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Source / Izvornik: **Transactions on Maritime Science, 2023, 12, 1 - 10**

Journal article, Published version
Rad u časopisu, Objavljena verzija rada (izdavačev PDF)

https://doi.org/10.7225/toms.v12.n01.w04

Permanent link / Trajna poveznica: https://urn.nsk.hr/urn:nbn:hr:191:797605

Environmental Requirements for Passenger Terminal Development (Case Study of Zadar County)

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Cruising as part of nautical tourism is an important segment of maritime passenger transportation. Nautical tourism and cruise tourism have developed over the years and are experiencing increasing demand, with the exception of the pandemic period, when cruise tourism did not experience positive trends. In normal tourism conditions, high growth requires an increase in supply, which can have negative consequences for the environment. This is especially true when the destination where cruise tourism is developing has a fragile ecosystem. At a time when environmental sustainability and responsibility are becoming increasingly important, tourism supply is implementing the parameters of sustainability in its development, and cruise tourism is no exception. However, the fact is that the development of passenger terminals inevitably changes the view of the coast. The aim of this paper is to thoroughly define the parameters whose reconstruction is necessary for the construction of a passenger terminal and for which it is necessary to analyze the impact on the environment in order to make the construction itself environmentally friendly.

Systematic analysis is the most appropriate method for delineating the parameters whose reconstruction could harm the environment and have negative effects on the sustainability of the ecosystem as well as on tourism and locals in the area.

The results of the analysis conducted on the example of capacity construction in the coastal region of Zadar County show that special consideration must be given to protected natural values, landscape properties, population, purpose and use of space, noise and air.

It can be concluded that disregarding all the construction parameters described in the study and emphasizing the financial benefits could affect the ecosystem in the long run. Besides the analyses, the proposal for the environmental monitoring program was elaborated on in this paper.

KEY WORDS

~ Cruise tourism
~ Maritime ecosystem
~ Sustainable development
~ Zadar County
~ Capacity construction
~ Environmental monitoring program

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doi: 10.7225/toms.v12.n01.w04

Received on: Oct 12, 2022 / Revised: Dec 16, 2022 / Accepted: Jan 22, 2023 / Published online: Feb 13, 2023

1. INTRODUCTION

Passenger shipping is a special form of maritime shipping that continuously carries out maritime transport of passengers with special ships (Glavan, 1992:56). Taking into account technological, but also organizational and economic criteria, one of the most important types of maritime shipping is passenger shipping, which can be further divided into liner shipping and tourist shipping. Cruises are included in tourist passenger shipping. Passenger shipping is a significant form of passenger transportation that occurs for work and entertainment and is often neglected in the scientific literature (Stupalo et. al., 2016). In the last decade, there has been a significant expansion, as shown by the development trends. However, to meet the increasingly sophisticated and complex needs of passengers, modern passenger terminals today must not only enable the best development, but also development for both liner shipping

and cruises. As the term implies, passenger sea transport enables and provides embarkation on and disembarkation of passengers or passengers and vehicles in port for sea transport from a passenger ship, as well as transport by ship from the port of embarkation to the port of disembarkation, and finally disembarkation of passengers / passengers and vehicles in port.

Tourism is one of the most important drivers of growth in the global economy, especially in the economies of developing countries (Sajjad, Noreen and Zanan, 2014:12404; Perić and Šverko Grdić, 2017:41). The main benefits that tourism brings to the economy include increasing income, capital investment, employment, stimulating regional growth, but also increasing public revenues (Čavlek, Bartoluci, Prebežac, Kesar et. al., 2011:237; Perić and Šverko Grdić, 2017:41). It is considered an important factor that promotes economic development and contributes to the well-being of the local population (Webster and Ivanov, 2013:138). However, in addition to the positive factors, tourism also brings negative factors to the destination, such as environmental pollution, spatial pollution, spatial degradation, etc. Therefore, local authorities and residents are particularly interested in maximizing the positive factors and minimizing the negative ones (Perić and Šverko Grdić, 2017:41). This trend is also applied to nautical tourism and its forms.

Tourist travel depends on motives that lead a person to leave his/her permanent residence and visit a tourist destination for the purpose of recreation and entertainment. One of the most important specific forms of tourism is certainly nautical tourism, and in this sense cruises are presented as one of the segments of maritime passenger transport. These trips have emerged relatively late compared to other types of passenger transport. They can take place in international waters or territorial waters. Cruises in international waters are voyages on extremely large vessels that have a large accommodation capacity to accommodate a large number of passengers. From the perspective of the port or destination, such cruises are usually one-day visits. Although the ship sometimes stays in port for several days, passengers on these ships spend the night on board. Such cruise ships are usually equipped exclusively to provide passengers with an experience of comfort, quality tourist products and facilities. Tourist cruises also include excursion ships, which are an important tourist product of coastal resorts (Mrnjavac, 2006). The positive aspects of such trips are the high quality of service, the mobility of passengers, and the search for new experiences in a new environment, far from everyday life and stress.

2. CRUISE TOURISM AS A SEGMENT OF NAUTICAL TOURISM AND MARITIME PASSENGER TRANSPORTATION

As one of the types of tourism, nautical tourism is a complex tourist-maritime concept, and due to its intense connection with the sea and shipping, its definition is also complex. Without going deeper into the analysis of specific definitions, it can be concluded that nautical tourism is the totality of multifunctional activities and relations caused by the stay of nautical tourists in nautical tourism ports or outside of them and the use of ships and other facilities related to nautical tourism for recreation, sports, leisure and other needs (Luković, 2007).

There are various aspects under which nautical tourism can be observed, and there are a number of criteria by which forms of nautical tourism are classified. In practice, nautical tourism takes place through a number of economic activities, and in theoretical and conceptual terms it has three basic forms (Gračan et al., 2011:217).

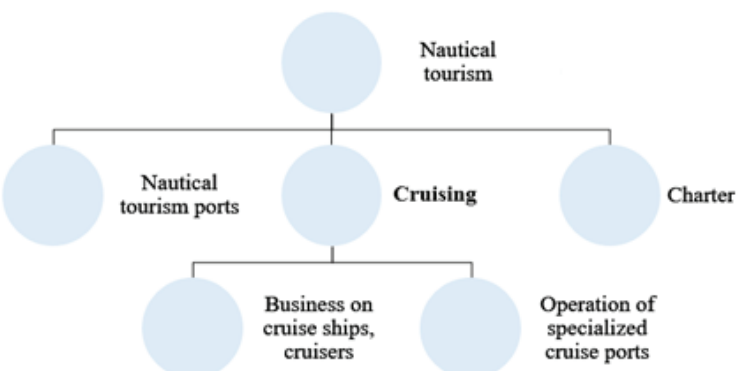

Figure 1.
Cruising as part of nautical tourism.
(Source: Luković and Gržetić, 2007; Gračan et. al., 2011:217).

Ports for nautical tourism refer to a group of activities related to the accommodation of ships and the crew, as well as the provision of a range of services to ships and the crew. Ship chartering refers to renting ships to sailors, while cruising is an organized business, such as a cruise on ships owned by cruise companies.

Cruises, which are also the subject of this article, are an important and best-organized global industry in the nautical tourism in the world (Luković, 2012). The size and number of cruise ships are increasing worldwide as the number of passengers continues to rise (Hung et. al., 2020). With approximately 26.9 million international tourists in 2018, the cruise industry now plays an important role in the global economy (CLIA, 2018). Cruise tourism is a form of tourism based on carrying passengers on a cruise ship (Smirnov et. al., 2022).

Cruising is such a form of nautical tourism organized as a cruise on a ship owned by a cruise line or a ship procured and prepared specifically for this purpose (Luković and Gržetić, 2007; Gračan et al., 2011). Cruising tourism is becoming increasingly important on a global, European, and national scale. The growth recorded in this segment of nautical tourism is impressive (Gračan et. al., 2011). In the beginnings of its development in the mid-1960s, cruising tourism was above all intended for a narrow, elite part of the segment of tourist demand. Over time, due to growth, with offers accompanying an increased market interest in this type of tourism, cruising tourism has diversified into 1) a smaller part still retaining exclusivity, and 2) a dominant part that becomes a product available to a large part of the tourist market and takes on the characteristics of the so-called mass tourism (Horak et. al., 2015:46).

Cruise has become one of the world's leading business sectors. As a result of the continuous development of demand for cruises in the world market, large cruise companies have developed, as well as smaller companies with smaller fleets of specialized cruise ships. The connection and interdependence of cruise ships and ports for their reception are particularly emphasized. Ports have the character of immobile objects, while cruise ships are mobile objects, and this fact leads to a significant difference in their business in terms of seasonality. World cruising has developed in the borderland of tourism and maritime affairs, and has inherited from these two activities its basic characteristics, tourist features, and maritime and shipbuilding capabilities. The dynamic development of cruising has combined large capital investments and cruise fleet development with the task of satisfying tourist travelers and ensuring high profits for the companies (Gračan et al., 2011:227).

The sociological impact of cruising tourism refers to the impact on the local population but also on stationary tourists, who stay temporarily at a destination. Namely, it concerns the distortion of the beauty of sight by large cruise ships, but also the crowding that occurs when many cruise ship guests disembark in a tourist destination. The economic impact of cruising tourism is the measurement of the revenue generated by the total consumption of passengers and crew at a destination and the costs incurred by the ship (Gračan et. al., 2011).

Environmental impacts refer to changes in the biological, physical, or chemical state of the environment that determine the quantity and quality of ecosystems and eventually affect human health and socioeconomic performance (Kristensen, 2004). Tang (2015) asserts that understanding the relationship between tourism and the environment is important because of the complex interaction of environmental impacts generated by tourism. According to Rizal et al. (2020), environmental impacts need to be monitored and considered as a basis for decision-making on the readiness of tourism development. According to Goliath-Ludic and Yekela (2020) and Arintoko et al. (2020), some research results show that environmental impact is considered a factor to measure sustainable tourism (Lee et al., 2013; Lundberg, 2015; Vargas-Sánchez et al., 2009; Diedrich, García-Buades, 2009). Mangwane et al. (2019) suggest that to maintain sustainable tourism, local communities must engage in responsible tourism initiatives and practice responsible tourism ethics (Setokoe, 2013).

Marine and coastal recreation resources for nautical tourism are becoming key factors of attraction for tourists. Therefore, the need to better understand the relationship between nautical tourism and ecology, especially in terms of the protection of beaches, bays, marinas, and the environment in general, should be emphasized, paying attention to the physical appearance of the environment and its population (Koljatić, 2000). Since the subject of this paper is the environmental requirements for passenger terminal (port) development, in order to establish environmental policy, it is first necessary to determine the objective state of the environment, particularly the sources, extent, and effects of air, water, sea, and land pollution sources. Environmental policy is closely related to the development and economic policy, whose main objective today is not the highest possible economic growth, but ecologically sustainable development (Gračan and Alkier Radnić, 2005).

3. ZADAR AS A MARITIME DESTINATION

Croatia is a Mediterranean country with an indented coastline and islands by which it is recognized around the world. An archipelago with more than a thousand islands is a recognizable market sign of Croatian tourism and a comparative advantage under development. It is precisely because of such natural potential that a particularly valuable and successful

part of Croatian tourism is nautical tourism (Ministry of the Sea, Transport and Infrastructure and the Ministry of Tourism, 2008:3).

Zadar is the administrative, economic and cultural center of Zadar County. Since ancient times, the city has been an important transportation hub on sea routes, and with the development of land routes in the 20th century, Zadar County has become a leader in Croatian fisheries and especially in mariculture, white fish farming, and Bluefin tuna farming. Zadar is also the seat of the largest Croatian shipping company specializing in the transportation of oil and petroleum products. The entire economy depends on transport connections with the sales and procurement markets, and further development of tourism is expected. Not only the natural beauties of the Zadar region but also large private investments in tourism, infrastructure development, municipal facilities, and world-famous tourist attractions have led to an increase in the number of tourists, employment, and revenues of the tourism sector in recent years. Among the numerous awards, the most recent is the award from the prestigious tourism portal European Best Destinations, which declared Zadar the best destination for 2016.

The Transport Development Strategy of the Republic of Croatia defines the need to relieve the passenger port of Zadar and move ferry traffic from the city center (peninsula) to the new passenger port away from the city center. The strategy envisages the construction of a new ferry terminal as a priority investment. The advantages of the new port are the short distance from the city center (3.5 kilometers), the proximity of the airport (10 kilometers), the railroad, and good transport connections to the A1 highway and the network of other EU highways. The new passenger port meets diverse traffic requirements - island, coastal, and international ferry traffic, passenger traffic on mega-cruisers and cruise ships, and RO-RO, with the necessary infrastructure and upgrades. The new port became operational in April 2015 with a temporary terminal building for all types of domestic ferry traffic and cruise ships, and in early July 2015 for ferries in international traffic. The passenger-cargo terminal of the new port has been in operation since the spring of 2015. The local ferry traffic, the international passenger line Zadar-Ancona and the berthing of the largest cruise ships were moved from the city center. The new passenger terminal building was opened in 2019. The new port in Zadar is the most important economic zone in Zadar County, although it does not formally have such a status. The port is an exceptional intermodal hub.

The ideal location in the center of the Adriatic, close to the old town of Zadar, the airport, and the railroad, with a highway connection without traffic lights and intersections, opens great opportunities for this port, especially as a 'home port' for cruise ships. Three cruise ships of 250-350 meters in length can dock simultaneously at the largest pier. The fact that the relocation of the passenger terminal to a new location has had a positive effect on the increase in passenger and cruise traffic can be seen from the statistics below.

Table 1.
Domestic passenger and vehicle traffic from 2015 to 2020.
(Source: Zadar Port Authority https://www.port-authority-zadar.hr/)

Year	2015	2016	2017	2018	2019	2020
Number of passengers	2,156,480	2,238,312	2,348,950	2,354,127	2,390,575	1,723,512
Number of vehicles	360,475	397,618	429,321	457,117	484,69	415,429

Table 2.
International passenger and vehicle traffic from 2015 to 2020.
(Source: Zadar Port Authority https://www.port-authority-zadar.hr/)

Year	2015	2016	2017	2018	2019	2020
Number of passengers	33,215	30,637	38,532	38,632	38,335	1,672
Number of vehicles	5,58	5,496	8,116	8,218	7,263	618

Table 3.
International passenger and vehicle traffic from 2015 to 2020.
(Source: Zadar Port Authority https://www.port-authority-zadar.hr/)

Year	2015	2016	2017	2018	2019	2020
Number of passengers	70,366	136,462	137,625	166,528	182,682	714

Table 4.
Total number of passengers and vehicles for the period from 2015. to 2020.
(Source: Zadar Port Authority https://www.port-authority-zadar.hr/)

Year	2015	2016	2017	2018	2019	2020
Number of passengers	2,260,061	2,405,411	2,525,107	2,559,287	2,611,592	1,725,898
Number of vehicles	366,055	403,114	437,437	465,335	491,953	416,047

The new port infrastructure consists of 12 new berths, 7 of which are intended for the needs of domestic traffic to the islands, while 5 berths are planned to receive ferry lines and cruise ships in international traffic. A graphic representation of the growth in the number of cruise passengers can be found below.

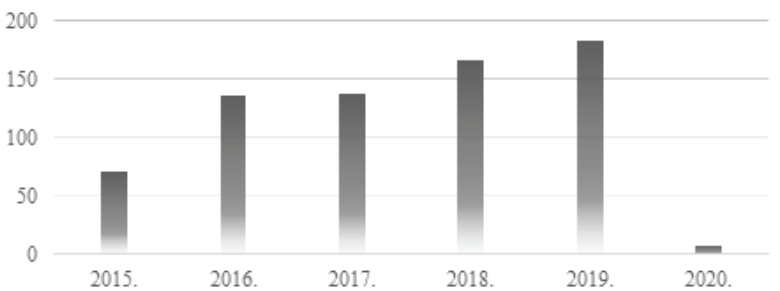

Figure 2.
Cruise traffic from 2015. to 2020.
(Source: Zadar Port Authority https://www.port-authority-zadar.hr/)

Already in the first year after the transfer of traffic from the old city center to the new location, the number of passengers and vehicles increased overall, but also the number of passengers on cruises. An exception is also the 2020 pandemic when cruising was the most affected form of nautical tourism. However, for such an increase in capacity to be possible, the high environmental standards of the new site must be met. The analysis of the environmental feasibility and impact of the construction as well as the elements it must meet are detailed below.

4. ECOLOGICAL REQUIREMENTS FOR EXPANDING PASSENGER-TRAFFIC PORT CAPACITY

In addition to the existing spatial planning documents, conducted analyses and other documents that deal with the issue of the passenger terminal, it is necessary to conduct an environmental impact analysis as one of the basic documents and indicators of whether the construction of a passenger port is environmentally friendly. For this purpose, a study is prepared

in which an environmental impact assessment of the project is carried out, protective measures are identified, and a proposal for an environmental monitoring program is made.

The construction acceptability analysis is preceded by several key analyses, including the analysis of the spatial planning documentation, the description of the existing state of the environment and the areas that will be affected by the project. The analysis of the meteorological characteristics of the sea - the hydrodynamics of the sea, quality of the sea, biocenological structure and composition of the flora and fauna of the seabed, cultural and historical heritage, protected natural values, landscape features, population, purpose and use of space, noise, air, climate, the relationship of the project with the protected areas and the areas of the ecological network, condition and capacity of the port in terms of protecting the sea from pollution.

4.1. Description of the Current State of the Environment and the Scope of the Project for a New Port Construction

This analysis includes the geotechnical evaluation of the site, i.e., the geologic base, analysis of hydro geologic and hydrologic data, seismic characteristics, and the analysis of the exploration work performed (Port Authority Zadar, 2011).

Geological basis: The Zadar area belongs to the Ravni Kotari tectonic unit. On the basis of the conducted field exploration works, laboratory tests of characteristic rock and soil samples and inspection of the OGK (Geological Base Map - Zadar, 1:100000), it is concluded that the terrain in the investigated construction area is a source rock of different geological age, foraminiferous limestone of the lower to middle Eocene and flysch deposits of the middle to upper Eocene. The source rock is mostly covered by Quaternary deposits of marine sand and flour and partly by fill material, although there are places where the source rock emerges directly from the seabed.

Hydrogeological and hydrological data: Because of marked cracking and erosion, the carbonate rock is generally considered to have medium to good permeability. The porosity is of the fissured-cavernous type. Observations have shown that the most intense karst is up to 30 m deep. The dynamics of groundwater movement are very complex and are mostly related to the provision of transverse and diagonal faults. Most groundwater flows diffusely to the sea. Springs have low yields and are usually saline. The yield of springs is significantly influenced by the amount and intensity of precipitation in the immediate hinterland.

Seismic properties: The wider surroundings of Zadar are seismically active. This is shown by the density of epicenters of earthquakes, their frequency, and the intensity of seismic tremors. The reason for the increased seismic activity is the underpinning of the Adriatic plate under the Dinarides. The wider surroundings of Zadar belong to the epicentral area of Zadar-Šibenik. The epicenters of the earthquake are located on the islands of the Zadar archipelago and in the hinterland: Ravni Kotari, and the Krka and Zrmanja valleys. Historical records contain data about the devastating earthquakes of 1280 and 1300, but in the period of instrumental measurements from the end of the 19th century, no more devastating earthquakes were recorded in the closer vicinity of Zadar ($M > 4,6$).

Investigated works interpreted: The exploration works carried out included drilling on the marine and land parts. The drilling depth ranged from 2.0 to a maximum of 16.0 m, measured from the surface of the land or the mouth of the well.

Geomechanical data: On the basis of the conducted field research, laboratory tests of characteristic rock and soil samples, and consultation of the OGK (Geological Base Map - Zadar 1:100,000), the separation of materials was made vertically. The embankment consists mainly of stone fragments to blocks. In the dam body, zones of mixed clay-stone material or waste stone material have also been established.

a) Cover: marine mud of varying thickness was found in most of the studied area. It is composed of sandy clay powder, dark gray to black in color, with low to medium plasticity and a fluid consistency involving organic impurities - marine mud.

b) Substrate rock: The terrain in the studied area of the construction of the parent rock is of different geological ages, foraminiferous limestones of the lower to middle Eocene, and flysch deposits of the middle to upper Eocene.

Maritime-meteorological characteristics - sea hydrodynamics: An analysis was performed to gain insight into the wind climate of the study area and finally, on this basis, to express the long-term wave climate with the relevant deep-sea wave parameters of the wind gravity waves. Four sources of information on the direction, duration, intensity, and probability of winds by direction or sector were used for this analysis.

Analysis using the Groen-Dorrenstein methodology: The analysis includes the following parameters: average annual wind climate, days with strong and stormy winds, distribution of days with different wind directions and speeds, winds by sector, wind pattern formation for short-term wave forecasts, deep-water wave forecasts, short-term forecasts of significant wave heights for the deep sea, long-term forecasts of significant wave heights for the deep sea, probabilities of wind duration by direction, determination of wave height in the deep water according to the long-term wind forecast.

The quality of the sea: Zadar is geographically located approximately in the center of the Adriatic Coast. From Zadar to the southwest, parallel to the coast, stretches the Zadar archipelago. The islands of Zadar are elongated and follow the direction of the coast SE - NE, mainly in three rows. The lateral distance between

the rows of islands and the coast is approximately equal and is about 2 miles. The Zadar Channel is a typical closed channel area in the southeast-northwest direction. Its depth decreases from 50 m at the northwestern entrance to 25 m in the southeastern part. The coast of Zadar is very indented and has a number of small bays and capes. Their purposes are different. The largest part is used for bathing, recreation, and tourism. The endangered zone is the narrower area of Zadar, where, in addition to municipal and industrial sewage, the main polluters are the ports and related maritime traffic. The sea quality of the old ports and bays of Južine improved significantly after 2006 with the construction of a sewage system and the cessation of the discharge of municipal and industrial wastewater into this area where the inflow of fresh sea is difficult. The ecological state of the sea in the Zadar area can be described as oligotrophic, i.e. a state characterized by low primary production, good transparency, low concentrations of nutrients and chlorophyll, and the absence of hypoxia. Pollutants enter the sea in different ways: effluents from industrial plants and public sewage systems, leaching from agricultural lands and roads, dry and wet deposition from the atmosphere, sewage and ship waste, combustion of marine fuels, etc. Bivalves feed indiscriminately on plankton, which filters particles of a certain size from seawater so that hazardous substances accumulate in their bodies. Sediment particles also have the ability to adsorb and accumulate hazardous substances that enter the marine environment from various sources. The ability to accumulate in sediment is particularly pronounced for metals and persistent substances as well as poorly water-soluble organic substances such as chlorinated pesticides and polychlorinated biphenyls. Concentrations of hazardous substances in marine organisms and sediments are systematically monitored in the Zadar region.

Sea quality on beaches.: In the wider area of the planned project, at six stations (Bazen, Kolovare, Arbanasi–School, Punta Bajlo, and Lipavska), the sanitary quality of the sea will be tested in accordance with the Regulation on Bathing Water Quality (OG 73/2008). The tests are carried out ten times during the bathing season (May to October) and include the determination of microbiological indicators of fecal contamination. According to the results of the tests in 2010, the quality of the sea at the stations Kolovare, Arbanasi-škola, Punta Bajlo, and Lipavska was excellent and at the station 'Bazen' it was good. In addition to the quality of the sea, it is also necessary to take into account possible sources of pollution from the land and pollution from maritime traffic. Maritime transport is considered the most efficient, safe, and environmentally friendly form of transport, accounting for almost 90% of the total world trade in goods, and its role in the development of the global and European economy is irreplaceable.

It can be concluded that the hydrographic characteristics of the coastal sea of the Zadar Channel are primarily reflected in the changes in the atmosphere, while the effects from the land (watercourses and sewage) are minor. In terms of sea quality, the situation can be considered very favorable. The ecological condition of the sea in the Zadar Channel is very good, i.e. with an oligotrophic degree of eutrophication. Pollution by hazardous substances (metals and chlorinated hydrocarbons) is characteristic of areas with low anthropogenic pollution. The sanitary quality of the sea on the beaches near the proposed project is excellent. In the narrower area of the planned project, the main problem is that the issue of wastewater discharge has not been systematically solved. With the construction of a central sewage treatment plant for the public sewage system in the center of Zadar, the conditions for solving this problem have been created.

Biocenological structure and composition of sea flora and fauna: In the area of the proposed passenger terminal, an inspection of the seabed biotic communities was conducted along two transects, in the area where the works envisaged under the project could have an impact. For the purpose of the biological assessment of the environmental impact study for the construction of the passenger terminal, a biocenological analysis of the natural flora and fauna was carried out in order to enhance the natural communities.

Cultural and historical heritage: The impact of the construction of the passenger terminal on cultural-historical objects (cultural-historical heritage) is observed through direct and indirect impacts. A direct impact is any physical destruction of these buildings/sites within the designated zones of influence - Zone A is an area of cultural and historical significance (archaeological, hydro-archaeological sites, ethno-zones, or buildings with cultural and historical elements) that is directly threatened by new construction. Any construction in an area of cultural and historical significance is considered a direct impact. Based on the analysis of the impact of construction on cultural and historical values, their vulnerability is determined and the following system of protective measures is applied:

- Relocation of structures - for all cases of physical destruction and threat to the fundamental values of cultural property.
- Relocation of cultural property - for all cases where relocation is possible without harming the fundamental values of cultural property.
- Protection of cultural property on site - for all cases when the cultural property can be protected by special protective measures at the existing site.
- Research and documentation of cultural property - measures carried out for all endangered cultural property and include the preservation of movable archaeological finds from endangered sites and areas.
- Professional monitoring during construction - archaeological, hydro-archaeological, and conservation

monitoring, permanent or occasional, in the zone of direct or indirect influence.

During the hydro-archaeological surveys, no artifacts were found that would indicate the existence of a cultural layer in the entire port area. No elements of cultural and historical heritage were found in the coastal area of the future terminal.

Protected natural values: Protected natural values are regulated by the Nature Protection Act (OG 70/05), which establishes nine categories of spatial protection. On the territory of the City of Zadar, there are protected and proposed-for-protection parts of nature. Protected areas: Vladimir Nazor Park – Zadar, a monument of park architecture. Particularly valuable areas and parts of nature proposed for the procedure of entry into the register: Reefs near Silba with the submarine, submarine from the bay of St. Ante to the bay Nozdre - Silba, Queen Jelena Park - Zadar. Inland areas and waters are special values for which an increased level of protection is required: the passage between Zapuntel and Ist, the sea belt around the island of Škarda, areas and sites of special biological and landscape value, karst ecosystems, areas of native vegetation, sea and underwater, forests (e.g., Musapstan). From the above protected or proposed-for-protection parts of nature, we can conclude that in the area of the future passenger terminal, there is none of the categories of spatial protection regulated by law.

Landscape properties: The construction of a new modern ferry terminal with its architectural solution brings the concept and urban element to this neglected part of the port complex and offers a modern approach to new conceptual solutions within the port where the passenger terminal should find its place.

Population, purpose and use of space: The terminal area is defined as a port, industrial and storage zone of international economic importance. The realization of the passenger terminal fully fits into this type of economic activity. In accordance with the purpose and use of the space, the project in question is located in a defined port and industrial zone and in a part of the maritime area through which international and national waterways pass. According to the defined spatial planning objectives and characteristics that determine the purpose and use of a given space, we can conclude that the passenger terminal intervention in question fits perfectly in all segments of the spatial purpose.

Noise: The construction of a passenger terminal involves certain dynamic activities. This is important to emphasize so that the entire area can be defined in terms of the presence of noise attributable solely to sources originating from port activities. In addition to the noise sources that originate in the coastal part of the port, there are noise impacts and traffic impacts in the existing zone, which can be divided as follows:

- Existing noise impact from vessel traffic - the waterfront area is dedicated to the traffic of various vessels, from smaller ships and tourist boats to ferries, passenger ships, fishing boats, and cargo ships. The continuity of noise caused by vehicular traffic is consistent with the volume of traffic, i.e., noise increases during periods of higher congestion, which is more pronounced during the summer months, when passenger traffic and transportation by smaller vessels increases.
- Existing impacts of road traffic noise - Since there are roads in the area that are exposed to some traffic, there is also noise pollution that will increase and further impact the area due to the construction of the passenger terminal and modernization of other port units.

The presence of noise in the observed area of the passenger terminal is due solely to the above sources. The direct impact of the noise negatively affects the workers who work in the area of the port complex, while the impact on the population is low due to the distance of the settlement from the area in question.

Air: Air and air quality are one of the basic indicators of the natural preservation of a given area and the quality depends on the concentration of pollutants in a given area. On the territory of the City of Zadar, there are stations for measuring air quality (Gaženica, Poluotok, and Puntamika). The current conditions in the City of Zadar in terms of clean air are good although occasionally some facilities in certain excessive situations can release certain amounts of pollutants; relatively clean industry of low intensity in the field of construction threatens clean air, but such cases are very rare. Within the framework of spatial planning and economic activities in a given area, it is necessary to analyze possible existing negative impacts on the protection of air and, based on the results, prescribe certain measures, as well as consider and verify at the planning stage certain economic purposes with the impact of planned activities on air quality.

Climate: The area is under the influence of the Mediterranean, moderately warm, rainy climate with dry and hot summers and mild winters. The average temperature of the coldest month is not lower than 3°C, and at least one month of the year has an average temperature higher than 10°C. An important feature of this climate is the proper exchange of seasons, which distinguishes it from most other climatic zones. In the local context, the wide apartment hinterland, Ravni Kotari, the widest apartment belt on the Croatian coast, which mitigates the effects of Velebit, forty kilometers away, plays an important role.

The average temperature values are very favorable. The average annual temperature is 14.7°C on the coast, while it is slightly lower inland (13.2°C). The average annual moisture content is 72%. The wettest seasons are spring and autumn, winter is a little dry, and the driest period is summer. The winds are pronounced, as land and sea meet here, and the differences in atmospheric pressure determine the daily and seasonal distribution of directions, which is reflected in the good ventilation of the area.

Relationship between projects and protected areas and ecological networks: According to the Decree on the Proclamation of the Ecological Network (OG 109/07) in Annex 3.2. The Ecological Network of the Republic of Croatia designates the "Important areas for wild taxa and habitats" and "Internationally important areas for birds". The location of the passenger terminal is outside the indicated important areas, so we can conclude that the project will have no impact on the protected areas and areas of the ecological network of the Republic of Croatia.

The location of the terminal is about 2.0 km away from the "internationally important bird sanctuary". Even though it has no direct impact and is not located in the area, it is still necessary to emphasize the importance of the area for birds and the minimum distance of intervention from the border of the area.

Condition and ability of the port with regard to the protection of the sea against pollution: A special decree (Decree on the Conditions to be Fulfilled by Ports, OG 110/04) establishes the conditions that all ports must meet in order to allow the safe entry, anchoring and stay of ships, as well as the protection of the sea from pollution from ships. The decree requires, as a basic requirement for all ports, the presence of reception facilities for ship waste, and means and equipment for the prevention and elimination of the consequences of marine pollution.

Equipping the port to receive waste and oily water from ships is understood to mean that the port has:

- Organized service (or contract with a specialized company), i.e., a company for cleaning the sea and collecting waste from ships,
- Ships for the removal of pollution from the sea surface (solid waste, oil, hazardous and noxious substances, algae, etc.),
- Smaller vessels for transportation of people and equipment,
- Dams for enclosing pollution,
- Skimmers for collecting oil from the sea surface,
- Equipment on land for receiving and processing collected waste from the sea,
- Special vehicles for participation in cleaning and recovery operations,
- Various types of pumps,
- Dispersants and equipment for their application,
- Information transmission system.
-

4.2. Proposal of Environmental Monitoring Program

The system of intervention measures in case of emergencies that may endanger the environment includes monitoring the state of the environment. A monitoring program must be developed on a case-by-case basis (water, seabed flora and fauna, and noise).

Water monitoring program: The environmental monitoring program should include regular inspection of the drainage system, as provided for in the project documentation. In the event of an accident where harmful and hazardous substances suddenly enter the space, act in accordance with the operational intervention plan. It should also include checking the quality of technological wastewater at the exit of the pre-treatment plant (technological wastewater from the workshop for maintenance of port machinery and washing of containers) and polluted water at the exit of the separator settling tank.

Program for monitoring the flora and fauna of the seabed: After construction, the condition of the biotic communities on the existing transects should be monitored in future years, and these future results should be compared to the current pre-construction results. Regular inspections should be conducted once a year to continuously monitor the process of macrobenthic establishment and recovery of natural communities. The use of additional sampling methods suitable for sediment soils (grabs) and the permanent video transect method would greatly improve the existing results.

Noise monitoring program: Conduct one-time noise measurements at vulnerable facilities, i.e., commercial buildings within the terminal and at the nearest passenger terminal facilities during the largest port activities (container handling and storage). Based on the results obtained, take additional protective measures at the facilities if necessary.

5. CONCLUSION

In addition to daily local, national and international traffic with Italy, the ports of Zadar and the new passenger terminal have seen an increasing number of cruise ship arrivals in recent years. The new passenger terminal is ideally positioned in relation to the highly developed cruise tourism market in Europe with high growth rates. It is located only 3.5 kilometers from the center of Zadar, directly on the highway connecting the north and south of Croatia with the Euro network and in close proximity to Zadar Airport. Zadar is becoming an increasingly attractive tourist destination due to its rich cultural and natural heritage.

Zadar is an important transportation center of the region halfway between Venice and Dubrovnik and has always been an important transit port. With an annual throughput of 2.4 million passengers and 350,000 vehicles, Zadar is one of the busiest ports in the Mediterranean.

The construction of a new passenger terminal fits into the economic and developmental framework determined by the desire to balance and improve the entire area and create the conditions for greater adaptation to the market conditions necessary for integration into the European development systems and world trade. The newly constructed passenger terminal justified the construction by showing an increase in traffic, both in the passenger and tourist segments of demand. The construction did not harm the environment since all aspects were analyzed before the construction, but also monitoring

proposals were made so that the newly built port does not pollute the environment during the operations. In addition to the external influence, the construction of the terminal improves the elements of internal development, which can be recognized by the objectives of the spatial planning program as increasing the value of the spatial function, improving the spatial development structure, directing development priorities to improve efficiency and creating conditions for the start of business and tourism but also for the entire economy of the Republic of Croatia.

CONFLICT OF INTEREST:

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

ACKNOWLEDGMENTS:

THIS paper was funded under the project line ZIP UNIRI of the University of Rijeka, for the project ZIP-UNIRI-116-2-21 "Influence of exogenous changes on the impact of nautical tourism" supported by the Faculty of Tourism and Hospitality Management, University of Rijeka.

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