

THE METHODOLOGY OF EVALUATING THE TECHNICAL AND TECHNOLOGICAL PARAMETERS OF THE AVAILABILITY OF INLAND INFRASTRUCTURE

Case study: evaluating of availability of Cargo center Zagreb

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Abstract: *This paper covers the methodology of evaluation the availability of terminals, introducing the criterion of availability. The methodology that was established for this purpose was made on a case study of Cargo center Zagreb. The proposed methodology was evaluated based on four pre-defined technical-technological subcriteria which determine availability.*

Key words: *availability, freight flows, containers, cargo center*

1. INTRODUCTION

In this paper we present a methodology for determining the position of intermodal terminals and cargo center in the real environment. For this purpose, addressed the problem of positioning from the perspective of the needs of the most important seaports in the Republic of Croatia, the port of Rijeka. Technological and logistical base that was used to developed the methodology primarily related to the study of freight flows on the observed traffic route in order to determine the current volume and structure of freight flows and their forecasts.

The analysis does contain a basic element of the proposed methodology, since the aim of examining the technical and technological parameters:

- existing freight flows including transit
- development of transport networks and opportunities to participate on the main road, deep waters of the port terminals, connecting with at least two branches of transport (road and rail)
- impact on the environment
- size of the area planned for the terminal

Based on the analysis of these criteria is described in detail the proposed methodology is further tested for the purpose of determining the position of Cargo center of Zagreb. (CCZ)

2. ANALYSIS OF CURRENT SITUATION OF CARGO FLOWS IN CROATIA AND THE REGION

2.1. The analysis of cargo flows in container transport

To illustrate trends in container traffic can be used data of container traffic in terminal Brajdica. In the port of Rijeka in 2008. was reloaded about 170,000 container units, of which around 23%

shipped by rail. In the year 2009. was a significant decrease in the number of transhipped container units, which indicates the relationship of economic trends in the world (especially in neighboring countries) and the number of transhipped containers. The percentage of containers transported by rail has remained the same, around 25%. It should be emphasized that all the ports in 2009. The recorded fall in the number of transshipped containers, which corroborates the previous hypothesis. If we analyze the period 2001 - 2009. year, then was seen continuous growth in the number transshipped container units in the port of Rijeka, and therefore can be expected upward trend of transshipment of containers at a time when the economy in the surrounding countries that gravitate to the port of Rijeka enters a phase of recovery. This is supported by the European Commission's forecasts for the ports shown in Figure 1 .

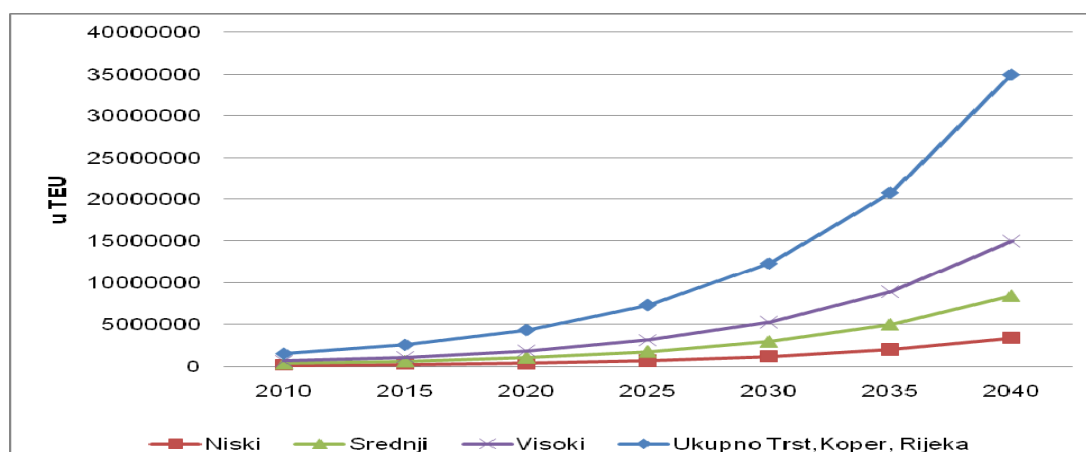


Figure 1: The European Commission's forecasts of container traffic for the ports of northern Adriatic and scenarios for the port of Rijeka (in TEU)

The European Commission, predicted growth in container traffic for the ports of northern Adriatic (Trieste, Koper, Rijeka) could be 11% and in the port of Rijeka could be 17% in the low scenario, 25% in the medium scenario and 25% of growth in high scenario. (Figure 1) .

The analysis of the volume of container traffic in the port of Rijeka and the container terminal Vrapče, it is evident that the fluctuations in the number of containers transhipped at one time and another terminal connected, which supports the hypothesis about the dependence of transport on the container terminal Vrapče with turnover in the port of Rijeka (Figure 2) .

The largest recorded trade port of Rijeka was achieved in 2007. year when reloaded approximately 175,000 container units. That year, the container throughput at the terminal Vrapče reached the highest level of about 17,000 container units. Given that forecasts traffic on the container terminal port of Rijeka is expected to grow to the level of container traffic of about 250,000 container units per year in the next medium term, there is a need to build a container terminal, the background of larger capacity than the existing in Vrapče. In addition, according to all relevant technical assessments container terminal in Vrapče is not suitable for further expansion of the existing location. Therefore, the construction of container terminal at the location of the Cargo Center Zagreb is justified from a technical and technological point of view.

The amount of transshipped containers at the terminal Vrapče from 2002 - 2009. is shown in the table Figure 2. It is evident that the number of containers transshipped to the terminal in 2009. fell to levels in 2006. years. If you take into account the number of manipulated container terminal Vrapče in relation to the port of Rijeka, then we can say that the terminal Vrapče manipulate about 10% of the total number of containers in the port of Rijeka.

If we consider the empirical data on which the traffic of containers at the terminal Vrapče 90% related to the port of Rijeka, one can draw a clear relationship between the future prediction of the movement of cargo in the port of Rijeka and the need for terminal facilities Vrapče or potential container terminal in the Cargo the center of Zagreb.

Table 2: Operation of Container Terminal Vrapče

	2001	2002	2003	2004	2005	2006	2007	2008	2009
TEU	4.988	5.939	5.538	8.520	10.947	14.271	18.412	17.009	12.087
%		18,98%	-7,24%	53,84%	28,48%	30,37%	29,02%	-8,25%	-28,93%

3. CRITERION OF AVAILABILITY (AS A FUNCTION OF DETERMINING GRAVITY ZONE OF LOGISTICS CENTER)

For a more detailed definition of the gravitational zone of each logistics - the distribution center can be used by different criteria, depending on the purpose and role of logistics - the distribution center in the system of distribution. Based on a research conducted for the purpose of positioning CC Zagreb proposes the introduction of a new group of technological criteria called criterion of availability. This criterion consists of four sub-criteria presented in Table 3.

Table 3: Overview of sub-criteria

Sub-criteria which determine the criterion of availability	
1.	<i>Current freight flows including transit</i>
2.	<i>Development of transport networks and possibility to include in the the main roads, the depth of aquatorium the port terminals, connecting with at least two mode of transport (road and rail)</i>
3.	<i>Impact on the environment</i>
4.	<i>The size of area provided for terminal.</i>

Source: Made by authors

3.1. Existing freight flows (structure)

In traffic-technological point of view to implement these concepts for gravitational zone of Cargo Center Zagreb, the key agents of commodity flows are road, rail, intermodal and maritime transport as a carrier of the freight flow to endpoint of major transport corridors taken into consideration.

Defining gravitational zone according to the criterion of commodity flows were performed according to the processed data collected on the movement of goods flows, which are further outlined in the previous chapter.

The structure of the existing cargo flows in the railway industry can be further clarify the importance of airports that are significant generators of commodity flows to these rail corridors. To illustrate the before mentioned will be taken before all the following facts related to the realized work of the port of Rijeka as the endpoint of gravitational zone of the city of Zagreb in the period since 2000. - 2008. year. In the last nine years, total turnover increased by 197% higher. In figures this means that in 2008. were reloaded 3.5 million tons of cargo more than the total turnover in 2000 (Table 2).

Table 2: Overview of the realized turnover port of Rijeka in the period 2000th - 2008

TYPE OF CARGO	1. 2000.	2. 2001.	3. 2002.	4. 2003.	5. 2004.	6. 2005.	7. 2006.	8. 2007.	9. 2008.	INDE X 9 : 10
TOTAL[t]	2.569. 30	2.906.4 1	2.726.5 0	3.571.9 8	4.663.0 7	4.867.7 2	5.000.8 8	5.646.7 4	6.055.9 5	236
TEU	8.925	12.711	14.695	28.205	60.168	76.258	94.390	145.040	168.76 1	/

Source: www.dzs.hr

Expanding the gravitational zone of the Rijeka port, and thus the gravitational zone of Cargo Center Zagreb can expect more intensive transport of containers to the countries of Central Europe, and German and Polish, and increased number of shipping lines to Asia and the node container ports in the Mediterranean.

3.2. Development of transport networks and possibility to include in the the main roads, the depth of aquatorium the port terminals, connecting with at least two mode of transport (road and rail)

One of the limiting or even a stimulating factors in defining the gravitational zone of each logistic distribution center is definitely the condition of transport infrastructure.

Total length of roads in the Republic of Croatia is 29.472.5 km (main, regional, local), than that 1523 km of highways and 2256 km E-roads. Croatia has a 23 km highway/100.000 population and EU countries have a 14 km highway/100.000 population. Even 75% of the total investment was invested in the highway Zagreb - Split, which is not part of any European traffic corridors.

All strategic documents of EU defined rail transport subsystem as a the main carrier of current and future intermodal transport chains, to define the gravitational zone of railway operators need to process additional criteria. Additional criteria are related to the analysis of technical compatibility of railway systems. The technical compatibility is one of the prerequisites for increasing traffic capacity of railway systems and their competitiveness relative to other transport sectors.

Internal organizational shifts (choice of transport, types of locomotives, etc.) by the railway operator can achieve a better utilization of existing infrastructure and transport large quantities of cargo. Thus it is possible to extend the gravity zone, the ability to attract and processing large amounts of cargo flows to infrastructure nominally equal capacity.

According to the structure of commodity flows at the mode of transport, most goods are transported by road,

The port of Rijeka is crucial maritime links to new Cargo Centre Zagreb. In the previous sections are shown the features of commodity flows, gravitational zone, the structure of goods and characteristics of the Rijeka port connectivity with the hinterland. The operating depth of the port of Rijeka has not taken by now as a limiting factor in business as an element that significantly affects the ability to accommodate ships. According to available data, the depth along the quay of the Rijeka port can be 12-18m (at the container terminal depth is 12m), which in practice allows the docking of large container ships with capacity up to 6000 TEU. The depth is not enough to accept the largest container ships, which are the requirements for depth of 12.5 m for Post Panamax ships with 6000 TEU capacity and more than 16 m depth for mega container ships.

3.3. Impact on the environment

Evaluating the environmental impact of transport on the environment is one of the possible criteria to evaluate transport services. In addition, the impact of transport activities on the environment and cause a change in the conception and implementation of transportation systems that have minimal negative effects on the environment. The biggest sources of negative environmental impacts are exhaust gases generated by combustion of fuels, while road transport is one of the largest polluters if one looks at the amount of emissions per tonne of transported cargo.

The next source of pollution is the level of noise. These sources are considered and a noise caused by the action of means of transportation. They are especially important sources of noise heavy trucks, vans, airplanes, railways, etc. That is reason to limitation of movement of heavy trucks in urban areas during night and holidays, and restricting the movement of heavy trucks in residential areas.

Ecological impact of transport on the environment and indirect costs incurred as a result of this, one of the reasons that influence the creation of measures and the environments in which we want to in some way diminish the share of road transport in total transport of goods.

3.4. The size of area provided for terminal

The size of area provided for terminal depends on two key parameters. One relates to the purpose and role of the new terminal on the network in terms of logistics and distribution. The second element relates to the identification of technological processes of transport and processing of goods in this terminal. We will presented these elements on the example of the new Cargo Center Zagreb.

4. EVALUATION OF LOCATIONS OF CARGO ZAGREB BASED BY CRITERION OF AVAILABILITY

4.1. Rating locations Cargo Centre Zagreb by criterion of freight flows

The recovery of container transportation in the port of Rijeka began at a late of last century and since then the container transport recorded a steady growth until 2008. year. While the volume of container transportation in the last two years, slightly lower than in the previous period, it is at a level of about 130,000 container units per year (a more detailed view of the container traffic is given in Chapter 2). There are different projections of container traffic in the Port Rijeka in the future. For the purposes of this study was taken as the relevant European Commission's forecasts, which show more detail in Chapter 2. If we add to these forecasts, the expected flow of containers from the Cargo Center Graz, which is one of the shareholders of Cargo Centre Zagreb, and it and its strategic partner, we can make a forecast turnover Cargo Centre Zagreb in the next medium term. These forecasts show that the target volume of first phase of container terminal CC Zagreb between 28,000 TEU and 36,000 TEU per year by 2018. year. Since the construction of the terminal requires a certain reserve capacity in the first phase of the container terminal would have a capacity of 45,000 TEU per year. The second phase of construction of the terminal depends on movements and trends in container traffic after the 2018th , but assuming the traffic in the port of Rijeka of 500.000TEU per year and other synergy effects can be predicted traffic of 90,000 TEU per year. Accordingly, the target capacity of the terminal would be about 100,000 TEU in the second phase of construction.

4.2. Rating locations Cargo Centre Zagreb by criterion development of related transport infrastructure

Transportation possibilities and connection of Zagreb traffic junction with the rest of Croatian and neighboring countries is in a satisfactory technical and technological level. The general assessment is that the level of transport infrastructure satisfies needs of logistic - distribution center in Zagreb. If you are considering transportation connections of micro location in area Dugo Selo, it should be noted that the proposed location connected with the highway through the county road and that due to the technical features of the route and distance from the highway can satisfied the transportation needs in the near future. The proposed locations can connect with the railway network which allows the application of intermodal transport technologies and is directly connected to CC

Zagreb in intermodal flows of goods. This is especially important if we consider the potentials of container transportation and the ability to organize and accept RO-LA trains (Huckepack technology).

4.3. Rating locations Cargo Centre Zagreb by criterion environmentally friendly

This location is outside of the urban area, which includes the dominant eco-friendly transport of cargo by rail, in ecological terms is the most acceptable variant for the realization of this project.

4.4. Rating locations Cargo Centre Zagreb by criterion size of area provided for terminal

Logistics area of the Cargo Centre Zagreb can be divided into two categories: the surface of the primary logistics activities and areas for additional activities. Primary logistics areas include facilities for logistics services, including storage, disposal area for containers and Ro-La terminal. The additional facilities include all activities additional to the primary service of terminal: the customs service, veterinary supervision, workshops for the repair and maintenance of containers, garages, restaurants, accommodation, insurance services, power facilities, etc. In addition to the container terminal is planned to realize rail tracks for the trucks, and Ro - La trains. Such configuration of the railroad part for terminal takes a total of 194,331 m² of space, which represents 24% of the total area of Cargo Centre Zagreb.

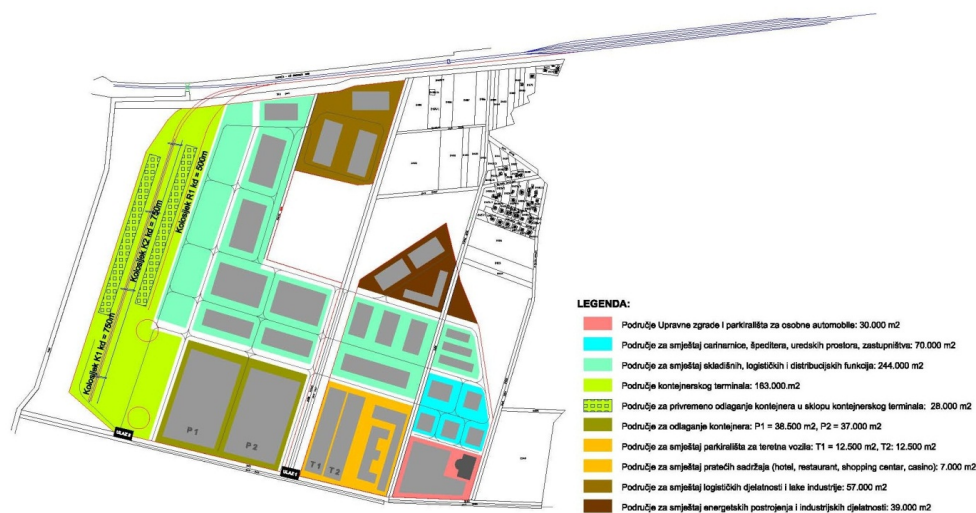


Figure 3: Display area for future Cargo Centre Zagreb with the details of the logistics area

CONCLUSION

Using proposed methodology, we evaluated the position of CC Zagreb reasonable, based on technological parameters of accessibility, which is a defined sub-criteria proved crucial in the evaluation. Such methodology covers all relevant criteria, which will be taking into account the forecast growth in traffic and in accordance with the time and provided space for expansion of the terminal, to enable the functionality of the terminal for an extended period, a time and cost investments envisaged.

In addition, in line with EU transport policy is the decision in the case of railways has been recognized as an environmentally friendly form of transport and therefore the greater the amount of traffic trying to focus on railways, in order to relieve road and reach the largest possible impacts associated with energy saving and environmental protection. In order to succeed in the Republic of Croatia, it is necessary to transform the rail system, which is unable to compete with other transport sectors

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МЕТОДИКА ЗА ОЦЕНКА НА ТЕХНИЧЕСКИ И ТЕХНОЛОГИЧНИ ПАРАМЕТРИ ЗА ГОТОВНОСТТА НА ВЪТРЕШНАТА СУХОПЪТНА ИНФРАСТРУКТУРА

Исследователски казус: оценка на готовността на Карго центъра в Загреб

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Ключови думи: готовност, товарни потоци, контейнери, карго център.

Резюме: Този доклад обхваща методологията за оценка на готовността на терминали чрез въвеждане на критерия за готовност. Методологията, създадена за тази цел, бе приложена за казуса за Карго центъра в Загреб. Предложената методология е оценена въз основа на четири предварително определени технико-технологични подкритерии, които определят готовността.