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Integrated Development Model for the Zadar Port System

Abstract

The Zadar Port System includes a series of ports and harbours of both the local and county importance, as well as of the national strategic importance. Year after year it has been recording good results in all its elements. However, it should be noted that the most significant growth has been recorded in sectors of nautical tourism and fisheries. Due to limited capacities and the recorded growth of the annual turnover in all the fields, the tendency is to develop the Zadar port system by improving any existing services and expanding by adding new ones. The aim is the integration into the system through diversification of services and enhancement of competitiveness on both the domestic and international markets.
This paper has examined the status of existing infrastructure, traffic connections, yearly turnover and strategies for the future development that are meant to serve the purpose of enhancing competitiveness through the concept of integrating all the elements into the whole with the aim of ensuring unlimited possibilities of future development with regard to the geographical position and the needs of future users.

Key words: the Zadar Port System, elements of the Zadar Port System, development model of the Zadar Port System.

1. Introduction

The construction of the new passenger port, the quay apron of the new fishing port, and the activation of the liquid cargo terminal are just some of the elements that should enable diversity in providing services in the Zadar Port System. The Port of Gaženica, as the most developed element of the port system, is situated in the vicinity of all the modes of transport (road, air and rail) and as such it represents the economic and transport centre of northern Dalmatia and parts of Lika. All this is of the utmost significance for the development of the Zadar Port System. The geostrategic location and the annual turnover growth in all the elements of the port system have resulted in enlarging the existent infrastructure and defining the need for new terminals, thus changing and affecting the organizational structure.

The expansion of the Port of Gaženica has been the most important infrastructure project for the Zadar port system in the recent period. The project "New Port Zadar" has included the relocation of the ferry terminal from the historic centre of Zadar and construction of the new passenger port on other location, in Gaženica. The port and the provisional terminal building were opened in April 2015 for all domestic ferries, cruise ships and, as of the beginning of July 2015, for international ferries [16]. Apart from the ferry terminal, there is also a fishing terminal with the new operational quay, while the rest of the project has been planned to be financed by foreign investments.

This paper will present the existing infrastructure, transport connections and traffic in the Zadar Port System. It will also present the strategy for its future development which should put it side by side to Rijeka, the most developed port system in the Republic of Croatia.

2. State of current infrastructure

According to the *Maritime Domain and Seaports Act* and *the Ordinance on Classification and Categorisation of Ports Opened for Public Traffic and Special Ports (Official Gazette, 110/2004, 82/2007)*, the ports of special (international) economic interest for the Republic of Croatia in the area of Zadar Port System are:

- *Old city port* with its 11 berths. Their primary purpose is berthing and carriage of passengers and cargo in the international, local and tourist traffic. The berth length varies from 61.5 metres of the smallest one to 174.7 metres of the longest one. The average depth is 8.5 metres [17],
- *Passenger port Gaženica,* opened for all traffic in April 2015, is situated 3.5 kilometres south of the city centre. The existing infrastructure and supra-structure include completely finished berths and breakwaters, temporary terminal building and the accompanying departure hall. The new port has 12 berths, 5 international and 7 domestic ones, with depths from 7 to 13 metres and the quay length ranging from 100 to 375 metres [12],
- *Cargo port Gaženica*, is in the industrial and commercial area extending from Bregdetti Bay - Arbanasi to the small town of Bibinje in the vicinity of the passenger port. In terms of organization, this location is divided in two main areas, namely:
    1. The area between the road D8 (Jadranska magistrala) and the railway line. In this area there are Agrokor complex (Sojara), Kepol-terminal Ltd silos, The Port of Zadar, Tankerkomerc and a number of smaller users.
    2. The area below the railway and the maritime zone are predominantly state owned and are administered by Zadar Port Authorities. In this area there are storages for oil products (Tankomerc) and for chemicals, and cargo loading/unloading facilities on the existing piers (Sojara), pumping plants for fuel and chemicals and other smaller facilities [7],

- *Fishing port Vela Lamjana* is situated in the Vela Lamjana Bay on the island of Ugljan. It is used solely for berthing since the existing infrastructure is insufficient to be fully operable [15].

Apart from ports of a particular (international) economic importance for the Republic of Croatia, the Zadar Port System includes 8 ports of the County importance [9] which have been opened for public traffic as well. These are: Preko, Brbinj, Silba, Zaglav, Biograd, Tkon, Fortica, Pag. There are also 68 ports of local importance [10].

Special purpose ports in the area of the Zadar Port System:

- *Shipyard port Vela Lamjana* is located on the island of Pag in the small bay of Vela Lamjana and is a part of the fishing port. The shipyard occupies the area of 190,000 square metres. It has all the necessary infrastructure for docking survey of ships up to 300 GT, drilling platforms and off-shore objects [1],
- *The port of Gaženica – Tankerkomerc/Kepol* is a liquid cargo terminal with the wharf length of 60 metres and capacity to accommodate ships up to 190 metres long, 12 meters draught and up to 40,000 DWT [23],
- *The port of Gaženica - Sojara* is a bulk terminal situated on Pier 3. The terminal includes 140 metres long quay with the depth of 12 metres and capacity to accommodate ships of up to 80,000 DWT [24],
- *Ports of nautical tourism;* according to the "Travel and Tourism Act" (Official Gazette, 8/96, 19/96 and 76/98) and the Ordinance on Classification and Categorisation of Nautical Ports (Official Gazette, 142/99, 47/00, 121/00, 45/01 and 108/01) there are 22 anchorages, 2 berths, 4 dry marinas, 4 II-category marinas and 4 III-category marinas in the area of the Zadar Port System.

Analyzing the displayed data, it is evident that the Zadar port system has a number of strategic components that will further mark the competitor's position with further development.

3. Transport connections

With its location in the centre of the north-east part of the Adriatic coast, Zadar is an ideal transport link to overseas countries, not only of Croatia, but of central European countries as well. The sea routes of the Zadar County connect all the elements of the Zadar Port System and are the approaching routes from the open Adriatic or coastal lines.

The land traffic infrastructure consists of the road and railway routes. The Motorway A1 is the main connection of the Croatian south with the capital city of Zagreb and, indirectly, with all parts of Croatia and neighbouring countries. The Port of Gaženica, as well as other elements of the Zadar Port System, is connected directly to A1 Motorway through D424, a 17.6 kilometres long motorway with two traffic lanes

in either direction, with no crossings and traffic lights and practically leads directly to the coast. On the 12th kilometre of the motorway there is a slip road to the Zadar airport which can accommodate all types of passenger or cargo aircrafts. Thus, the entire road transport, regarding the existing and future port facilities, can be carried out without any congestions or obstructions:

- passenger transport from the passenger terminal and cruise port by car, taxi and coach;
- truck transport from RO-RO and container terminal
- truck transport of liquid and bulk cargo from cargo terminal, oil products storages and bulk cargo silos;
- truck transport of fresh fish from the fishing port [7].

The integration into the Croatian and European railway networks is currently the weakest link of the Port's intermodal junction. Zadar and its transit port were connected with Knin to the already existing transversal Split-Zagreb back in 1967. The Croatian railway network consists of two main routes that have been used for the transport of passengers and cargo: the Lika railway track, connecting Knin with Ostarije, i.e. with the frequent route Rijeka-Zagreb and the Una railway track, connecting Zagreb with Vinkovci and onwards with Belgrade. Both routes, due to the terrain configuration, have certain restrictions regarding the speed and axial load.

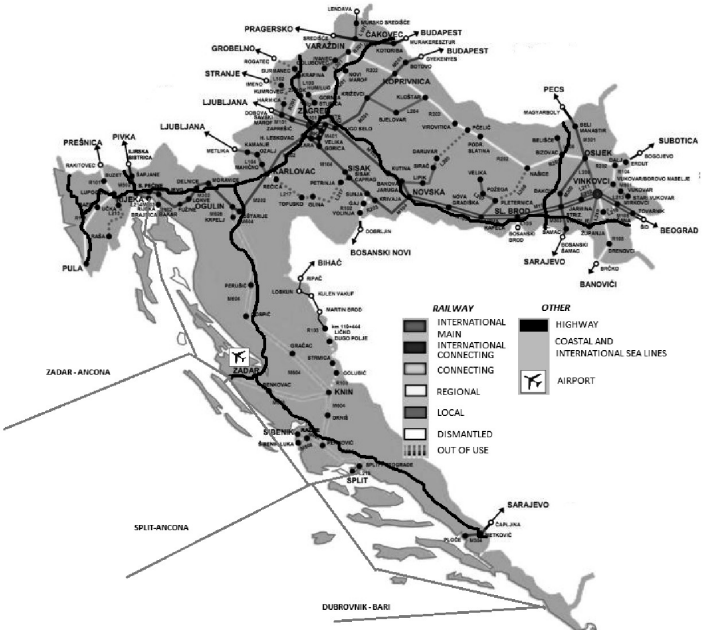

Figure 1 - Transport connections of the Zadar Port System [authors]

Throughout the decades prior to the Croatian War of Independence, 1991-1995, the Una railway-track had been more used due to higher average speeds of trains and due to a great number of users of transport services who gravitated to the Bosnian railway-track section.

During that period the railway was of great importance for the operation and development of the Zadar transit port. Therefore, several industrial gauge railways were built, connecting directly the plants, warehouses and liquid cargo tanks.

Analyzing the above, it can be clearly concluded that the full development of the Zadar port system and, thereby, the Port of Gaženica as the most important intermodal junction, is possible through the re-establishment of the traffic between Zadar and Knin. The revitalization and modernization of the Una railway-track is desirable as well, and this requires the engagement of both countries, especially with the fact taken into consideration that this route crosses the border between Croatia and Bosnia and Herzegovina at multiple points [7].

4. Traffic in the area of the Zadar port system

An analysis of the overall domestic traffic of passengers and vehicles in the area of the Zadar Port System, including both, the Old City Port and the Port of Gaženica for the period from 2010 to 2016, makes it evident that the traffic increased in 2016 as opposed to 2014 when the traffic of passengers was lowest. At the same time, the traffic of vehicles increased and in 2016 it was by 20% larger in comparison to the somewhat constant traffic between 2010 and 2013.

Table 1 Domestic traffic of passengers and vehicles for the period from 2010 to 2016 [18]

Year	2010	2011	2012	2013	2014	2015	2016
Passengers	2,362.054	2,349,575	2,321,836	2,367,215	2,080,811	2,156,480	2,237,810
Vehicles	312,939	314,828	312,908	319,251	339,758	360,474	397,542

An analysis of the international traffic of passengers in the area of the Zadar Port System, i.e. in the Old City Port and the Port of Gaženica, clearly shows a significant decrease of passenger traffic by about 50% in the period from 2010 to 2016. It should be mentioned that the international ferry line Ancona – Zadar did not operate during the first three months of 2010. The international traffic of vehicles was decreasing constantly by more than 60% in the period from 2010 to 2016 (Table 2).

Table 2 International traffic of passengers and vehicles for the period from 2010 to 2016 [18]

Year	2010	2011	2012	2013	2014	2015	2016
Passengers	73,880	61,112	47,434	38,626	42,406	33,215	30,637
Vehicles	14,319	15,174	9,623	6,658	7,354	5,580	5,496

The reconstruction of the "Istarska obala" on the Zadar peninsula in 2004, i.e. the reconstruction of Berth 1b, opened the possibilities for larger ship calls on international cruising voyages. Thus, the average number of calls in the period from 2010 to 2014 was 71.

The relocation of the international passenger traffic to the new port of Gaženica and the extension of berthing capacities opened the port for berthing of larger ships and for multiple berthing at the same time. Thereby the number of calls of ships on international cruising trips was increased by almost 40%.

Table 3 Calls of ships on international cruising trips for the period from 213 to 2016 [18]

Year	2010	2011	2012	2013	2014	2015	2016
Calls	80	72	57	69	77	92	114
Passengers	17,157	28,677	20,958	33,647	53,791	70,366	136,462

The local ferry traffic was constantly increasing, although the line Gaženica-Ošljak-Preko carried fewer passengers by approximately 600 thousand due to the splitting of the line into the passenger and the ferry line, while other lines recorded an annual increase in the carriage of passengers and vehicles.

Table 4 Local ferry traffic for the period from 2014 to 2016 [19, 20]

Line	Passengers			Vehicles		
	2014	2015	2016	2014	2015	2016
Gaženica-Ist-Silba-Olib-Premuda-M.Lošinj	28,852	30,592	34,090	7,415	7,749	8,363
Gaženica-Ošljak-Preko	1,645,921	1,068,266	992,985	261,368	276,415	308,346
Gaženica-Rivanj-Sestrunj-Zverinac-Molat-Ist	19,025	17,653	19,267	4,708	5,098	5,524
Gaženica-Brbinj	161,478	165,589	177,320	56,937	61,014	63,997
Gaženica-Bršanj-Rava	29.390	31,705	35,308	9,458	10,213	11,310

High speed lines and local lines had recorded a constant increase in the number of passengers on all lines from 2014 to 2016, as displayed in the Table below. Due to that, the national high speed line „Olib-Silba-Premuda-Zadar", that had recorded an annual decrease by 5% in the number of passengers, was excluded.

Table 5 High speed traffic and local lines traffic for the period from 2014 to 2016 [19, 20]

Lines (high speed)	Passengers			Lines (ferries)	Passengers		
	2014	2015	2016		2014	2015	2016
Brbinj-Božava-Zverinac-Sestrunj-Rivanj-Zadar	27,049	36,949	37,581	Rava-Iž-Zadar	48,422	50,585	47,104
Zadar-Iž-Rava	28,829	29,546	29,404	Sali-Zaglav-Zadar	29,813	29,333	32,344
Zadar-Sali-Zaglav-Bršanj	88,282	93,958	95,270	Zadar-Preko	-	497,392	635,960
Olib-Silba-Premuda-Zadar	63,935	58,694	59,587				
Ist-Molat-Zadar	40,056	40.699	41,590				

Luka Zadar (The Port of Zadar) is the foremost concessionaire of port quays, while warehouses are operated by various concession holders: Tankerkomerc in bankruptcy – storages for oil products Kepol - VMC tanks, Sojara – bulk cargo storages, Luka Zadar – general cargo storages.

In the period from 2010 to 2013, as presented in the Table below, the total volume of cargo turnover in the Cargo Port Gaženica was decreasing, the lowest having been recorded in the beginning of 2011, when the cargo volume decreased by almost 50%. This had a significant impact on Tankerkomerc and resulted in bankruptcy and breaking of the business cooperation contract with INA Ltd.

In the period from 2014 to 2016, there was a slight decrease of the cargo turnover volume, due to the increase of the liquid cargo turnover volume in 2016, when the former Tankerkomerc liquid cargo infrastructure was sold to and put into operation by Crodux Ltd.

Table 6 Cargo Turnover in the Port of Gaženica from 2010 to 2016 [18]

Year	2010	2011	2012	2013	2014	2015	2016
Liquid	364.432	229.448	188.950	4.583	44.242	1.382	60.908
Bulk	224.596	78.739	44.032	110.597	157.404	131.679	153.653
General	18.126	22.049	19.600	29.693	16.761	22.930	22.930
Containers	0	0	0	0	0	0	0
Total	607.154	330.236	252.582	144.873	218.407	155.991	233.346

The Zadar Port System has a well developed system of nautical ports, with the capacity of 3,966 moorings and 881 dry berths. By comparing this number of moorings with the number of nautical ports in Croatia (139 nautical ports and 17428 moorings in 2016), it becomes evident that the nautical infrastructure in the Zadar County makes almost 20% of the overall nautical infrastructure in the Republic of Croatia.

The remarkable potential of nautical ports in the area of the Zadar Port System is evident in figures as well. Namely, the number of nautical ports increased and the number of anchorages was increasing annually by almost 50% from 2013 to 2016. That was a considerable capacity increase, although there was not one I-category marina, i.e. which complies with the highest standard in respect of available facilities at disposal.

According to statistics, the number of permanently moored vessels and those in transit in the area of the Zadar Port System has been increasing constantly as well as the interest for nautical ports. The best evidence supporting this trend was the number of vessels in transit that used sea moorings, although the number was slightly smaller than in the record year of 2015.

Table 7 The number of permanently moored vessels and vessels in transit in the nautical port within the Zadar Port System [3-6]

Permanently moored vessels					Vessels in transit			
Year	2013	2014	2015	2016	2013	2014	2015	2016
Vessels that used sea moorings								
Total	2,605	2,597	2,565	2,457	34,371	32,170	38,733	34,424
Motor yachts	1,221	1,175	1,105	1,090	14,439	13,578	18,394	12,687
Sailboats	1,342	1,378	1,423	1,327	19,712	18,412	19,913	20,946
Other	42	44	37	40	220	180	426	791
Vessels that used land berths								
Total	338	364	312	253	3,253	3,170	2,750	132
Motor yachts	213	237	207	162	2,314	2,121	1,887	111
Sailboats	119	78	69	53	939	1,049	863	21
Other	6	49	36	38	-	-	-	-

Apart from passenger, cargo, tourism and nautical components, the fishery sector in the area of the Zadar Port System represents one of the most important strategic and economic interests.

Small pelagic fish is most represented in the quantity caught while the most important landing locations are Zadar, Vela Lamjana (Kali) and Biograd.

In 2014, the largest catches landed in the Zadar County were in Kali – Vela Lamjana, 8,682 tonnes of fish, Zadar (Adria, Gaženica, Foša) – 10,118 tonnes of fish and Biograd mole – 4,098 tonnes of fish. In 2014, the overall catch in the Zadar County was 30,873 tonnes, and in the Republic of Croatia, 79,414 tonnes of fish [13]. According to the data provided by the Croatian Chamber of Commerce for Zadar, there was a decrease in total catches. In 2015, total catches of fish landed were 23,000 tonnes and 25,000 tonnes in 2016.

An analysis of the realized turnover of passengers and goods in the area of the Zadar port system shows that it has had the total annual growth of turnover rate, which is primarily related to nautical tourism and liner carriage of passengers and vehicles. Due to the current infrastructure situation and the development projects implementation rate, it can be clearly concluded that the planned integration of the port system and the development of the port system will increase the turnover rate of passengers and goods, whereby considerable investments will be justified.

5. The Zadar Port System development model

The high capacity utilization rate of all the elements of the Zadar Port System, accompanied by multiyear turnover growth have resulted in further development, comprising the improvement of existing facilities and introduction of new ones designed to maintain competitiveness and to satisfy future needs and requirements.

For this reason, in 2009 a model was developed through which several projects have been launched with the aim of integrating the port system as a whole, with a view to achieving an even development of all the elements, but also to achieving a greater degree of competitiveness and stratification of services offered. As a product of the mentioned model of 2009, a project called the "New Port of Zadar" was launched which included the relocation of the ferry terminal from the historic centre of Zadar and the construction of the new passenger port on another location, in Gaženica, in the vicinity of the cargo port, 3.5 kilometres south of the city centre, with a direct access to the motorway, railway and airport. The port and the provisional terminal building were opened in April 2015 for all domestic ferries, cruise ships and, as from the beginning of July 2015, for international ferries [16].

The statistics mentioned in former chapters have revealed a constant growth of passenger turnover rate both on local and international lines in the area of the Zadar Port System. In the last few years the turnover exceeded the number of 2 million passengers.

The multiyear growth of the passenger turnover on local and international lines and the growth of the vehicle turnover have resulted in the construction of the passenger terminal in the Port of Gaženica which started on 1st September 2016, as an extension of the "New Zadar Port" project.

The port is expected to be finished and fully operational by 1 December 2017. The terminal will occupy approximately 24,000 square metres of useful area, with the domestic traffic terminal and cruise ships terminal comprising a 178 metres long skyway leading to the berth. The net value of the construction is 24.7 million euro [14].

Figure 2 - Future passenger terminal building Gaženica [2]

As an addition to the original project of the "New Port of Zadar", the construction of the container terminal has been planned as well. There are several economic reasons justifying the investment:

- the potential market of the new container terminal could be determined by the Zadar County and the new Crno business zone facilities, or by the turnover to be generated by the international trade with neighbouring countries of central and southeast Europe,
- a disproportion between the future larger container turnover volume in NE Adriatic container terminals and designed capacities of these terminals (except for the new container terminal in Zadar) are likely to attract the container traffic towards Zadar,
- road and sea distances are significantly shorter then via North European ports which could result in shorter transport time and lower transport costs.

The implementation of the project has been planned in 11 phases, each one defined by respective Location Permits to be carried out one by one, depending on the needs. All basic elements relevant for the basic terminal operation will be built through the first 5 phases. These include: construction of waterfront walls, deepening of the quay to the depth of 10 to 18 metres, earthworks on the overall surface, northern and southern plateau up to the level +3.00, road entrance/exit points, parking area and all installations. The remaining 6 phases will include: construction of enclosed storages, service complex, railway gauge, and slip road with a connection to the traffic circle and D424 motorway Gaženica-Zadar 2. The estimated value of this phase amounts to approximately 35 million euro [7].

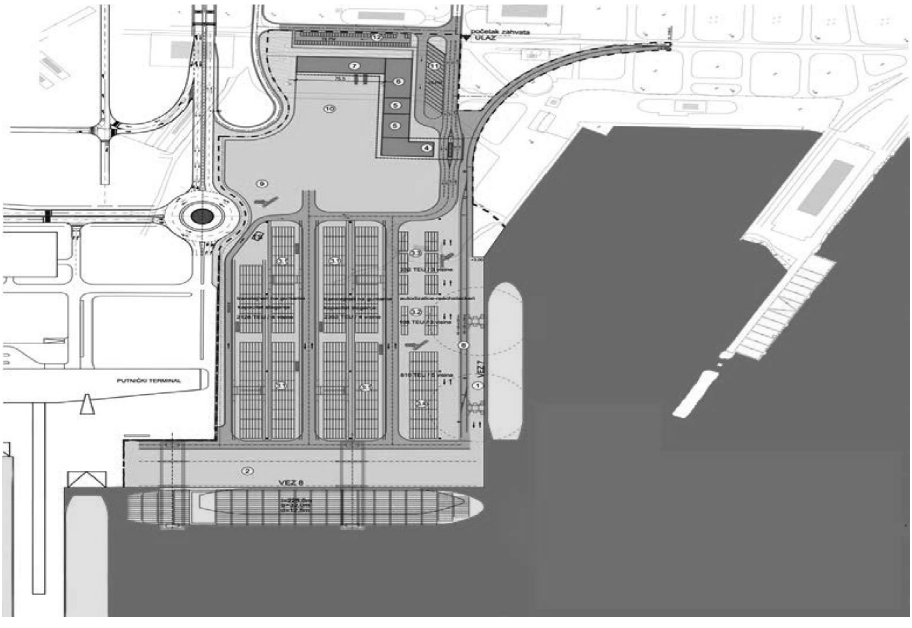

Figure 3 - Future container terminal in the Port of Gaženica [2]

The growth of nautical tourism in the Zadar County has shown the need for the enlargement of the number of available moorings, i.e. construction of new moorings and extension of existing marinas that have not changed significantly in recent years either in number or capacity, according to the information provided by the Croatian Bureau of Statistics. The income realised in nautical ports has been growing each year and in 2016 it amounted to almost 159 million HRK, thus representing a significant financial component for the Zadar region [6].

As a result of insufficient accommodation capacity of nautical ports in the area of the Zadar Port System and insufficient exploitation of the Zadar nautical tourism potential, the project "Jazine – a nautical tourism port" has been introduced. The idea of the project is to develop Jazine as a nautical port with 200 moorings, berths for mega yachts, over 400 permanent moorings, 150 metres long glass pavilions with exhibition areas along the coast and a new city bridge 30 metres wide, to serve as a square above the sea, with a promenade, aquarium and an undersea elevator for pedestrians. This investment has been estimated at about 15 million euro [8]. Jazine as a port for nautical tourism is still an idea, a project waiting for potential investors. Besides, it is the path that would classify Zadar as a port for nautical tourism, putting it side by side with the most prominent nautical destinations such as Monte Carlo, Nice, etc.

Figure 4 - Concept design of the nautical port Jazine [8]

Apart from passenger, cargo, tourist and nautical components, the fishery sector in the Zadar County represents one of the most important strategic and economic components. The important role of the Zadar County fishery, especially in respect of small pelagic fish catch, fish processing and mariculture, determines the importance of its development on a national level. By introducing the Integrated Coastal Zone Management in 2003, the Zadar County recognized the needs, giving the priority to the coastal structure development for the needs of fishery.

In accordance with the spatial planning process, the fishing port had been planned in the area of the Zadar-Adria landing place, in the vicinity of the ferry port Gaženica. Currently, most of fish has been discharged on the completed operational quay within the future fishing port, in the west part of the ferry port Gaženica and in the vicinity of the Cromaris processing facility.

The Zadar Port Authority has announced a public tender for the concession on the fishing port in Gaženica, the subject of the concession being commercial exploitation of the maritime domain for the construction and use of facilities of the fishing port in the area of the Port of Gaženica, Zadar. Accommodation, maintenance of fishing vessels, fishing gear and equipment, discharging, transfer and storage of fish and other marine organisms or their products from the commercial fishing are basic commercial activities planned for the area to be put under concession along with other corresponding activities (manufacturing and selling of fishing equipment, fishing gear services, catering, etc.). The area tendered for concession covers 11,891 square metres of land area in the southwest part of the Port of Gaženica, Zadar [13].

Figure 5 - The envisaged construction area for the fishing port and container terminal in the Port of Gaženica [authors]

6. Conclusion

This paper clearly presents strategic components important for the improvement and development of the Zadar Port System, such as storage capacity or the superior terminal for the coastal distribution of oil products.

Besides, the ferry port of Zadar is closest to Ancona on the neighbouring Italian coast. Upon completion of the passenger terminal in the new port, advantages of its geographical position will come ahead as it will be less congested and closer to the northern Croatia and other points of departure or destination.

The revitalization of the railway, which used to be the main connection for overseas cargos in the past decades, the construction of the new container terminal and fishing port, the extension of nautical port capacities, with the integration of all the elements of the system as a whole, will enable the port to achieve an exceptional competitiveness as well as the complexity of the supply on the market and an even development of the entire system.

Based on the above mentioned, it can be clearly concluded that by integrating and realizing the mentioned projects the Zadar port system will become the backbone of the Zadar economy, which will place it in economic terms in the category of justified investments.

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Model integriranog razvitka lučkog sustava Zadar

Sažetak

Lučki sustav Zadar obuhvaća niz luka i lučica od lokalnog i županijskog te državnog strateškog značaja. Iz godine u godinu isti bilježi zavidne rezultate od strane svih elemenata, pri čemu treba istaknuti da najznačajniji rast bilježi nautički turizam, te ribarski sektor. S obzirom na ograničenost kapaciteta, te rast godišnjeg ostvarenog prometa na svim poljima, tendencija razvoja lučkog sustava Zadar upravo ide u smjeru poboljšanja postojećih usluga, te proširenja novim sadržajima kako bi se isti integrirao u cjelinu te kroz slojevitiji oblik usluga povećala konkurentnost na domaćem i stranom tržištu.
U ovom radu istraženo je postojeće infrastrukturno stanje, prometna povezanost, ostvareni godišnji promet, te strategija budućeg razvoja, čija je svrha povećanje konkurentnosti, koristivši koncept integriranja svih sastavnih elemenata u cjelinu, sa ciljem sadržanim u osiguranju neograničenih mogućnosti razvoja s obzirom na geografsku poziciju te potrebe budućih korisnika.

Ključne riječi: lučki sustav Zadar, elementi lučkog sustava Zadar, model razvoja lučkog sustava Zadar.