infrastructure.^{5,7}

The most important intermodal facilities which include rail are located in the already mentioned ports: Port of Rijeka, Port of Ploče and Port of Šibenik, Port of Split and Port of Zadar. Each of those ports connect the railway freight transport with maritime freight transport. Port of Rijeka, the largest Croatian port, is part of the Ten-T core network, and as such contains: 58 berth and two additional berths in the Liquid Cargo terminal, 150-hectare total port area and 335,000 m² of enclosed warehouses.

The Port of Rijeka is comprised of several terminals:

Bulk Cargo Terminal - handles coal, iron ore and bulk cargo;
Cereal Terminal - handles and stores cereals and oilseeds;
Container and Ro-Ro Terminal - handles intermodal containers;
General Cargo Terminal - handles general cargo, salt and cement;
Timber Terminal; Škrljevo Terminal - handles, stores and processes timber;
Frigo Terminal - handles and stores refrigerated and frozen foods;
Bršica Terminalw - handles livestock, timber and general cargo;
Passenger Terminal - has 11 piers, serving around 200,000 passengers per year;

Liquid Cargo Terminal - handles fuel and other liquid cargo; has two Capesize berths, with annual capacity of 24 million tonnes of oil; 130,000 tonnes storage capacity.

Port of Ploče is the second largest cargo seaport in Croatia, and contains the following terminals:

General Cargo Terminal - handles general cargo;

Bulk Cargo Terminal - handles coal, iron ore and bulk cargo;

Liquid Cargo Terminal - handles fuel and other liquid cargo;

Grain Cargo Terminal - handles, ships, packages and stores cereals and oilseeds;

Wood Terminal - handles, stores and processes timber;

Alumina and Petroleum Coke Terminal - handles alumina and petroleum coke;

Container Terminal - handles intermodal containers;

Bulk Cement Terminal;

Slag Terminal;

Passenger Terminal - has two moorings, the first accommodates vessels up to 120m with an 8-meter draught; the second accommodates vessels up to 65m with a 5-meter draught

Port of Šibenik is comprised of four main terminals:

Passenger Terminal Vrulje - with 4 berths;

Terminal for transshipment of phosphates Dobrika - with 2 berths;

Terminal for bulk and general cargo Rogač - with 4 berths;

Wood Terminal - with 2 berths.

Port of Split offers the following facilities and terminals:

Bulk Cargo Terminal;

General Cargo Terminal;

Container & RO-RO Terminal;

Truck Terminal;

warehouses and free zone

The Port of Zadar consists of the following terminals:

Liquid Cargo Terminal;

Oil Platform Supply Terminal;

Bulk Cargo Terminal;

Southern Fruit Handling and Storage Terminal;

General Cargo Terminal;

Cement Transshipment Terminal;

Wood Transshipment Terminal;

Container Terminal

Another intermodal facility worth mentioning is the Spačva Ro-La terminal, located at Spačva's railway station, 20 km from the border with Serbia to the west (corridor X) and 22 km from the border with Bosnia and Herzegovina to the north (branch of corridor Vc). The terminal was built in 2006, but hasn't been used much so far.

Table: Goods transported in intermodal transport units (Containers and swap bodies) in railway transport by type of transport

Year	National (tonnes)	International - unloading (tonnes)	International - loading (tonnes)	Transit (tonnes)
2010	8,515	165,456	178,865	596,843
2011	18,191	162,363	191,683	242,748
2012	36,676	138,419	174,341	123,097
2013	41,179	137,419	186,431	139,420
2014	122,892	100,936	179,046	116,851
2015	138,502	125,975	228,877	19,833
2016	133,639	158,058	253,799	331,842
2017	156,201	242,154	257,120	416,973
2018	131,663	263,932	538,934	99,605

Source: dzs.hr

Table: Number of loaded intermodal transport units (ITU) and Twenty-foot equivalent units (TEU) in containers and swap bodies in railway transport by type of transport

Year	National		International - unloading		International - loading		Transit	
	ITU	TEU	ITU	TEU	ITU	TEU	ITU	TEU
2010	102	155	5,407	7,506	6,068	8,613	20,194	31,155
2011	158	235	5,268	7,558	6,251	9,340	6,105	7,163
2012	731	860	3,910	5,865	5,552	7,851	4,879	7,766
2013	895	1,280	4,454	6,421	5,667	8,104	6,571	9,397
2014	4,092	5,933	3,183	4,615	5,297	7,680	4,114	5,965
2015	4,278	6,004	4,169	6,408	5,508	6,592	661	923
2016	4,032	5,756	4,807	7,366	5,054	6,490	34,923	58,151
2017	4,414	8,506	6,356	12,248	5,707	10,997	15,061	29,826
2018	3,922	7,939	8,324	14,556	20,331	31,994	5,299	10,529

Source: dzs.hr

The Transport Development Strategy of the Republic of Croatia 2017 - 2030 states that there is considerable potential for increasing freight transport on the Zagreb - Rijeka railway line. Due to investments in the cargo terminals of the port of Rijeka, which are underway, higher growth rates of freight transport can be expected than usual. Along with that, the strategy states that a logistics concept for the railway sector will be developed, relying heavily on the existing Croatian network, and co-operation with neighbouring countries, primarily Hungary, Bosnia and Herzegovina, Slovakia, Italy and Serbia. The strategy defined general and specific measures based on the analysis of the current transport situation with the goal of achieving the defined general and specific goals for both passenger and freight transport in Croatia.⁸ Listed here are all the set general goals:

- CO1 - Change the distribution of passenger traffic in favor of public transport and forms of transport with zero emissions. These include public transport in agglomerations and local regional context (trams, local bus lines, etc.), rail transport, public maritime transport (ships), bus transport on regional and long-distance lines, as well as pedestrians and cyclists.
- CO2 - Change the distribution of freight traffic in favor of rail, maritime and inland waterway transport.
- CO3 - Develop a transport system (management, organization and development of infrastructure and maintenance) according to the principle of economic sustainability.
- CO4 - Reduce the impact of the transport system on climate change.
- CO5 - Reduce the impact of the transport system on the environment (environmental sustainability).
- CO6 - Increase transport system safety.
- CO7 - Increase the interoperability of the transport system (Public transport, rail, road, maritime and air transport and inland waterway transport).
- CO8 - Improve the integration of traffic modes in Croatia (management, ITS, VTMS, P&R, etc.).
- CO9 - Further develop the Croatian part of the TEN-T network (basic and comprehensive).⁸

Listed here are the specific goals related to the entire transport sector:

- SC - Better harmonize traffic management with neighboring countries (BiH - ports of Ploče and Slavonski Brod, road and rail connections with BiH, Slovenia, Serbia, Italy, Montenegro and Hungary).
- SC - In some parts of Croatia, complete, where applicable, the development of the tourism sector as a major economic factor with adequate transport development, especially in favor of public transport and green mobility.
- SC - Improve the accessibility of remote parts of Croatia (eg islands, southern Dalmatia, hilly and mountainous areas, border areas ...)
- SC - Develop the potential of the main logistics centers (port of Rijeka, port of Split, port of Ploče, port of Vukovar, port of Osijek, port of Slavonski Brod, Zagreb junction via port of Sisak)
- SC - Strengthen the position of Croatia as a logistics hub of the wider region, with special emphasis on Zagreb.
- SC - Improve the integration of the transport sector into socio-economic trends in the region (concept of functional regions, FR).
- SC - Resolve the specific situation in Croatia arising from the seasonality of traffic.¹⁰

Listed here are the specific goals related to the rail transport:

- SC1 - Improve the railway freight corridors from the port of Rijeka to the markets with the greatest potential for the port (Hungary, BiH, Slovakia, Italy, southern Poland and Serbia).
- SC2 - Make better use of the Croatian railway system in larger Croatian agglomerations (Zagreb, Rijeka, Split, Varaždin, Osijek) and within and between functional regions (sub-regions).
- SC3 - Improve the level of service of the rolling stock and its impact on the environment.
- SC4 - Better integrate the railway system into local transport systems (safety and security at stations, connections with other modes of transport, etc.).
- SC5 - Increase safety at level crossings.
- SC6 - Increase the efficiency of the Croatian railway system (traffic management, operations, etc.).
- SC7 - Ensure infrastructure maintenance while respecting cost-effectiveness aspects.¹⁰

Table: Freight related general (G) and rail specific (R) measures defined in the Transport Development Strategy of the Republic of Croatia 2017 - 2030

General Measures (only those related to rail freight and rail in general)		
Code	Measure	Description of the measure (only parts related to rail)
G.1	National Concept for freight logistics	The Republic of Croatia should define a national concept for freight logistics that would include all types of transport. It is very important, among other things, to determine the role of the port of Rijeka and the port of Ploče, as well as the Zagreb hub. A separate study needs to be developed that would cover all relevant stakeholders. As it is generally said that the transport system of the Republic of Croatia has large unused capacities, it is necessary to investigate whether it is possible to transfer traffic from other countries where bottlenecks have been identified.
G.3	Improvement of safety in the transport system	<p>Since safety is one of the main goals of the Transport Development Strategy, there is an urgent need to raise the level of safety in all aspects of the transport system.</p> <p>In order to raise the level of safety of the railway system it is necessary to take specific measures such as:</p> <ul style="list-style-type: none"> • denivelation or abolition with reduction of railway-road crossings, if the same is justified by traffic flows. Railway crossings that are not justified to be levelled or closed must be secured with adequate safety devices. In order to increase safety at railway-road crossings, it is necessary to design and implement educational marketing campaigns, with the aim of raising the awareness of road vehicle drivers. • Introduction of ERMTS on all lines that are part of TEN-T core network. • Involve railway safety in each phase of project implementation based on a study of the impact, at the strategic level, of various infrastructure project options on railway safety, as one of the important elements for route selection and the final solution. In the later stages of the project, railway safety checks should identify in detail the elements of the

		<p>uncertainty of the railway infrastructure project and propose corrective measures.</p> <ul style="list-style-type: none"> • Equip railway stations with adequate signal safety and TK devices. • Equip railways / stations with axle load detectors, axle overheating detectors and other devices to increase railway safety. Additional studies will show where such devices need / are justified
G.5	Sustainability concept for different transport systems	<p>The owner of the national infrastructure should have a maintenance concept that will guarantee the long-term sustainability of the various modes of transport.</p> <p>It is necessary to establish an appropriate structure and organization of maintenance in order to enable a railway service that would be efficient and effective, i.e. sustainable. The concept must be derived from purposeful and concrete analyses of the situation in the Republic of Croatia and the company HŽ Infrastruktura taking into account technical and financial conditions, as well as user needs, as derived from Directive 2008/57/EC on interoperability of rail systems within the Community and basic international standards relating to Railway Applications - Specification and demonstration of reliability, availability, maintenance and safety (PROS).</p>
G.6	Raising energy efficiency of the transport system	<p>According to the guidelines for the development of the trans-European transport network, encouraging the efficient and sustainable use of infrastructure is one of the priorities in infrastructure development. In this regard, it is necessary to raise the level of energy efficiency and identify low-carbon energy sources and propulsion systems as a priority. Further studies will aim to analyze specific requirements</p>
G.7	Reorganisation of the transport system for higher financial sustainability	<p>Public service contracts, concluded in accordance with Regulation EC 1370/2007 as well as the introduction of integrated public passenger transport, are one of the basic mechanisms to guarantee transparency and efficiency of public transport services. Therefore, their wider application is necessary not only for compliance with the Regulation but also as a first step towards raising the sustainability of the Croatian transport system. The type and duration of the public service contract should be determined on a case-by-case basis in combination with an analysis of existing internal models, either for the purpose of verifying compliance or after a thorough examination of the technical and financial conditions. Growing financial sustainability is one of the goals of the trans-European transport network. In order to achieve this goal, it is necessary to optimize the structure of transport systems and increase the efficiency of operations and maintenance. The financial sustainability of the transport system aims to reduce the system's dependence on subsidies from public revenues.</p>
G.8	Adaptation of the legal framework and planning guidelines to the relevant requirements and policies of	<p>Legislation and planning guidelines must support the development of the sector and follow best practice and European regulations, especially in the areas of safety, interoperability, sustainability and environmental protection. The entire legal framework needs to be harmonized in order to enable the implementation of large infrastructure projects, certain procedures need to be simplified, and definitions need to be harmonized in all laws and bylaws.</p>

	the European Union	
G.9	Preparation and adaptation to the requirements of the Schengen Agreement	The potential for future development of the Republic of Croatia and neighbouring countries entering the Schengen area will increase the importance of international traffic. Adapting transport systems requires removing infrastructural and administrative bottlenecks. The removal of bottlenecks towards neighbouring countries outside the scope of the Schengen Agreement will contribute to the growing importance of international traffic on some corridors with international connections. Special studies will assess the technical requirements to be met in each specific case.
G.10	Increasing administrative capacity / training	Lack of administrative capacity and properly trained staff are some of the key problems identified in the transport sector and one of the priorities of the European Union's cohesion policy. The introduction of new technologies and the increase in the requirements for the supervision of traffic and means of transport implies the necessity of training the existing staff and new employees in accordance with their specific needs.
G.11	Improving the public perception of the transport system in Croatia	<p>Creating and promoting a positive image of the transport system to the public as a reliable, safe and environmentally friendly mode of transport is important to stimulate demand and thus investment. Better publicity requires the existence of complete and up-to-date information and knowledge of infrastructure, opportunities and development plans.</p> <p>In the railway transport sector, it is extremely important to inform users about the movement of trains in order to enable adequate travel planning, i.e. planning the work of economic entities and thus increase the attractiveness of railway transport. For these reasons, it is extremely important to constantly adapt and update information technology and information channels in order to improve the entire sector. It is also important to involve the media more in the transmission of information.</p>
G.12	Reducing the negative environmental impacts of traffic	Based on the monitoring of the state of the environment, efficient planning / implementation of infrastructure and the establishment of the necessary environmental protection measures (which also refers to air pollution), the negative ecological and socio-economic impacts of the transport system should be reduced. Mitigation of the negative impact of transport on the environment must be achieved through greater energy efficiency, especially through the use of energy sources with low or zero hydrocarbon emissions.
G.13	Adaptation to climate change and its mitigation	The development of the transport sector in the Republic of Croatia should take into account the need to reduce CO2 emissions, and thus mitigate the impact of transport on climate change. At the same time, transport infrastructure and business need to be built taking into account the possible consequences of climate change and the extreme weather conditions on them.
G.14	Improving the data collection process	For the further development of the transport sector, it is necessary to have all the necessary and quality data necessary for traffic planning. The data collection system needs to be improved and simplified to facilitate access to data. It is necessary to consider the possibility of planning a central access point as a single place for collecting and distributing traffic data in the Republic of Croatia and from other countries in the region.



G.15	Increasing interoperability with neighbouring countries	Improving the interoperability of the Croatian transport system in all sectors with neighbouring countries is very important to ensure proper connectivity and strengthen the role of the Republic of Croatia as a transport hub for the Western Balkans and Central and Eastern Europe, thus increasing transport demand in Croatia. Harmonization of technical standards in different sectors and simplification of procedures at border crossings with Schengen and non-Schengen countries are examples of tasks to be undertaken. In order to identify bottlenecks and propose solutions, specific studies in each sector are needed	
Rail specific measures (only freight related)			
Elements of the railway network			
Code	Measure	Compatibility	Description of the measure (only parts related to rail freight)
R.1	Zagreb - state border with Slovenia towards Ljubljana (TEN-T core network / TEN-T Mediterranean Corridor / Pan-European Corridor)	In line with the Strategy; the measure is necessary and well defined, even if some additional studies are needed.	The M101 line is part of the basic TEN-T network and the RH1 corridor and is one of the main international connections to Zagreb and the only city node of the core TEN-T railway network in the Republic of Croatia. RH1 has historically been the most important corridor in terms of long-distance passenger traffic. Future scenarios, such as the entry of the Republic of Croatia into the Schengen area, will increase the volume of traffic on this line. Although certain activities are being developed to improve this line, the fact is that currently some parts of the M101 line have a speed limit of 60 km/h. The local / regional functionality of the M101 line should be assessed through the concept of functional regions that will take into account the eastern parts of Slovenia. Further studies will assess the technical requirements to be met in terms of capacity and allowable speed taking into account both economic and environmental aspects. Since this line is also important for freight traffic, it will have to meet the following minimum technical criteria: axle load (mass per axle) 22.5 t/o, useful length of receiving and dispatching tracks 750 m, ERTMS.
R.2	Zagreb - Karlovac (TEN-T Core Network / TEN-T Mediterranean Corridor / Pan-European Corridor RH2)	In line with the Strategy; the measure is necessary and well defined, even if some additional studies are needed.	The corridor connecting Zagreb and Rijeka is primarily important for freight traffic and partly for suburban passenger traffic. The analysis shows that suburban passenger traffic primarily refers to the section from Zagreb to Karlovac. Currently, this part of the M202 line is mostly single-track, which limits the potential for capacity increase. The importance of this line for freight traffic is expected to increase in the medium to long term, given that Rijeka is defined as the main Croatian port within the TEN-T network. Further studies will analyse the optimal route of the railway, keeping in mind the possible construction of a container terminal on Krk and the connection to the Dalmatian railways, the planned speed and capacity needs, taking into account economic and environmental aspects. In addition to increasing capacity, freight traffic also requires that the railway meets the following technical criteria: axle load

			(mass per axle) 22.5 t/o, ERTMS, useful length of receiving and dispatching tracks depending on the logistics concept.
R.3	Karlovac+ to Rijeka (TENT core network / TEN-T Mediterranean Corridor / Pan-European Corridor RH2)	In line with the Strategy; the measure is necessary and well defined, even if some additional studies are needed.	The analysis shows that this part of the corridor connecting Zagreb and Rijeka is mainly used for freight traffic. Currently, this part of the M202 line is mostly single-track and electrified, with a speed limit of 50 km/h in some parts. Rijeka is defined as the main Croatian port within the TEN-T network and it is therefore expected that the importance of this line for freight traffic will increase in the medium to long term. This section should therefore meet the following technical criteria: axle load (mass per axle) 22.5 t/o, ERTMS, useful length of receiving-dispatching tracks depending on the logistics concept. In accordance with the feasibility studies, the best variant of the railway was selected, the so-called "Lowland railway", and having in mind the possible construction of a container terminal on Krk and the connection to the Dalmatian railways, the planned speed and capacity needs, taking into account economic and environmental aspects.
R.4	Railway network of the Rijeka railway junction	In line with the Strategy; the measure is necessary and well defined, even if some additional studies are needed.	According to current preliminary analyses, there is potential for the reorganization of the Rijeka railway junction with the introduction of suburban passenger lines, with priority given to the modal shift from the use of passenger cars. Additional analyses should investigate the capacity of the railway taking into account the logistics concept and the capacity of the terminal of the port of Rijeka. The remaining capacity can be used for regional passenger transport. The improvement of the connection with Slovenia needs to be harmonized with measures R.2 and R.3.
R.5	Zagreb - Križevci (TEN-T core network / TEN-T Mediterranean Corridor / Pan-European Corridor RH2)	In line with the Strategy; the measure is necessary and well defined, even if some additional studies are needed.	The corridor that connects Zagreb and Rijeka with Eastern Europe via Hungary is primarily important for freight traffic and partly for suburban passenger traffic. The analysis shows that in this part of the corridor suburban travel is mostly related to Dugo Selo and Križevci. Currently, this part of the M201 railway is two-track to Dugo Selo and one-track to Križevci. This fact limits the potential for capacity increase, especially if we take into account that the importance of this line for freight traffic will increase in the medium to long term given that Rijeka is defined as the main Croatian port within the TEN-T network. Since this line is also important for freight traffic, in addition to increasing capacity, it will have to meet the following minimum technical criteria: axle load (mass per axle) 22.5 t/o, useful length of receiving and dispatching tracks 750 m, ERTMS.
R.6	Križevci - state border with Hungary towards	In line with the Strategy; the measure is necessary and	The analysis shows that this part of the corridor connecting Zagreb and Rijeka with Eastern Europe via Hungary is the most important for freight traffic and partly for suburban traffic. Hungary is currently working on the further



	Budapest (TEN-T core network / TEN-T Mediterranean Corridor / Pan-European Corridor RH2)	well defined, even if some additional studies are needed.	development of this corridor (development of the Gysev and Szekesfehervar network - development of the Boba railway). Currently, this part of the M201 line is single-track and electrified, with a speed limit of 80 km/h in some parts. Rijeka is defined as the main Croatian port within the TEN-T network and it is therefore expected that the importance of this line for freight traffic will increase in the medium to long term. For this reason and taking into account that this section is part of the core network and TEN-T corridor, it must meet the following technical criteria: axle load (mass per axle) 22.5 t/o, useful length of receiving and dispatching tracks 750 m, ERTMS.
R.7	Zagreb - Novska (TEN-T Core Network / Pan-European Corridor RH1)	In line with the Strategy; the measure is necessary and well defined, even if some additional studies are needed.	The M102 and M103 lines are part of the basic TEN-T network and the RH1 corridor and are one of the main international connections to Zagreb, the only city node of the basic TEN-T railway network in the Republic of Croatia. RH1 has historically been the most important corridor in terms of long-distance passenger traffic. Further studies will analyse the planned speed and capacity needs, taking into account economic and environmental aspects. Since this line is also important for freight traffic, it will have to meet the following minimum technical criteria: axle load (mass per axle) 22.5 t/o, useful length of receiving and dispatching tracks 750 m, ERTMS.
R.8	Novska - state border with Serbia (TEN-T basic network / Pan-European Corridor RH1)	In line with the Strategy; the measure is necessary and well defined, even if some additional studies are needed.	The M105 railway is part of the core TEN-T network and the RH1 corridor and one of the main international connections to Zagreb. RH1 has historically been the most important corridor in terms of long-distance passenger traffic. Future scenarios, such as the entry of the Republic of Croatia into the Schengen area and the entry of neighbouring countries such as Serbia into the European Union, will increase the volume of traffic on this line. Currently, the M104 line is two-track between Novska and Tovarnik, which was constructed as a border crossing between the Republic of Croatia and Serbia on the core railway network. Further studies will assess the technical requirements to be met taking into account both economic and environmental aspects. Since this line is also important for freight traffic, it will have to meet the following minimum technical criteria: axle load (mass per axle) 22.5 t/o, useful length of receiving and dispatching tracks 750 m, ERTMS.
R.9	State border with Hungary - Osijek - state border with Bosnia and Herzegovina (TEN-T comprehensive)	Lacking sufficient data to establish clear compliance with the Strategy; additional studies are	The M303 line is part of the basic TEN-T network in the Republic of Croatia, and Slavonski Šamac is the border crossing of the basic railway network with Bosnia and Herzegovina. Railways M301 and M302 are part of a comprehensive network, but also serve as a connection on the route Bosnia and Herzegovina - Republic of Croatia - Hungary, following the Pan-European Corridor Vc. The



	network / core network / Pan-European Corridor RH3)	needed to assess or confirm the appropriateness of the measure.	potential of this international corridor will increase if the Schengen borders shift from their current position.
R.10	Regional connection Vinkovci - Vukovar (TEN-T basic network / access to the Pan-European Corridor RH1)	In line with the Strategy; the measure is necessary and well defined, even if some additional studies are needed.	The M601 Vinkovci - Vukovar railway will serve as a railway connecting RH1 and the only Croatian inland port of the core TEN-T network on the Danube, Vukovar. Future scenarios related to the development of the port of Vukovar will increase the importance of freight traffic on this line in the medium to long term. Since this line is also important for freight traffic, it will have to meet the minimum technical criteria in terms of axle load (mass per axle) and useful lengths of receiving-dispatching tracks.
R.11	Zagreb junction	In line with the Strategy; the measure is necessary and well defined, even if some additional studies are needed.	The current configuration of the Croatian railway network and the fact that Zagreb is the only city node of the TEN-T core network testifies to the importance of the Croatian capital in the entire transport system. In order to increase the importance of the role of railways in regional connectivity and the urban transport system, further studies will analyse the specific conditions to be met.
R.12	Zagreb freight traffic	Measure covered by the General Measure.	Covered by general measure G.1
Railway network			
R.15	ETCS L1, L2 on other lines, GSM-R	Lacking sufficient data to establish clear compliance with the Strategy; additional studies are needed to assess or confirm the appropriateness of the measure.	The installation of the European Train Control System (ETCS) on the lines, in addition to those described in the previous measures ("Elements of the railway network"), would increase the interoperability of the entire network. Depending on the operational concept, the installation of ETCS and the GSM-R system (Global System for Mobile Communications - Railway) could be feasible on other lines of the Croatian network (comprehensive and non-TEN-T). Specific studies will define the specific needs and technical parameters to be met in each individual case.
R.16	Electrification of other railways	Lacking sufficient data to establish clear compliance with the Strategy; additional studies are	Depending on the operational concept, electrification of all railways in the Republic of Croatia would enable an increase in the efficiency of the existing infrastructure. Further studies will define specific needs and technical parameters as a source of electricity (ensuring the environmental efficiency of the measure) to be met in each individual case.

		needed to assess or confirm the appropriateness of the measure.	
R.17	Renovation of other railways, stations, stops and construction of new ones	Lacking sufficient data to establish clear compliance with the Strategy; additional studies are needed to assess or confirm the appropriateness of the measure.	Case studies (Lika railway, Una railway, Lepoglava junction, etc.) will determine the need for renovation and construction of new railway lines, stops, in addition to those already described in previous measures, taking into account the operational concept and economic and environmental aspects. In order to increase the competitiveness of Dalmatian ports and enable their further development, it is necessary to modernize the railways (Lika railway and sections from Dalmatian ports to Knin) that connect them with the Mediterranean Corridor in the Republic of Croatia. The fee for the use of railway infrastructure must be proportional to the emission and is therefore based on the principle that those who pollute pay.
R.18	Regional traffic, except Zagreb and Rijeka (Split, Varaždin, Osijek, etc.)	Lacking sufficient data to establish clear compliance with the Strategy; additional studies are needed to assess or confirm the appropriateness of the measure.	Rail transport can play an important role in both regional transport and in regional centers that are not part of the basic TEN-T railway network due to the existing network configuration in these areas. The concept of functional regions will analyse the potential in cities such as Split, Varaždin and Osijek and the possibilities of using the railway network within and between functional regions. An example of a railway important for connecting within a functional region is the Čakovec-Varaždin-Zabok-Zagreb railway, which connects the Varaždin region with the Central Croatia functional region and the capital city of Zagreb, where the construction / reconstruction of the Varaždin-Lepoglava-Zabok line can significantly reduce travel time between major centers. An example of a line of regional importance is the Čakovec-Kotoriba-Koprivnica-Osijek railway, which has its contribution to regional and international connections and also represents the shortest connection of Corridor Vc with Corridors X and Xa and other branches of Corridor V. In order to increase the competitiveness of Dalmatian ports and to enable their further development, it is necessary to modernize the railways (Lika railway and sections from Dalmatian ports to Knin) that connect them with the Mediterranean Corridor in the Republic of Croatia, since only rail can provide transport of large quantities of cargo. Increasing the competitiveness of the railway sector will reduce environmental pollution and enable intermodal transport. In this regard, in order to define the scope of modernization of Dalmatian railways in the next period, a Feasibility Study will be prepared which will select the optimal variant of modernization of all Dalmatian railways. These studies will also assess the required technical parameters for each individual case.



R.19	Improvements and new marshalling yards and logistics centers	Lacking sufficient data to establish clear compliance with the Strategy; additional studies are needed to assess or confirm the appropriateness of the measure.	The national concept for freight logistics and the concept of functional regions based on demand assessments will analyse the need to develop new marshalling yards and logistics centers or improve existing ones to increase the potential of rail in the freight sector.
R.20	Improving safety at crossings, axle load detectors, axle overheating detectors, etc.	Measure covered by the General Measure.	Covered by general measure G.1 and G.3
R.21	Services that bring added value and improve the image of the railway Services that bring added value and improve the image of the railway	Measure covered by the General Measure.	Covered by general measure G.11
R.23	Intermodal freight hubs	Measure covered by the General Measure.	Covered by general measure G.1
R.24	Development of a concept for the maintenance of the existing infrastructure	Measure covered by the General Measure.	Covered by general measure G.5
R.25	Energy efficiency	Measure covered by the General Measure.	Covered by general measure G.6
Management / Organization			



R.26	Reorganization of charging for the use of railway infrastructure	Lacking sufficient data to establish clear compliance with the Strategy; additional studies are needed to assess or confirm the appropriateness of the measure.	The fee for the use of railway infrastructure can be used as a tool to improve the sustainability of the railway transport system. The fee for the use of railway infrastructure must be proportional to the emission and is therefore based on the principle that those who pollute pay. Coordinating the collection of railway infrastructure charges with railway managers in neighbouring countries will facilitate international traffic.
R.27	Multi-year public service contracts	Measure covered by the General Measure.	Covered by general measure G.7
R.28	Increasing financial sustainability	Measure covered by the General Measure.	Covered by general measure G.7
R.29	Reorganization of the railway transport system	Measure covered by the General Measure.	Covered by general measure G.7
R.31	Improving the fleet for freight transport	In line with the Strategy; the measure is necessary and well defined, even if some additional studies are needed.	The existing rolling stock for freight consists mainly of conventional covered and open wagons, some of which are suitable for combined transport operations. A large number of locomotives need to be replaced, with an estimated 70% of locomotives reaching the end of their service life in the next decade. The first step in the implementation of this measure is a detailed analysis of the current organizational and operational structures and maintenance structures of the railway operator, where future needs, operational plan and maintenance plan will be analysed. Given that the freight transport market has been liberalized, it is important to involve interested and relevant freight carriers. Once the actual needs are identified, further studies will define the functional and specific technical requirements for the rolling stock.
R.32	Update legislation and planning guidelines	Measure covered by the General Measure.	Covered by general measure G.8
R.33	Preparation for changes to the Schengen borders	Measure covered by the General Measure.	Covered by general measure G.9



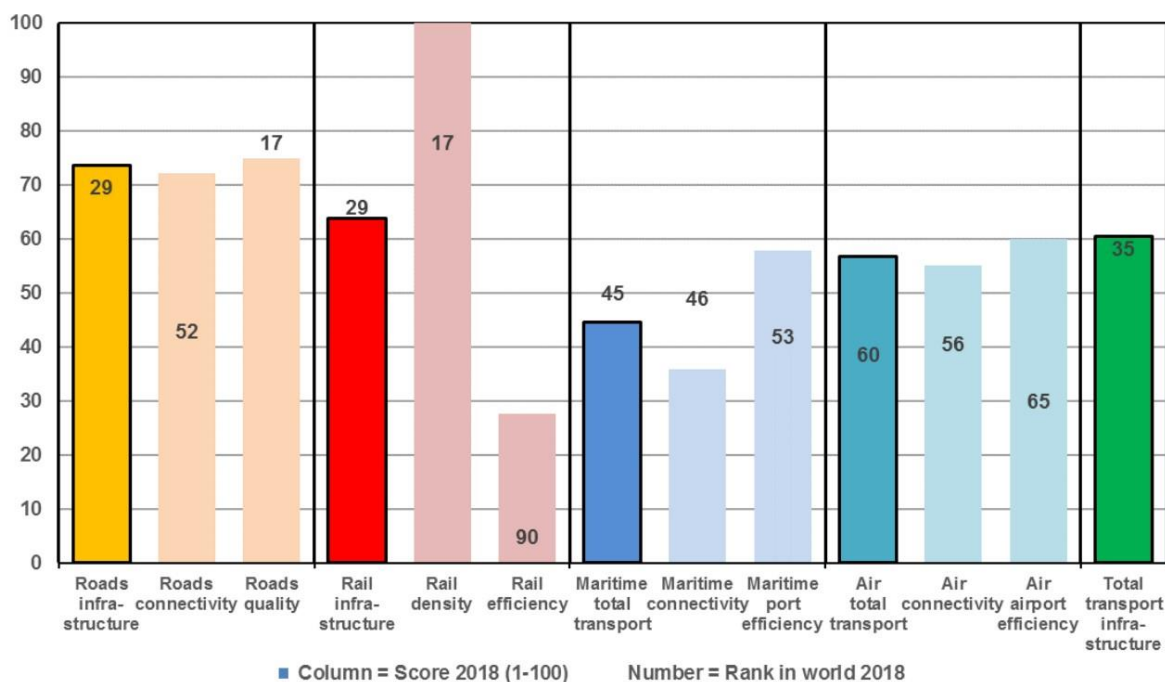
R.34	Preparation / adjustment of non-Schengen borders	Measure covered by the General Measure.	Covered by general measure G.9
R.36	Freight liberalization	In line with the Strategy; the measure is necessary and well defined, even if some additional studies are needed.	Liberalization of the freight railway sector in the Republic of Croatia has already begun, and the following freight transport operators are active on the Croatian market: HŽ Cargo, PPD Transport L.T.D., Rail Cargo Carrier Croatia L.T.D., RAIL & SEA L.T.D., RTS Rail Transport Service GmbH, Train Hungary Kft , SŽ - Tovorni promet L.T.D. and Transagent L.T.D. Administrative bodies, such as the regulatory and security agency, need to be further technically and organizationally strengthened.
R.37	Increasing administrative capacity / training	Measure covered by the General Measure.	Covered by general measure G.10
R.38	Business / timetable reorganization	In line with the Strategy; the measure is necessary and well defined, even if some additional studies are needed.	In order to increase the share of rail traffic, timetables need to be reorganized to improve connectivity and efficiency of services provided. Through the concept of functional regions, this possibility will be analysed taking into account the samples of the "destination-starting" structure and operational and infrastructural requirements.
R.39	Information platforms	Measure covered by the General Measure.	Covered by general measure G.11
R.40	Reducing environmental impact	Measure covered by the General Measure.	Covered by general measure G.12 and G.13
R.41	Improving the data collection process	Measure covered by the General Measure.	Covered by general measure G.14

Source: The Transport Development Strategy of the Republic of Croatia 2017 - 2030; p. 200-204; 209-214

According to the European Commission's report on Transport in the European Union - Current trends and issues, 2019, the overall quality of transport structure is considered satisfactory on average, however, the efficiency of Croatia's railway infrastructure is considered to be lagging behind other modes of transport. This is due to the lack of infrastructural investments and the lack of maintenance over a longer period of time. Despite some of the more recent improvements in the railway sector in Croatia, restrictive regulations and policies are still prevalent in the sector. The dominant market position of the state-owned companies

prevents the development of private rail enterprises in Croatia. On the positive side, Croatian ports have lifted a major barrier by publishing complete lists of access conditions and prices of rail-related services.⁹

Graph: Grade and overall ranking of efficiency of each mode of transport in Croatia, 2018



Source: World Economic Forum, The Global Competitiveness Report 2018.

Due to the COVID-19 global pandemic, many of the previous forecasts for the transport sector aren't relevant anymore. The lockdowns across the globe have had, and the continuation of the pandemic will continue to have great impacts on the economy through decreased production, GDP decline, changes in supply and demand etc. This is valid for many countries around the world, including Croatia. Passenger transport has been partially or completely halted, while freight transport has managed to continue. So far, only the data for the first quarter of 2020 has been uploaded by the Croatian Bureau of Statistics. The first release of "Transport - First Quarter of 2020" shows that, unlike passenger transport, an increase was achieved in freight transport. In the first three months of 2020, 29.3 million tons of goods were transported, which is an increase of 11.7% compared to the first quarter of 2019. The increase was realized in all types of goods transport. Rail freight operators' amount of goods transported increased by 6,7 percent.^{10,11} The report on the 2nd quarter should give a much clearer picture on the effects of the pandemic, as the first cases of COVID 19 in Croatia were discovered in late February and the pandemic has only affected a portion of the quarter.

The Croatian Pro-rail alliance has listed the following as pros of rail freight transport in the current pandemic: The railway can transport large quantities of goods with a smaller number of employees which significantly reduces the risk of infection; one locomotive pulling one train replaces 40 to 60 trucks and drivers; there are no traffic jams at border crossings - well-established and safe procedures; Railways have enough free capacity at the time of stopped passenger transport; Safety measures to protect employees are easily implemented into the railways system; there is a sufficient number of carriers, locomotives, wagons and staff for uninterrupted logistics; There are enough rail stations in Croatia that can be put into operation

as freight stations; The rail stations are open and ready to work, with many among them ready for intermodal transshipment; The railway system in Croatia has enough staff to ensure the system is operational.³

Table: Railway transport of goods in Croatia - comparison between three different quarters

Goods carried (in thousands of tonnes)	1st Quarter of 2019	4th Quarter of 2019	1st Quarter of 2020
Domestic transport	575	877	633
International transport - loading	1621	1522	1502
International transport - unloading	332	351	412
Transit	912	1118	1124
Total	3440	3868	3671

Source: dzs.hr

To add to the negative effects of the pandemic, on March 22nd, the Capital city of Croatia, Zagreb, was hit by two strong earthquakes which caused significant material damages in the city core. The first of the two earthquakes was measured at 5,5 on the Richter scale, and the intensity at the epicenter was of the VII degree of the MCS scale. The second earthquake occurred less than an hour later and was measured at 5,0 on the Richter scale.¹² What are the consequences for freight transport caused by this natural disaster remains to be seen upon release of the statistical data for the 2nd quarter of 2020 by the Croatian Bureau of Statistics.

2.3. Analysis of the economic, political and technical market conditions

There are multiple existing factors which are currently affecting rail freight transport and its market potential. One of the biggest such factors are the legal and political documents made on both the European and national levels. An example of such a document would be the European Commission's White paper written in 2011 - Transport 2050 which has set ten benchmark goals such as: Shifting 30% of road freight over 300km to other modes, including rail; a fully functional and EU-wide multimodal TEN-T core network by 2030, with a high-quality and capacity network by 2050 and a corresponding set of information services; and establish the framework for a European multimodal transport information, management and payment system. Increasing the competitiveness of transport through the European Commission's actions while reducing 60% of greenhouse gas emissions from transport is seen as the most important result to be achieved in this white paper.¹³

Several other important policy documents have also been developed on the national and regional levels. These include:

1. Transport Development Strategy of the Republic of Croatia 2017 - 2030, developed by the Croatian Ministry of Sea, Transport and Infrastructure, considered to be the starting point in the process of planning the transport development in Croatia. This strategy evaluates and defines future infrastructural, operational and organizational measures in the transport sector related to national and international transport in all transport sectors regardless of their source of funding. The strategy identifies the need for further data collection and defines the steps to be taken for future revision of the Strategy. The first hypothesis regarding railway freight transport states that there is considerable potential for increasing freight transport by rail between Zagreb and Rijeka. The Strategy also states that increasing the level of interoperability of the Croatian railway network and railway systems of all neighbouring countries, especially Slovenia and Hungary, offers significant opportunities for achieving a more favorable share of railway transport in the structure of all modes of transport.⁸
2. National Railway Infrastructure Program 2016-2020 which is the base document setting out development priorities, construction, modernization, renovation and maintenance of the functionality of the railway infrastructure system. The National Railway Infrastructure Program 2016-2020 establishes plans for the construction of new railways and the modernization and maintenance of the existing railway network; determines priorities and the dynamics of realization and the amount and sources of necessary financial resources. The planned investments in modernization and construction as well as the cost of maintaining the railway infrastructure from 2016 to 2020 are approximately 17,2 billion HRK, of which 2,23 billion HRK relates to reconstruction and modernization programs; 10,2 billion HRK for the construction of new and upgrading of existing lines and tracks; and maintenance costs (together with infrastructure management costs) are planned in the amount of 4,77 billion HRK.¹⁴
3. Territorial Development Strategy of the Republic of Croatia describes the Croatian railway infrastructure as above the European average in length according to the size of the population of Croatia, but the network is technologically not adapted to today's needs, with the exception of the line from the borders with Slovenia to the border with Serbia and several sections that have been modernized. The existing railway network is an integral part of the network of international and national railway corridors. Renovation and re-commissioning of the RH1 corridor, as well as the reconstruction and renovation of the RH2 corridor, have put the existing railway network in full operation.¹⁵
4. HŽ Infrastructure's Railway Network Report is released yearly and its purpose is to provide a single source of information on railway infrastructure services managed by HŽ Infrastructure. This report provides an overview of the railway infrastructure managed by HŽ Infrastructure, information on conditions for access to the railway infrastructure and the allocation of infrastructure capacity, as well as payment models for services provided by the infrastructure manager.²

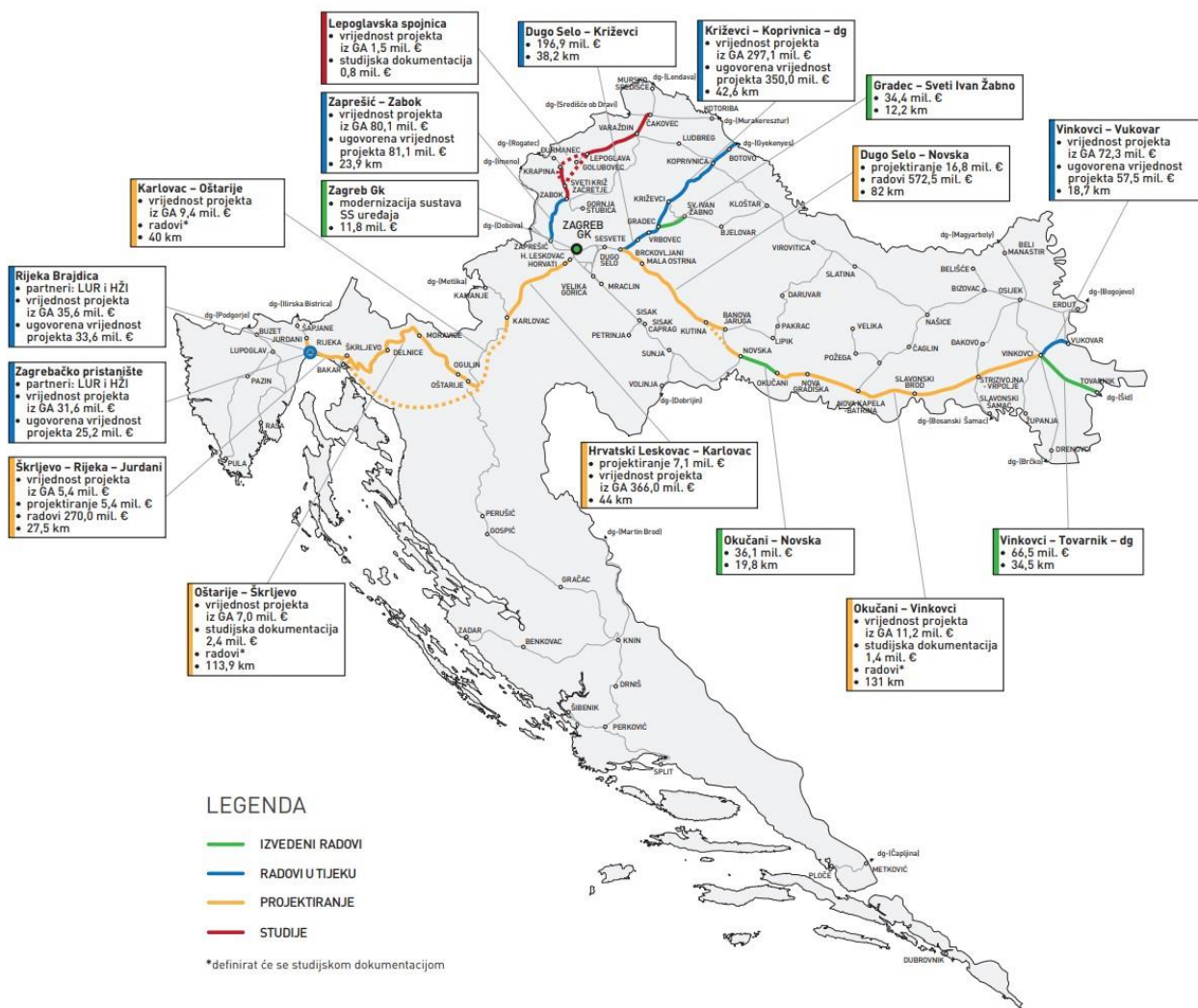
5. Croatian Railway Law regulates the manner and conditions of railway transportation, the status of railway infrastructure, the market for railway services, the management of railway infrastructure and conditions of access to infrastructure, the principles and procedures applicable to the introduction and determination of charges for railway services and the allocation of capacity of railway infrastructure, the criteria for issuing and revocation of licenses for railway undertakings and railway services of special national interest for which the Republic of Croatia provides part of the funds. Along with the Railway law, there are many railway regulations currently in use such as: Law on the Regulation of the Market in Railway Services; Railway Act; Railway safety and Interoperability Act; Law on Contracts for Carriage by Rail; Law on the Establishment of the Agency for Investigation of Air, Sea and Railway Accidents; Law on the division of the HŽ - Croatian Railways L.T.D. etc.¹⁶

6. Croatian Law on Combined Freight Transport regulates distances, incentive measures and conditions for the carriage of goods in combined freight transport. In the case of combined carriage of goods which is considered to be a carriage of goods between EU Member States, the truck, trailer, semi-trailer, with or without a towing vehicle, a removable crate or container of 20 feet or more, is used on the road at the initial or final leg of the journey, and rail, inland or sea transport sections The combined freight services referred to in this Law shall be exempt from all quota and authorization systems in the EU Member States.¹⁷

Considering that almost 55 percent of the railway network in the Republic of Croatia refers to railway lines important for international transport, HŽ Infrastruktura focuses on projects funded by the EU for modernising the Croatian railway network.¹⁸ In the context of investments, the most notable ones are the investments by HŽI to renew and modernize the railway infrastructure in order to increase the quality of service to its users. A 258 million HRK investment was made into constructing and opening the first new railway line in Croatia in 52 years, that railway line being Sveti Ivan Zabno - Gredec, opened at the end of 2019. By 2030, Croatia should have up to 681 kilometres of double-track lines and 1,022 kilometres of electrified lines in operation.²

Some of the projects which have been highlighted by HŽI are: Project Rijeka Brajdica - in which all eight rail tracks of the Rijeka Brajdica railway station have been completely reconstructed The contact network and station lighting were reconstructed, all new external signals and new switchgear control devices were installed. A facility for signal-safety and telecommunication devices and a facility for auxiliary power supply were built next to the station building; and Zaprešić - Zabok Project which included the laying of a completely new railway track, platforms for receiving passengers have been arranged, railway bridges and culverts were build, and works in the underpasses have been completed. Final works are still to be done on the platforms, on the completion of the drainage along the railway, on the contact network, the construction of the parking lot as well as on the completion of the Horvacka road bridge and the installation of signaling and safety devices.¹⁹

Picture: Map of HŽI EU funded projects for railway renewal



Legend:

- Works Performed
- Works in progress
- Planned works
- Studies

Source: hzinfra.hr

2.4. Analysis of the industrial structure and clusters (potential customers)

Croatia has several main industry branches which include the following: tourism, shipbuilding, construction, manufacturing of machinery and equipment, petrochemicals, food processing and wood industry. Most of these industries are year-round, except for tourism, which is active during the summer months along the coastline, and in the snowy parts of the mountains during the winter months.

Tourism is one of the most important economic branches of the Republic of Croatia. The history of tourism in Croatia goes back to the mid-19th century. It has been successfully developed to this day, and today Croatia is one of the most visited and important tourist destinations of the Mediterranean. Tourism accounted for 23,1% of Gross Value Added in 2018, and has done so through the 9,5 billion € revenue and the employment of 104,565 people.^{20,21}

Shipbuilding industry is generally considered as one of the key global industries, and is an industry of great significance in Croatia as well. This industry in Croatia encompasses 5 large, 14 medium and 352 small shipyards that produce, maintain and repair ships and offshore structures. The large shipyards in Croatia are: 3. Maj and Viktor Lenac in Rijeka, Uljanik in Pula, Brodosplit in Split and Brodotrogir in Trogir. According to the Cross section of the Croatian shipbuilding industry, Croatia is the 9th largest shipbuilding country in the world, and 2nd largest in Europe.^{20,21}

Construction is a branch of the manufacturing industry based on building, maintaining and repairing structures. Construction is largely represented in Croatia's cities with Zagreb in the lead. Zagreb averaged 1783 new completed dwellings per year from 2011 to 2018. The cities that come closest in the same time period are Split, Zadar, Osijek and Dubrovnik with an average of 298, 279, 158 and 150 respectively.

Manufacturing of machinery and equipment is one of the most important industries in Croatia. Companies working in this industry are mostly focused on exports, the introduction of new technologies, training professional personnel, quality system certification, environmentally friendly production and connecting domestic and foreign producers. The production program of the Manufacture of Machinery and Equipment in Croatia is very diverse, and has a large share in Croatia's total export with around 6,7%.^{20,21}

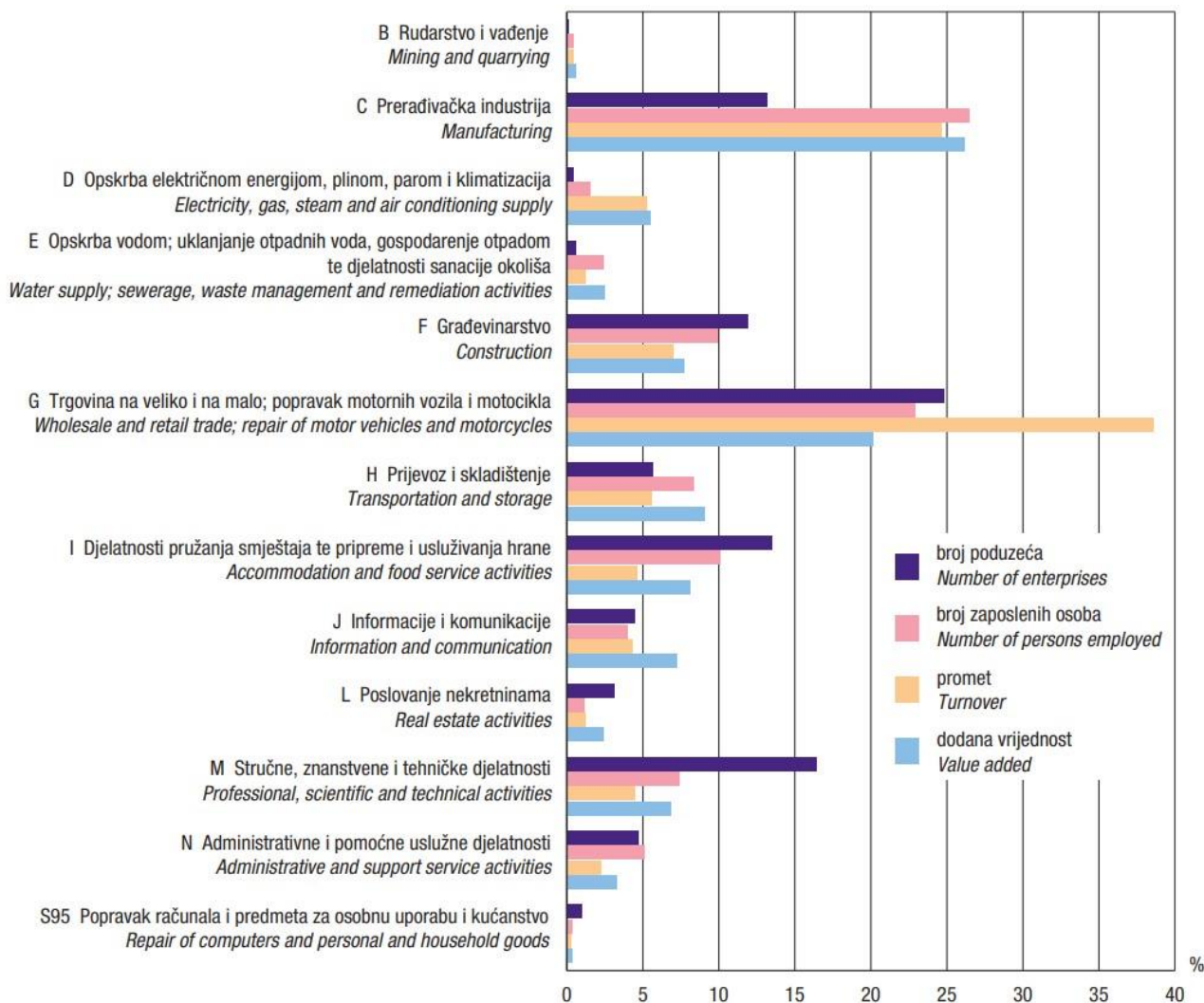
Petrochemical industry can be defined as an industry based on processing oil or petroleum. INA P.L.C. is the main representative in this field with two refineries in Rijeka and Sisak producing benzene, toluene and xylene. INA is engaged in the business of liquefied petroleum gas, natural gas transportation, oil and technical services, engineering, tourism and information processing. INA operates in Croatia, Egypt and Angola, and since 2003 has been operating together with the Hungarian strategic partner MOL, which has become the majority owner. Liquid fuels, or petroleum products, are the main energy source in Croatia, but their consumption and production have been decreasing in recent years.²²

The food processing industry compared to other branches of the processing industry in Croatia, generated the highest total revenues and employed the most people. The sector is the most developed in the city of Zagreb and Zagreb County, northwestern Croatia and Osijek-Baranja County. The most profitable activities in this sector are the production and processing of milk and cheese, the production of beer, the processing of tea and coffee, and the production of soft drinks, as well as one of the important branches of the Croatian food industry is the confectionery industry.^{20,21}

Wood industry in Croatia consists of a larger number of small and medium-sized enterprises. The industry is resource-intensive, and as such doesn't have high added value, but it is important for the Croatian economy because of its notable share in employment, rural development and export. The importance of the wood industry for the entire Croatian manufacturing industry is great, as this sector employs around 10 percent of total Croatian employees and accounts for 8 percent of total national exports. Export and import of wood products are mostly oriented toward Italy, Germany, Slovenia, Austria and other countries in the EU.²³

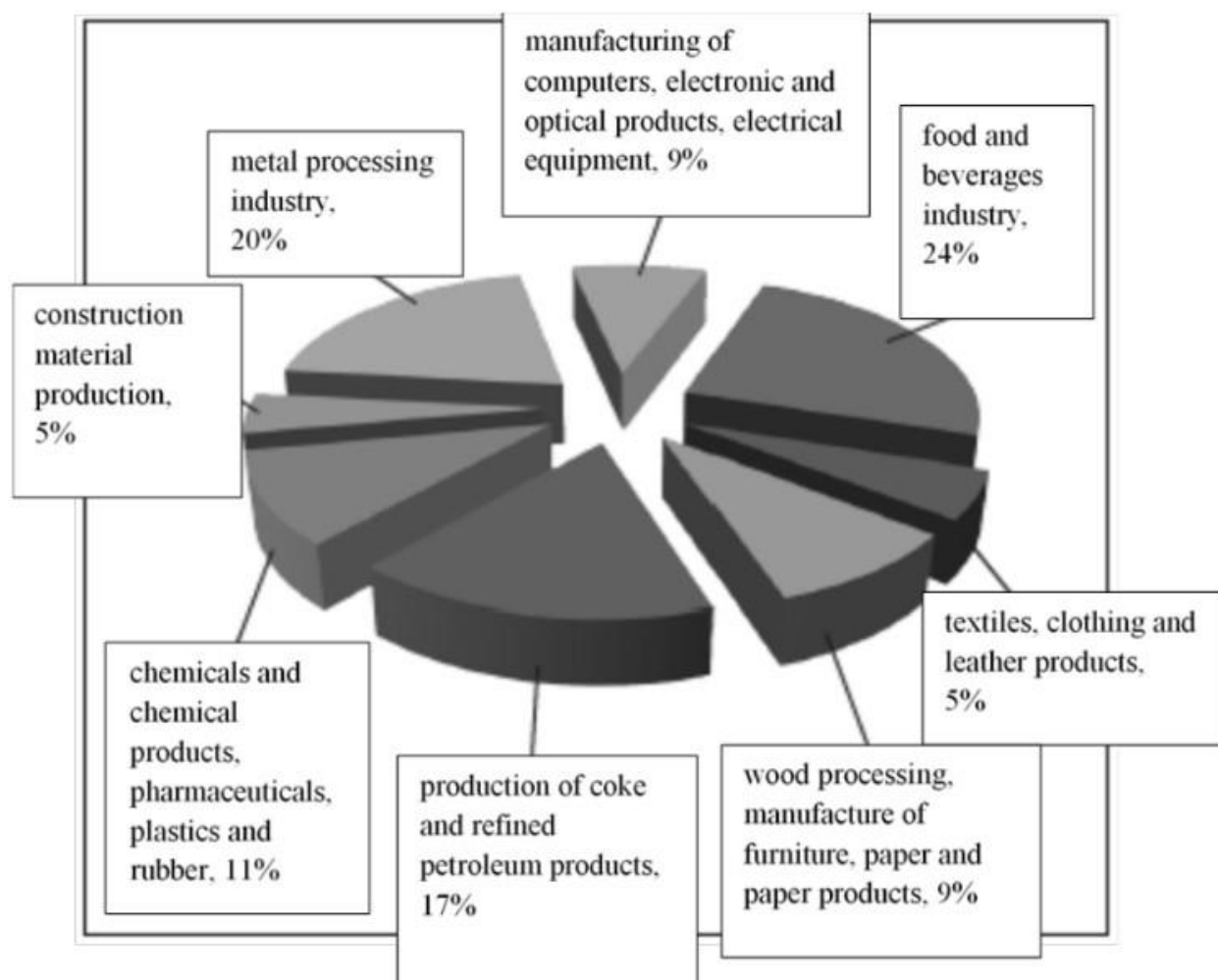
Several other, less represented sectors in Croatia include: the logistics sector; creative and cultural industry; ICT industry; textile industry; automotive industry; and pharmaceutical industry.

Graph: Basic structural business indicators in Croatia in 2016 according to the National Classification of Activities, 2007 version



Source: dzs.hr - Statistical Yearbook of the Republic of Croatia, 2018

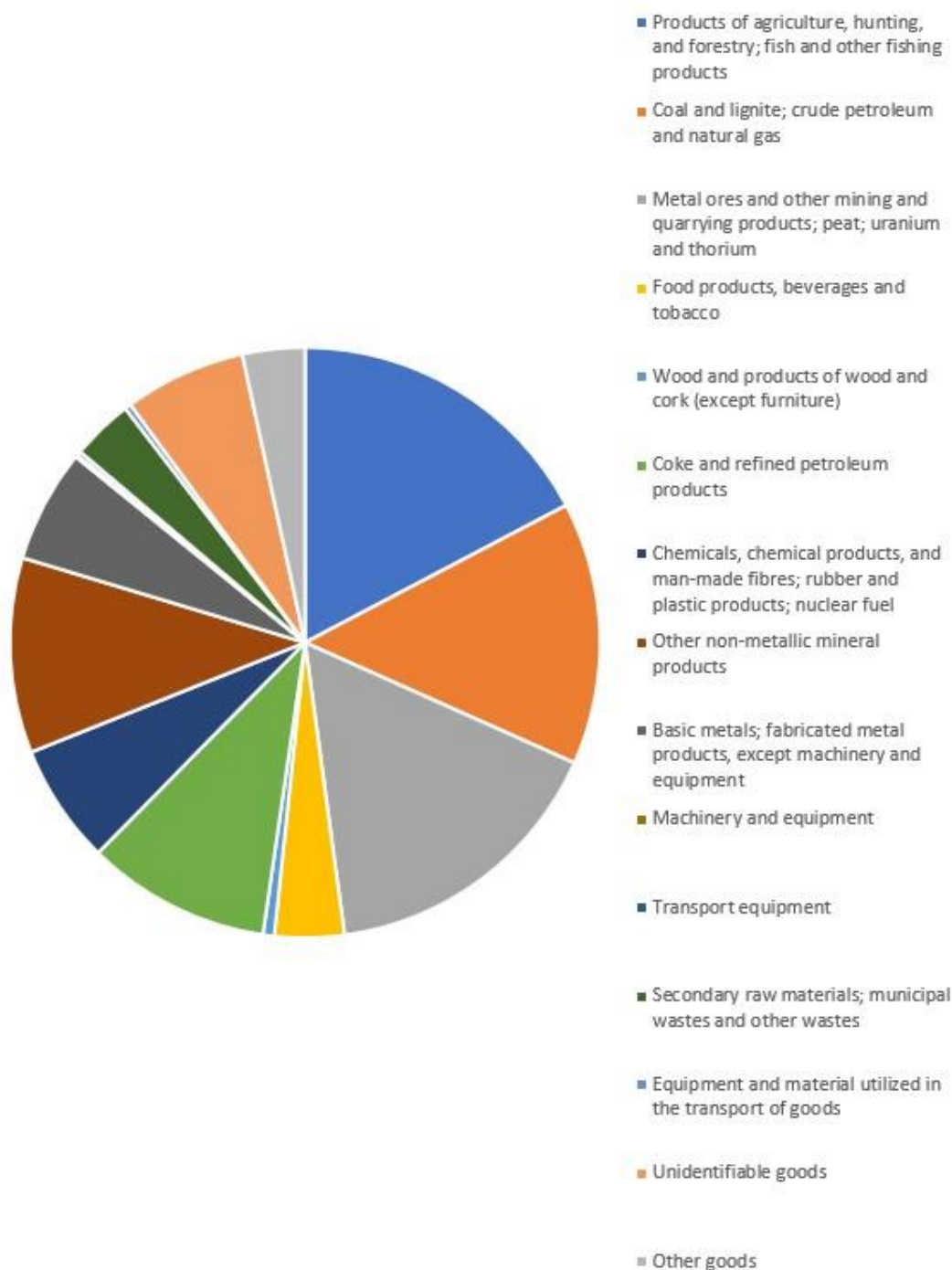
Graph: Structure of industrial production in the Republic of Croatia



Source: Šandrak Nukić, I; Miličević, I: Fostering eco-innovation: Waste tyre rubber and circular economy in Croatia; 2019, Osijek, Croatia

Graph: Croatia's total rail freight transport by type of goods

Total amounts of goods transported (in thousands of tonnes) by type of goods



Source: Created by the author based on data from dzs.hr

Table: Croatia's railway transport of goods by type of goods and type of transport in 2018 (in thousands of tonnes)

Type of goods	Total	Type of transport			
		National	International		
			Loading	Unloading	Transit
Products of agriculture, hunting, and forestry; fish and other fishing products	2,326	179	460	39	1,648
Coal and lignite; crude petroleum and natural gas	1,934	-	1,854	26	54
Metal ores and other mining and quarrying products; peat; uranium and thorium	2,174	1,219	801	-	154
Food products, beverages and tobacco	512	29	134	7	341
Wood and products of wood and cork (except furniture); articles of straw and plaiting materials; pulp, paper and paper products; printed matter and recorded media	83	5	2	31	45
Coke and refined petroleum products	1,357	939	154	154	110
Chemicals, chemical products, and man-made fibres; rubber and plastic products; nuclear fuel	883	461	251	115	56
Other non-metallic mineral products	1,438	138	1,270	11	19
Basic metals; fabricated metal products, except machinery and equipment	833	24	265	134	410
Machinery and equipment	19	5	4	2	8
Transport equipment	30	5	3	4	18
Secondary raw materials; municipal wastes and other wastes	454	100	112	160	82

Equipment and material utilized in the transport of goods	46	13	15	17	1
Unidentifiable goods	896	118	524	247	7
Other goods	459	3	69	82	304
Total	13,444	3,238	5,919	1,030	3,257

Source: dzs.hr

Table: Rail freight suitability for each group of goods

Type of goods	Rail freight suitability
Products of agriculture, hunting, and forestry; fish and other fishing products	Yes
Coal and lignite; crude petroleum and natural gas	Yes
Metal ores and other mining and quarrying products; peat; uranium and thorium	Yes
Food products, beverages and tobacco	No
Wood and products of wood and cork (except furniture); articles of straw and plaiting materials; pulp, paper and paper products; printed matter and recorded media	Yes
Coke and refined petroleum products	Yes
Chemicals, chemical products, and man-made fibres; rubber and plastic products; nuclear fuel	Yes
Other non-metallic mineral products	Yes
Basic metals; fabricated metal products, except machinery and equipment	Yes
Machinery and equipment	No
Transport equipment	Yes
Secondary raw materials; municipal wastes and other wastes	Yes
Equipment and material utilized in the transport of goods	No
Unidentifiable goods	Cannot be estimated
Other goods	Cannot be estimated

Source: Author's representation

Table: Croatia's railway transport of dangerous goods in 2018 (in thousands of tonnes)

Type of goods	Total	Type of transport			
		National	International		
			Loading	Unloading	Transit
Gases - compressed, liquified or dissolved under pressure	73	39	9	11	15
Flammable liquids	870	713	87	30	41
Flammable solids	72	72	-	-	-
Substances liable to spontaneous combustion	96	-	2	-	94
Substances which, in contact with water, emit flammable gases	27	-	27	0	-
Oxidising substances	351	188	164	0	-
Corrosives	46	0	-	12	34
Miscellaneous dangerous substances	252	-	64	76	111
Total	1,787	1,011	352	130	294

Source: dzs.hr

Major logistic hubs include the already mentioned important intermodal facilities in the following ports: Port of Rijeka, Port of Ploče and Port of Šibenik, Port of Split and Port of Zadar. Each of those ports connect the railway freight transport with maritime freight transport. Other than those ports and their respective cities the most important logistic hubs include the larger cities in Croatia, such as the capital city of Zagreb or the main industrial and traffic hub for the eastern part of Croatia, Osijek.

3. Summary and recommendation

What are the main market potentials and chances for rail freight transport?

- Croatia's road and rail infrastructure are part of the TEN-T Network.
- The railway network is connected to the ports, enabling efficient intermodal transport and better connections with further destinations.
- European funding programs and initiatives promote rail freight transport.
- Big investments in rail transport (both infrastructure and fleet) will make using rail freight options more attractive, increasing its share in the modal split.

Table: SWOT Analysis for Croatian rail freight transport

Strengths	Weaknesses
Several ports which connect the coast to the hinterland	Single track railway lines are less efficient in achieving a successful rail freight transport economy
Croatian railway network serves as a link from Italy and Slovenia to Hungary and north-eastern European countries	Poor railway infrastructure
Market liberalisation	Level of interoperability on Croatian corridor railway network is low.
Sustainable and environmentally friendly mode of transport	Often train delays and inaccurate timetables
	Insufficient train speed on some lines
	Relatively old rolling stock in comparison to other EU countries
	Unsatisfactory maintenance level of infrastructure which causes limitations in operation
	The old rolling stock is deteriorating the infrastructure and therefore the noise levels during operations are high
Opportunities	Threats
Increase the amount of electric rail in Croatia	Dominant road transport competition
Availability of funds for strengthening the railway infrastructure	Punctual, fast and reliable road transport service
Increase of the amount of freight transport in the following years	Modern highway network in Croatia



Policy on combined transport encourages modal shift and wider use of railways	Lack of compatibility between fleet and rail infrastructure
Congestion of road network might be used as an opportunity for the usage of railways	The drainage system along the corridor is insufficient and/or out of service.
Raised awareness about the necessity of the usage of more environmentally friendly modes of transport	Current operations of all three major companies in Croatian railway system are not sustainable without government support
Modernization of fleet	

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