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## IMPROVEMENT OF PORT INFRASTRUCTURE ON CROATIAN ISLANDS USING EU FUNDS – THE ISLAND OF BRAČ, THE PORT OF BOL

**Abstract:** Bol is located on the island of Brač, therefore connecting Bol with the mainland or with the national road network is extremely important both for tourism and for the economy as a whole. Port Bol belongs to the ports of county significance and is managed by the Port Authority of Split-Dalmatia. In the town of Bol on Brač, there is a port open to public passenger traffic that connects the island of Brač with the mainland and the ports of the other islands. The existing port is characterized by limited capacity, dilapidation, and inadequate construction considering the demand of maritime traffic in the port. This paper will present the expansion of the port of Bol open to public traffic in order to create a high-quality harbor pier for public traffic, which would relieve the traffic burden of the city of Bol and the municipality of Bol and provide the local population with quality public transportation, which is currently not available, with as little as possible impact on the environment. The purpose of the project is not to make money, but to create content that will improve the quality of life of the local population and keep them in Bol in order to reduce the tendency of the "island dying". The local population is the main driver of the city's development and life. In order to improve the demographic picture, it is necessary to provide the local population with quality primary conditions for life and progress.

**Keywords:** economic development, Croatia, Island of Brač, Adriatic Sea, port

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## **Introduction with analysis of the state of the problems**

The municipality of Bol is located on the southern slopes of the island of Brač, in the central part of the coast, occupying 24.85 km<sup>2</sup> (Strategija razvoja Općine Bol, 2014, p. 9) with a population of 1,678 inhabitants according to 2021 census. In terms of the number of inhabitants, the municipality of Bol is one of the medium-sized municipalities on the island of Brač. The municipality has two settlements: Bol with 1,656 inhabitants and Murvica settlement with 22 inhabitants. Given that Bol is located on an island, connecting Bol with the mainland or with the national road network is extremely important both for tourism and for the economy as a whole. Bol is connected to island settlements by relatively good roads. In connection with the mainland, Bol is connected to Split by ferry via Supetar, then by ferry via the port in Sumartin, and also by sea with a catamaran to the island of Hvar. Brač has about 150 km of good roads that connect all settlements and all natural and cultural monument areas. By air, Bol is connected to airports in Croatia and Europe.

In the town of Bol on Brač, there is a port open to public passenger traffic that connects the island of Brač with the mainland and the ports of other islands. The existing port is characterized by limited capacity, dilapidation and inadequate construction considering the demand of maritime traffic in the port. The port of Bol has year-round direct lines and seasonal lines with other ports both on the mainland and on the islands, the lines that include the port of Bol are the following: the only national high-speed line: Jelsa-Bol-Split (Jadrolinija) and the following high-speed lines without public service obligations: Resnik-Bol-Stari Grad and vice versa (Adriatic fast ferries d.o.o.), Resnik-Split-Bol and vice versa (Adriatic fast ferries d.o.o.), Dubrovnik-Korčula-Hvar-Bol-Split and vice versa (MB Kapetan Luka) and Split-Bol- Makarska-Korčula-Sobra-Dubrovnik and vice versa (Jadrolinija) (Red plovidbe, 2023), (Fig. 1).

Considering the number of lines that include the port of Bol and considering that there is a demand for them, the quality of the wharf in the port of Bol does not meet the needs of the local population, making it inadequate and a limiting factor. A high-quality port for public transport should be built, which will relieve the traffic of the town of Bol and the municipality of Bol and provide the local population with quality public transport, which at the moment is not available. All of the above represent state of problems that arise when we analyze the island and its connections the solution of which would bring a series of positive consequences and modernization of the area of the municipality.



Fig. 1. Transport connection of the island of Brač  
Source: Donosimo detaljan red plovidbe Jadrolinije za 2021. godinu.  
Splitsko okružje

## Material and methods

At the moment, there is no adequate quay in the area of the port of Bol for shipping lines that connect the port of Bol with neighboring ports on the mainland and on the islands, but it is possible in the port development plan. Using direct primary research and analysis of available secondary research data, an attempt will be made to show that there are foundations necessary for collecting funds that will realize the goals of this project with as little impact on the environment as possible, and for the purpose of relieving the city port of the moorings of tourist sailboats for the purpose of building infrastructure intended for the local population. The purpose of the project is not to make a profit, but to create content that will improve the quality of life of the local population and keep them in Bol in order to reduce the tendency of the "island dying". The local population is the main driver of the city's development and life. In order to improve the demographic picture, it is necessary to provide the local population with quality primary conditions for life and progress. Availability of work, education, and medical care must not be the reason for the depopulation of the town of Bol and the municipality of Bol, as well as the island of Brač. Poor quality connection with neighboring ports throughout the year is a key factor that impairs the quality of life and economic prosperity.

## **Results and discussion – EU opens the door**

The accession of the Republic of Croatia to the European Union opened up the possibility of financing development from the instruments of cohesion policy, i.e. the instrument of the European Fund for Regional Development. The financial "weight" of cohesion policy reflects the scale of socio-economic differences within the EU, but also the political significance of cohesion for the project of a united Europe. Additional development funds from the EU level are a way to empower all regions and the population of the EU for the possibility of using all the advantages of the common market of goods, capital, labor and services: a larger market, greater mobility in work and education, a greater choice of services, etc. (The use of new provisions during the programming phase of the European structural and investment funds, 2016).

Cohesion policy instruments is a generic term for: European Regional Development Fund (ERDF), European Social Fund (ESF) and Cohesion Fund.

The Cohesion Fund would be significant for the development of port infrastructure and the environment. The overall framework for the use of EU cohesion policy instruments in the Republic of Croatia in the period from 2014 to 2020 is regulated by the Partnership Agreement between the Republic of Croatia and the European Commission for the use of EU structural and investment funds for growth and jobs in period 2014–2020 (hereinafter: Partnership Agreement). The general goal of the Partnership Agreement is to provide support in bringing the Republic of Croatia closer to other European Union member states, i.e. regions, by accelerating economic growth and encouraging employment (EU funds).

The basic principles of the National Transport Strategy draft, which are relevant in the wider context of EU transport and cohesion policy, are sustainability, availability and social inclusion, change in form of transportation and increased interoperability.

The key objectives of the draft Transport Strategy for Croatia are:

1. improvement of traffic connections and coordination with neighboring countries;
2. improving the availability of transportation for passengers on long distances in Croatia;
3. improvement of regional passenger connectivity in Croatia and promotion of territorial connectivity;
4. improving the availability of transportation for passengers to and within the main urban agglomerations;
5. improving the availability of freight transport in Croatia;
6. improving the organizational and operational structure of the transport system;
7. improving its efficiency and sustainability.

The 7th priority axis refers to traffic in the Operational Program Competitiveness and Cohesion 2014–2020 (OPKK) and marks the continuation of the strategic goals set in the OP "Transport" (2007–2013) modernization of railway infrastructure and system of inland waterways.

Within priority axis 7, the main priorities of ERDF and CF funding for OPKK are as follows:

- increase the level of use and relevance of the railway network (Cohesion Fund);
- improve the TEN-T road network and access to the TEN-T road network (ERDF);
- increase the number of passengers transported in public city transport (Cohesion Fund);
- improved accessibility of Dubrovnik by air (Cohesion Fund);
- improve the accessibility of inhabited islands to residents (Cohesion Fund);
- improve road safety in parts with a high level of mixed traffic (EFRR);
- increase the volume of freight traffic on inland waterways (Cohesion Fund).

According to the operational programs of competitiveness and cohesion, with an emphasis on specific objective 7ii1 Improving the accessibility of inhabited islands for their inhabitants, we can say that this project agrees with the following specified specific objective: "This specific goal aims to integrate the Croatian islands into the wider transport network and overcome a key obstacle to local economic growth. The goal is to gradually provide the islands with sustainable and modern transportation services throughout the year, regardless of the pressure of tourism, and thereby improve the availability of employment, education and other services to island communities".

The activities to be financed must be in accordance with the Strategies and strategic guidelines of the Republic of Croatia. Strategy of maritime development and integral maritime policy of the Republic of Croatia. It enumerates numerous goals for the development of shipping, and for the purposes of this study, we note only a few of the more significant ones, which concern the development of the port of Bol, are in line with the project in question. For example:

1. To achieve self-sustainability of the port system while increasing the efficiency of the system:

- Reduce the participation of the state in the co-financing of port infrastructure projects;
- Create more favorable conditions for the investment of private capital in the construction of port infrastructure and specialized port terminals through various forms of public-private partnership;
- Increase the efficiency and quality of service provision in order to ensure the competitiveness of the traffic direction;
- To encourage the development of port infrastructure in the function of the development of passenger traffic, primarily through the development of the infrastructure of county ports.

2. Revitalize already built and build new port capacities:

- Expand port areas to include all existing facilities intended for mooring vessels, as well as expansion of the sea area for anchoring purposes;
- Put unused and abandoned former industrial, military or similar facilities into the function of economic development.

3. To position Croatia as the most important nautical destination in Europe and the Mediterranean:

- Encourage the application of appropriate ecological standards in the protection of the marine environment, as a common interest and task.

In accordance with the acceptable activities in the port of Bol, part of the coast will be upgraded and infrastructure will be built that will improve the quality and safety of communication with other ports on neighboring islands and with mainland ports. The construction as well as the use of the vessel will be in accordance with eco standards that will monitor safety and environmental protection. The need for development in the sense of sustainable development is the need for economic development and the basis of any serious development strategy (Luković & Gržetić, 2007; Favro & Kovačić, 2010). Speaking of protected areas, one of which that certainly stands out is Zlatni Rat, which has become a world-famous symbol of Bol due to its specific shape. The construction of the marina also contributes to its protection, because now in its area you can find sailboats and yachts that are anchored and thus impair the quality of the seabed and the cleanliness of the sea.

While the specific goal of 7ii1 itself is focused on the integration of Croatian islands into the wider transport network and overcoming key obstacles to local economic growth, the ultimate goal is to gradually provide the islands with sustainable and modern transportation services throughout the year regardless of the pressure of tourism and thereby improve the availability of employment, education and other services to island communities.

**Legislation.** According to the principles of NATURA 2000 and Directive 2000/60/EC of the European Parliament, which refers to the protection of the environment and the well-being of the local population, to see that this project is being done for the needs of the local population, and thus is the basis for the protection of water areas and maritime assets that are population closely related. With the project, the local population will have multiple benefits, from just a better connection of the island with the mainland, to an increase in the quality of life of the locals themselves, while during the implementation of the project, great attention will be paid to the protection of the environment itself.

**Is it necessary?** The subject project has three measurable end results that we will discuss further. Those are:

- Option 1 – existing state of the infrastructure;
- Option 2 – minimal investment in infrastructure;
- Option 3 – investments in infrastructure foreseen by the project documentation.

**Option 1 – Do nothing.** This alternative presupposes that no further investments are made in material assets and improvement of the port infrastructure for the local point of view. Taking into account that, on the one hand, such investments are necessary due to outdated infrastructure, the increasing demand of the local population for transport services, and at the same time the reduction of the quality of life and safety of the local population, the above option does not represent a satisfactory and optimal solution and would lead to the following negative results:

1) There would be no increased investment in local infrastructure and modernization of the existing port and increase in security.

2) If the project is not implemented, there would be no connection with other islands and the mainland throughout the year.

3) The quality of life of the local population would remain at a low level and would decline due to inadequate public services.

4) Failure to implement the project would reduce the population's opportunity for employment and education, which leads to an increase in unemployment.

5) The potential provided for the local environment would remain unused.

6) The town of Bol and the municipality of Bol remain insufficiently integrated into the wider transport network and do not have the ability to overcome key obstacles to local economic growth.

7) With the existing situation, no additional value will be realized in the future either for the local or wider community.

**Option 2 – Do minimum.** As part of the option, the option was analyzed in which to invest in the rehabilitation and extension of the main breakwater of the port of Bol, the arrangement and extension of the gas station jetty (secondary breakwater) and the arrangement of the coastal line from the gas station jetty to the existing central jetty with the reconstruction of the existing coastal wall of the mooring from the beach to the central jetty with the reconstruction of the existing coastal wall of the mooring from the beach to the central jetty, and the arrangement of the outer coastal line from the root of the main breakwater to the new promenade. However, the partial arrangement of the port open to public traffic is not satisfactory for the following reasons:

1) Better infrastructure would be achieved only for the already existing main breakwater and central pier, but the safety and quality of the pier would still be questionable for the local population.

2) The impossibility of influencing the reception of vessels, increased traffic of the port and the safety of the infrastructure.

3) Failure to implement the project would not solve the problem of reduced opportunities for employment and education of the local population due to the lack of transport connections.

4) The town and municipality of Bol would still remain insufficiently integrated into the wider transport network and the goal of overcoming the obstacle to local economic growth would not be achieved.

5) The infrastructure would remain undeveloped and the negative impact of tourism on the port could not be reduced.

The analysis determined that the mentioned option is not a favorable solution due to its lack of comprehensiveness. Despite the fact that the rehabilitation and extension of the existing breakwater and the rehabilitation of the jetty would minimally improve the quality of the local population in that part, the problem of insufficient integration of the local population of Bol into the transport network would still remain open. The insufficient possibility of mobility of the local population would still result in a lower quality of life and an outflow of the population, which could not be solved solely for the sake of investing in the existing breakwater and jetty without renovating the remaining part of the port of Bol.

**Option 3 – Project option.** Project option for "Extension of the port open to public traffic Bol-phase 1" The option in which the project is realized in its full extent is the

only acceptable option that guarantees that the town of Bol will be integrated into the wider transport network in order to overcome the key obstacles for local economic growth and higher quality of life of the local population for the following reasons:

- 1) The project will establish adequate capacities for year-round traffic.
- 2) A satisfactory level of service will be achieved throughout the year for the local community.
- 3) Employment opportunities for the local population will increase and population outflow will decrease.
- 4) Traffic jams will be minimized.
- 5) The level of quality of life and safety of the local population will increase.
- 6) The town of Bol and the municipality of Bol will be integrated into a better connected transport network between the mainland and the island.

**Analysis of alternative and/or competitive modes of transportation.** There is no settlement/place on the island of Brač where an alternative competitive line to these lines could be created. The port of Bol is located on the southern side of the island of Brač, in the central part of the coast. It is the only port on that part, therefore there are no alternative and competitive lines that could be compared to the lines that operate through the port of Bol.

The main factor to look at when determining the location that represents a restrictive, neutral and stimulating factor are general that is purity of the sea, climate conditions, indebtedness of the coastline and special characteristics such as availability of the ports, safety of navigation, etc. (Dundovi et al., 2015.)

Bol is a port in the middle of the southern coast of the island of Brač. When talking about characteristics of the port, the latitude of the port is 43° 16' N with the longitude of 16° 40' E, length of the pier is 155 m, dock area is 833m<sup>2</sup> and water area is 36.230 m<sup>2</sup>. Port of Bol is protected from the east by a 140m long knee pier with a breakwater. The depths along it are from 3.3 m under the head with the port light to 2.5 m to the place where it breaks. Further on are the boats of the locals, and they are about a meter deep. It is the same along the waterfront all over the port. It is deeper along the waterfront on the northern side of the harbor. Where the moorings of the locals end, and the waterfront widens into a plateau with palm trees, there are only four to five spots for boaters. Moorings and connections for electricity and water have been installed.

**ORIENTATION:** The bell tower of the monastery to the east of the settlement and the tall gray building to the west of the monastery, the light at the head of the breakwater - a square stone port with a green dome and the light at the head of the jetty - a red tower.

**WEATHER CONDITIONS:** It is protected from all winds and waves except from the SW wind, which causes rough seas; small boats are recommended to moor on the part of the coast east of the tree line.

**ANCHORAGE:** Larger ships anchor in front of the harbor at depths of 20-25 m, depending on the tide, by mooring to the shore. South and southwest winds cause rough seas.

**MOORING:** Laterally on the inside of the breakwater or in a four-berth along the shore. The jetty in the western part of the harbor is intended for tourist boats and ships on regular lines.

**Existing condition east of BOL port.** The coastline of this stretch to the east of the port of Bol, in a position towards the location known as "Stara fabrika", is approximately 350 m long. On the north side of this area, from the main breakwater in the direction of the east, in a length of about 280 m, there is a recently built new coastal wall with a promenade and a new coastal parapet wall on the part above the existing beaches, and above these walls is the recently partly reconstructed local road "Račić Street". The remaining part of this coastal stretch is characterized by sikas and smaller beach areas.

**Technical feasibility and environmental sustainability. Demand analysis.** A description of the demand and supply analysis will give us answers to the potential expected demand and supply. First of all, we will look at all the parameters that affect the demand for the services of the project "Extension of the port open to public traffic Bol Phase 1", that is, the demand of the local population for a quality and safe shipping line.

As a result of the emigration process, the population of both Croatia and the town of Bola is decreasing. Negative demographic trends also lead to negative social consequences. The quality of life in accordance with modern standards is not at the best level throughout the year, even for other generations.

The town of Bol recorded an increase in population from 1961-2001, and in 2011 it recorded a decrease of 2.31%, but in 2021, a growth of 2.92%.

The source of the natural movement of the population is the state registers of births, deaths and marriages, which are kept by registrars for each register area. Vital statistics data refer to all persons who were born, died or married in a certain calendar year, and were registered in the state registers of births, deaths and marriages. From the above table, we can read that in 2011 there were a total of 27 live births, while there were 2 deaths in the same year. The natural increase was 7, and the vital index was 135.

In 2022, the number of live births was 16, while the number of deaths was 18, therefore the natural increase was negative, while the vital index in 2022 was 88.9. In the municipality of Bol, there are 150 students in primary school, of which 69 are boys and 81 are girls, in secondary school in the municipality of Bol there are 42 of them, of which 21 are boys and 21 are girls.

The average household in the municipality of Bol has 2.64 members (Table 1), which is certainly quite worrying from the aspect of demographic structure.

Table 1. Private households according to the number of members in the Municipality of Bol

Household number													Average number of persons in the household
Total	1	2	3	4	5	6	7	8	9	10	11 and more		
Household number	624	187	145	117	107	40	18	6	1	1			2,64
Number of persons	1646	187	290	351	428	200	108	42	8	9			

Source: Popis 2021. Državni zavod za statistiku

## Conclusions

This project will be carried out with the aim of having as little negative impact on the environment as possible, while at the same time redirecting the local population to the use of shipping lines, which will carry out boat traffic for the local population every day throughout the year. The necessity of realizing this project is evident from the way of doing business so far and the analysis that showed that it is only in this way that it is possible to ensure that transport services for the local population are improved throughout the year, regardless of the pressure of tourism, and thus improve the availability of employment, education and other service to Bol. With this option, the existing situation would be changed, and by increasing the quality of the capacity available to the port, it would provide a quality pier for shipping lines, and the local population would receive a higher quality of service and level of safety. In this way, the town of Bol will once again become a competitive area for year-round living and work for the local population.

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