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Impact of COVID-19 pandemic on passenger mobility in national and international railway traffic of the Republic of Croatia

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ABSTRACT

COVID-19 pandemic has brought difficult situations for the global economy and their economic activities. However, passenger traffic is one of the activities that has felt the impact of the pandemic the most. The movement of passengers was reduced to a minimum, and some forms of traffic were completely suspended. One such example is railway transport in the Republic of Croatia, whose activity was completely stopped in April 2020, which also affected the business of the company Croatian Railway Passenger Transport Ltd. In this paper, the authors will analyse the impact of coronavirus disease (COVID-19) on the mobility of passengers in national and international railway passenger transport of the Republic of Croatia.

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1 Introduction

The COVID-19 pandemic has had a significant impact on all segments of the economy. The whole world stopped in an instant and people were forced to be where they were at that moment. All forms of traffic were reduced, the number of existing lines was reduced, and the movement of passengers was restricted. For countries whose economies are significantly dependent on tourism, the suspension of traffic was one of the main threats to further development. From the very beginning of tourism, passengers travelled mostly by train and have been arriving to Kvarner since the first half of the 19th century. [10] The connection between the phenomenon of tourism and rail transport is so intense that it is often stated that it is difficult to say whether the train brought tourism to Kvarner or whether tourism brought the train to Kvarner. [11] Although most tourists nowadays travel by car, many in the world still choose to travel by train. Its importance stems from its regularity, which is also one of the basic characteristics of regular traffic, and the possibility to transport a large number of passengers to their destination regardless of weather conditions. Unfortunately, there was insufficient investment in railway infrastructure and infrastructure in Croatia, and most of the

available budget was used to build road infrastructure. Railways in the rest of Europe and the world have been developed to the extent that they have become a common form of daily transport and, in addition to tourists, citizens also prefer to opt for it. Tourism trains are reducing the volume of road traffic that is a growing environmental and safety problem in Europe. By encouraging the development of alternative tourism, i.e. the creation of preferences for the use of less harmful forms of transport, new and greater possibilities for strengthening the position of railways in the passenger transport market are opened up.

The COVID-19 pandemic has stopped the entire world, and has had a special impact on traffic, that is, passenger mobility in national and international traffic.

This work is divided into four units. After the introduction, the second part of the paper lists the basic characteristics of railway traffic in the Republic of Croatia. Data regarding the cross-section of the railway network, how the network looks like and under what conditions and in what way it is used (who are the stakeholders, infrastructure and etc.) has been taken from the network report. In the third part of the paper, the movement of passengers in the railway traffic of the Republic of Croatia in 2019 and

2020 was analyzed, followed by the conclusion. The aim of this paper is to determine how the COVID-19 pandemic affected the movement of passengers in national and international rail transport in the Republic of Croatia and how these consequences affected the operations of the company Croatian Railway Passenger Transport Ltd.

2 Railway infrastructure in the Republic of Croatia

One of the basic characteristics of rail transport is the high fixed costs resulting from capital intensity or high investments. Although rail transport is more expensive than sea and river transport, it is a cheaper option than air and road transport. From a market point of view, rail transport has the character of a natural monopoly and it is considered that competition could cause more negative consequences than benefits in the long run [6]. This characteristic is also evident in the example of the Republic of Croatia, which is the sole owner of railway companies. It is in charge of providing quality and safe transport services, implementing the process of restructuring the railway sector, and by adopting and implementing legal frameworks it affects the restructuring of the entire railway system. With the accession of the Republic of Croatia to the European Union and the acceptance of its *acquis*, a new era in the railway sector followed. This implies leaving the monopoly market structure and opening the market and its liberalization [1].

Rail transport has great potential for development and sufficient room for investment. "Compared to other transport industries, rail has a number of advantages in terms of energy efficiency, environmental sustainability and economic cost-effectiveness... it enables fast and economical transport of people and freight" [5]. The more developed countries of the world have recognized the importance and advantages of rail transport development, while the Republic of Croatia is still lagging behind. Although rail transport played an important role for the formation of the urban network in the Croatian area and has significantly influenced transport connections and spatial organization in the past, its importance lags behind road transport [8]. According to the data of the Ministry of Finance and grantors, out of the total financial support allocated for the provision of services of general economic interest, only 13% is allocated to rail transport, which is significantly less compared to land transport, which includes 37% of total allocations [9]. Given the numerous long-term benefits of rail transport development, the option of more intensive investment should be considered.

2.1 Management and ownership

The entire railway infrastructure in the Republic of Croatia is in state ownership and is managed by the company Croatian Railway Infrastructure Ltd., which is also 100% owned by the Republic of Croatia. Railway infrastructure is a public good in general use, it cannot be al-

ienated from the property of the Republic of Croatia, nor can real rights be granted on it, except in cases prescribed by the Railway Act (Official Gazette no. 32/19 and 20/21). Croatian Railway Infrastructure Ltd. manages the railway infrastructure of the Republic of Croatia on the basis of the concluded Agreement on the management of railway infrastructure with the Government of the Republic of Croatia dated 12 June 2008. Pursuant to the signed Agreement, Croatian Railway Infrastructure Ltd. is obliged to provide financial resources for maintenance (reconstruction), modernization, construction and upgrading of railway infrastructure, funds for the organization and regulation of railway traffic and funds for the management of the company. In addition, the basic functions of railway infrastructure management include the allocation of train paths, determining and assessing the availability of infrastructure capacity, determining the amount of fees for the use of railway infrastructure and their collection.

Access to the railway infrastructure managed by Croatian Railway Infrastructure Ltd. is defined by the Railway Act (Official Gazette no. 32/19 and 20/21), by-laws adopted on the basis of that Act, the Railway System Safety and Interoperability Act (Official Gazette no. 63/20) and other laws, ordinances and decisions regulating railway traffic. The right to perform railway transport has all railway undertakings which have a valid license to perform transport services in railway transport, a valid safety certificate for the performance of railway transport and a contract on access to railway infrastructure with Croatian Railway Infrastructure Ltd. The licence permitting the provision of railway transport services is issued by the Ministry of the Sea, Transport and Infrastructure, the Land Transport and Inspection Directorate, the Railway and Intermodal Transport Sector, while the Safety Certificate for railway transport is issued by the Railway Safety Agency.

The Access to Railway Infrastructure Agreement regulates the mutual rights and obligations between the railway undertaking and the infrastructure manager with regard to the minimum access package, access to the service facilities, allocated infrastructure capacity, fees for the use of allocated infrastructure capacity and other issues related to railway safety and security environment.

2.2 Analysis of the state of railway infrastructure

Croatian Railway Infrastructure Ltd. manages the railway network with a total construction length of 2.617 km, of which 1.460 km are intended for international traffic, 626 km for regional traffic and 531 km for local traffic (Figure 1).

Of the total length of railways, 2,342 km are single-track lines, of which 1,185 km are intended for international traffic, 626 km are for regional traffic and 531 km are for local traffic, while 275 km are double-track lines intended exclusively for international traffic (Figure 2).

The construction length of electrified railways is 970 km, of which 878 km are intended for international traffic,



Figure 1 Railway infrastructure of the Republic of Croatia according to their importance

Source: [3]

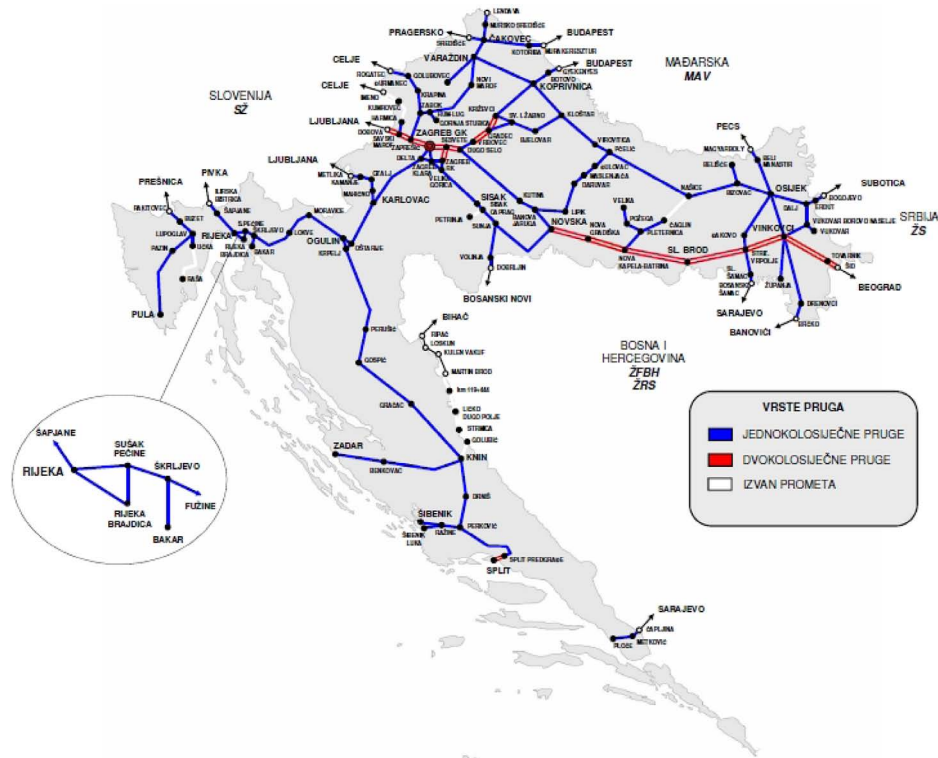


Figure 2 Railway infrastructure of the Republic of Croatia by types of railways

Source: [3]

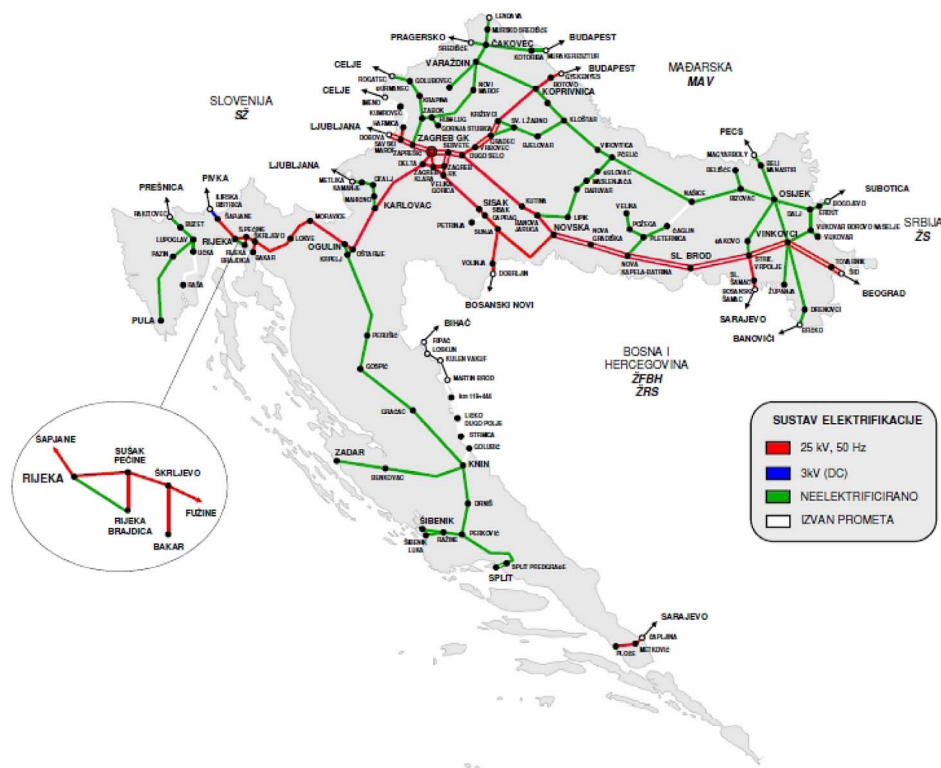


Figure 3 Railway infrastructure electrification system of the Republic of Croatia

Source: [3]

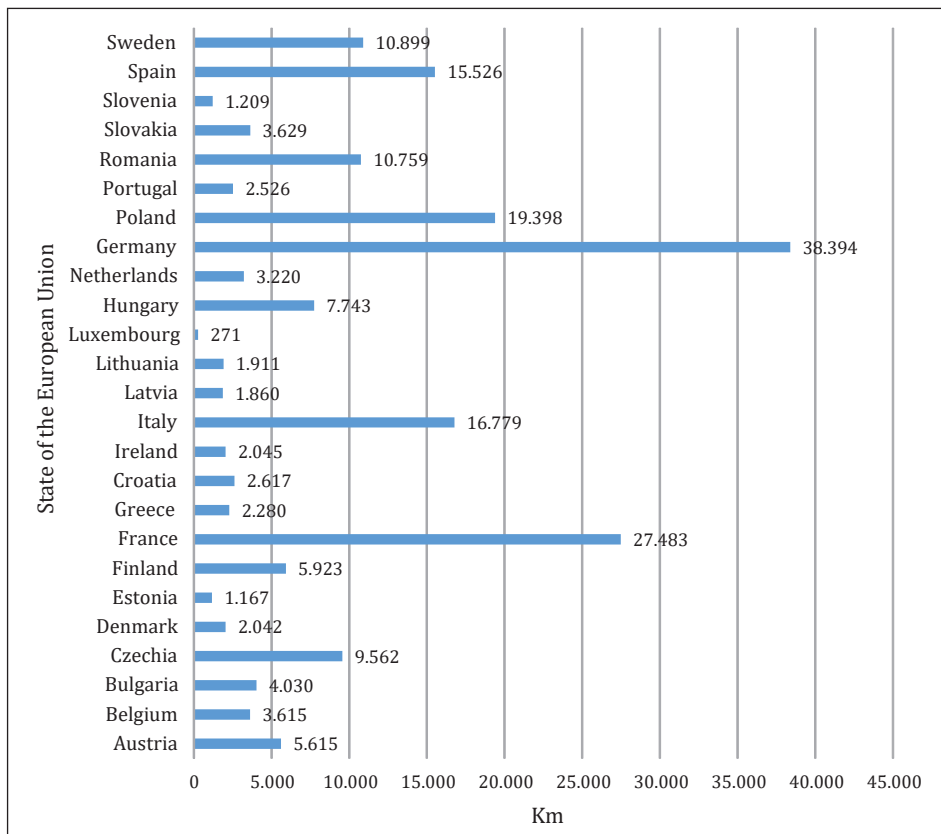


Figure 4 Total lengths of railways within the Member States of the European Union in 2020

Source: [7]

83 km for regional traffic and 9 km for local traffic, while 1,647 km are non-electrified railways, of which 582 km are intended for international traffic, 543 km for regional traffic and 522 km for local traffic (Figure 3).

Considering the availability of railway infrastructure managed by Croatian Railway Infrastructure Ltd. in the Republic of Croatia, Figure 4 shows the lengths of railways within other EU Member States.

Figure 4 shows that the countries of Germany and France have the largest total lengths of railways in the European Union, ie Germany has 38.394 km and France 27.483 km of railways. Compared to all other members of the European Union, the Republic of Croatia belongs to the category of countries with lower total lengths of railways.

3 Analysis of passenger movements in railway transport in the Republic of Croatia

In the Republic of Croatia, the activity of passenger transport in domestic and international railway transport is carried out by the company Croatian Railway Passenger Transport Ltd. Based on their annual reports and statistics, the corresponding tables have been prepared below. Considering the occurrence of COVID-19 and its negative impact on the development of rail passenger transport, in the period from 17 March to 22 June 2020 in international transport and from 22 March to 11 May 2020 in domestic transport, there was a complete suspension of public passenger transport by rail to/ from the Republic of Croatia.

Table 1 shows the total passenger traffic in rail transport in 2019 and 2020 on a monthly basis and the relationship

Table 1 Total passenger traffic in rail transport

Month	Total passengers carried			Domestic transport			International transport		
	2019	2020	Index	2019	2020	Index	2019	2020	Index
January	1.644.105	1.792.689	109,0	1.628.856	1.773.490	108,9	15.249	19.199	125,9
February	1.670.245	1.677.865	100,5	1.655.542	1.660.689	100,3	14.703	17.176	116,8
March	1.844.379	1.292.166	70,1	1.822.777	1.287.614	70,6	21.602	4.552	21,1
April	1.797.090	0	0	1.773.651	0	0	23.439	0	0
May	1.817.635	741.179	40,8	1.790.042	741.179	41,4	27.593	0	0
June	1.467.050	956.246	65,2	1.433.859	952.252	66,4	33.191	3.994	12,0
July	1.286.035	913.668	71,0	1.243.899	877.784	70,6	42.136	35.884	85,2
August	1.177.232	878.192	74,6	1.139.520	838.001	73,5	37.712	40.191	106,6
September	1.687.533	1.321.608	78,3	1.663.002	1.309.320	78,7	24.531	12.288	50,1
October	1.870.864	1.372.230	73,3	1.848.119	1.369.014	74,1	22.745	3.216	14,1
November	1.819.433	1.235.718	67,9	1.800.691	1.233.519	68,5	18.742	2.199	11,7
December	1.772.597	921.879	52,0	1.724.894	920.014	53,3	47.703	1.865	3,9
Total	19.854.198	13.103.440	66,0	19.524.852	12.962.876	66,4	329.346	140.564	42,7

Source: [4]

Table 2 Total passenger traffic in inland rail transport

Month	Inland transport			Local and long-distance transport			Urban-suburban transport		
	2019	2020	Index	2019	2020	Index	2019	2020	Index
January	1.628.856	1.773.490	108,9	858.700	939.313	109,4	770.156	834.177	108,3
February	1.655.542	1.660.689	100,3	903.789	881.774	97,6	751.753	778.915	103,6
March	1.822.777	1.287.614	70,6	1.016.297	654.335	64,4	806.480	633.279	78,5
April	1.773.651	0	0,0	978.016	0	0,0	795.635	0	0,0
May	1.790.042	741.179	41,4	981.500	292.969	29,8	808.542	448.210	55,4
June	1.433.859	952.252	66,4	755.649	473.828	62,7	678.210	478.424	70,5
July	1.243.899	877.784	70,6	633.577	439.533	69,4	610.322	438.251	71,8
August	1.139.520	838.001	73,5	582.447	419.476	72,0	557.073	418.525	75,1
September	1.663.002	1.309.320	78,7	894.698	701.073	78,4	768.304	608.247	79,2
October	1.848.119	1.369.014	74,1	989.335	734.909	74,3	858.784	634.105	73,8
November	1.800.691	1.233.519	68,5	955.066	664.894	69,6	845.625	568.625	67,2
December	1.724.894	920.014	53,3	916.955	459.135	50,1	807.939	460.879	57,0
Total	19.524.852	12.962.876	66,4	10.466.029	6.661.239	63,6	9.058.823	6.301.637	69,6

Source: [4]

between passenger traffic in domestic and international transport.

According to Table 1, the total passenger traffic in railway transport in 2020 decreased by 34% compared to the observed 2019, while at the same time the passenger traffic in domestic transport decreased by 33.6%, and in international transport by 57.3%.

Table 2 shows the total passenger traffic in inland rail transport in 2019 and 2020 on a monthly basis and the relationship between passenger traffic in local and long-distance and urban-suburban transport.

According to Table 2, the total passenger traffic in inland rail transport in 2020 decreased by 33.6% compared

to the observed year 2019, while at the same time passenger traffic in local and long-distance transport decreased by 36.4%, and in urban-suburban transport by 30.4%.

Table 3 shows the total passenger traffic in international rail transport in 2019 and 2020 on a monthly basis and the relationship between passenger traffic in their departure, arrival and transit.

According to Table 3, the total passenger traffic in international rail transport in 2020 compared to the observed 2019 decreased by 57.3%, while at the same time the total number of departing passengers decreased by 68.410, in arrival by 96.578 and in transit by 23.794 passengers.

Table 3 Total passenger traffic in international rail transport

Month	International transport			Departure		Arrival		Transit	
	2019	2020	INDEX	2019	2020	2019	2020	2019	2020
January	15.249	19.199	125,9	7.451	9.329	6.826	9.067	972	803
February	14.703	17.176	116,8	6.947	7.941	7.075	8.646	681	589
March	21.602	4.552	21,1	10.783	1.760	9.817	2.622	1.002	170
April	23.439	0	0,0	9.915	0	11.800	0	1.724	0
May	27.593	0	0,0	11.247	0	14.717	0	1.629	0
June	33.191	3.994	12,0	12.657	1.620	18.361	2.302	2.173	72
July	42.136	35.884	85,2	15.045	17.066	22.867	18.175	4.224	643
August	37.712	40.191	106,6	14.633	19.983	18.329	19.408	4.750	800
September	24.531	12.288	50,1	10.277	5.940	11.628	5.781	2.626	567
October	22.745	3.216	14,1	10.920	1.381	9.802	1.682	2.023	153
November	18.742	2.199	11,7	8.264	990	7.918	1.209	2.560	0
December	47.703	1.865	3,9	17.130	849	27.346	1.016	3.227	0
Total	329.346	140.564	42,7	135.269	66.859	166.486	69.908	27.591	3.797

Source: [4]

Table 4 Average passenger travel route in rail transport

Month	Total transport (km)			Domestic transport (km)			International transport (km)		
	2019	2020	Index	2019	2020	Index	2019	2020	Index
January	35.0	33.7	96,2	34.7	33.5	96,5	67,2	50,7	75.5
February	33.6	33.7	100.5	33.4	33.6	100.5	53.6	49	91.4
March	34.7	29.8	85,7	34.4	29.6	86,1	58.3	62.3	106.8
April	35.9	0	0.0	35.4	0	0.0	73.5	0	0.0
May	35.8	31.9	89.2	34.7	31.9	91.9	105.1	0	0.0
June	39.2	38.0	96.9	37.5	38.0	101.5	112.5	26.8	23.8
July	45.6	41.1	90.1	42.7	41.2	96,4	130	37,9	29.1
August	45.2	41.1	90,9	43	41.3	96.0	112.5	37,2	33,0
September	35,6	33,2	93.2	34.9	33.1	94.9	82,2	41,8	50.9
October	35,5	33,2	93.4	34.9	33.1	95	84.4	40,9	48.4
November	34.7	32.6	93.9	33,9	32.6	96.1	107.2	27.0	25.2
December	38.0	33.4	87,7	37	33.4	90.2	76,1	31,0	40.7
Total	36.9	34.3	92.8	36.0	34,2	95,1	93.3	41.4	44.4

Source: [4]

Table 5 Passenger traffic by countries in international rail transport

Country	Departure		Arrival	
	2019	2020	2019	2020
Austria	20,076	7,176	21,569	7,680
Belgium	2	2	9	2
Bosnia and Herzegovina	1,518	0	0	0
Crna Gora	30	0	2	0
Czech Republic	236	32,180	233	32,236
Denmark	5	0	8	0
France	593	14	0	0
Greece	1	0	0	0
Italy	79	7	2	0
Luxembourg	2	3	1	3
Hungary	10,649	1,828	30,391	2,155
North Macedonia	22	0	40	0
Netherlands	43	29	38	17
Germany	23,075	10,663	23,522	11,307
Poland	3	8	12	2
Romania	33	25	122	24
Slovakia	39	3	315	12
Slovenia	48,628	10,495	69,091	12,376
Serbia	20,881	1,891	12,148	1,518
Sweden	96	0	1	1
Switzerland	9,016	2,488	8,982	2,575
Ukraine	2	0	0	0
Other countries	240	47	0	0
Total	135,269	66,859	166,486	69,908

Source: [4]

Table 6 Total annual revenues from passenger transport

Revenues from passenger transport (in thousands of HRK)	2019	2020
Income from passenger transport	699,062	608,874
Revenues from ticket sales	250,462	147,374
1.1. Revenues from inland transport	219,686	135,442
1.1.1. Local and long-distance transport	165,523	98,316
1.1.2. Urban-suburban transport	54,163	37,126
1.2. Revenues from international transport	30,776	11,932
2. Revenue under public service contracts	448,600	461,500

Source: [4]

Table 4 shows the average transport route of passengers in 2019 and 2020 with regard to the total travel route, the travel route in domestic transport and the travel route in international transport.

According to Table 4, the total average passenger transport route was 36.9 km in 2019, while in 2020 it was 34.3 km, which is a decrease of 7.2%. In the same period, the average travel route of passengers in domestic transport decreased by 4.9%, and in international transport by 55.6%.

Table 5 shows the total traffic of passengers in international transport by countries of destination or departure in 2019 and 2020.

According to Table 5, the largest number of passengers in international rail transport in 2020 will go to the Czech Republic, Germany and Slovenia, while in the same year the largest number of passengers comes from the same countries. The biggest decline in passenger traffic in the observed years was experienced by passenger traffic with Slovenia. In 2020, compared to the observed year 2019, the total number of arriving passengers decreased by 58.01%, ie 96.578 passengers, and departure passengers by 50.57%, ie 68.410 passengers.

Passenger transport is the main source of revenue for Croatian Railway Passenger Transport Ltd., so it is important to determine how much loss the company has made due to a significant reduction in the number of passengers who used the services. The total decline in rail passenger traffic was directly reflected in the decline in total revenues from passenger transport activities in the company Croatian Railway Passenger Transport Ltd., and Table 6 shows the total revenues from passenger transport in 2019 and 2020.

According to Table 6, the total revenues of the company Croatian Railway Passenger Transport Ltd. from passenger transport in 2020 compared to the observed 2019 decreased by 12.90%. Revenues from passenger transport in inland transport decreased by 38.35% in the same period, and in international transport by 61.23%. Revenues from passenger transport in local and long-distance transport also decreased by 40.6% in the same period, and in urban-suburban transport by 31.46%. In the observed period, only revenues based on public service contracts increased by 2.88%.

4 Conclusion

To conclude, the appearance of the pandemic COVID-19 significantly affected the overall movement of passengers as well as national and international rail transport. In the Republic of Croatia, the activity of passenger transport in domestic and international railway transport is carried out by the company Croatian Railway Passenger Transport Ltd., therefore the data from their officially published reports were used in the analysis. Based on the conducted research, it can be established that in 2020 there was a

significant decrease in the number of incoming and outgoing passengers in international and national traffic compared to 2019, when the pandemic was not yet present in the observed area. This decrease is a consequence of the suspension of national rail traffic in May and international in April and May 2020. Also, the number of passengers decreased significantly due to restrictive measures that must be adhered to in the remaining months. In the seasonal months, when the measures were eased, there was an increase in the number of passengers, but only in August 2020 the number of passengers in international traffic exceeds the 2019 results. In the remaining summer months, the number of passengers was lower than in 2019, which is a consequence of the presence of fear of a pandemic of foreign travelers.

Furthermore, the COVID-19 pandemic also affects the Croatian Railway Passenger Transport Ltd. business, due to the fact that passenger transport is their main source of revenue. Revenues from passenger transport in inland transport decreased by 38.35% in 2020 compared to the observed 2019, and in international transport by 61.23%.

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