

# Proposal of New Criteria Model on the Classification of Ports Open to Public Transport of the County Importance: Case Study – Zadar County

A. Gundić, D. Županović, M. Barić & Lj. Peričin  
*University of Zadar, Zadar, Croatia*

**ABSTRACT:** Successful and sustainable development of county ports implies identification and assessment of all the elements that affect their performance. Several factors determine port's performance out of which the most significant one is its position, usually in the centre of a town/settlement. This situation is the most common in the Mediterranean countries where small ports are usually in the centre of a settlement. Such a location of ports affects their urban and spatial planning, i.e., it affects planning the development of county ports. To determine a direction of development of any port (of county importance), analysis and assessment of the current port conditions as well as the role and proportion of its operations are a mandatory prerequisite. Currently defined criteria on the classification of ports open to public transport (of all categories) of county importance (in Croatia) are rigid and imprecise, and therefore, cannot be a credible element to assess ports open to public transport of county or regional importance not matter of their specific attributes. Therefore, this article, based on the conducted analysis, presents new criteria model on the classification of ports open to public transport of county importance – a methodology that can be applied when analysing the current condition of county ports in Croatia based upon eight ports of county importance in Zadar County – Ports of Preko, Biograd, Tkon, Brbinj/Lučina, Fortica, Zaglav, Silba/Žalić and Pag.

## 1 INTRODUCTION

The paper presents a model of development of ports open to public transport of county importance under management of Port of Zadar County Authority. In Croatian terms, Port Authority implies a non-profit organization established based on the Law on Maritime Property and Seaports and on the Decree on Establishment of Port Authority. Its purpose is to manage, maintain, build and exploit the ports of county importance under the Regulation on the Classification of Ports Open for Public Transport in Zadar County issued by the Ministry of Maritime Affairs, Transport and Infrastructure [1, 2, and 3]. Accordingly, due to importance of island habitat preservation, its primary goal is not to be profitable,

rather to maintain and develop the ports of county importance when there is no direct economic interest from third (commercial) parties. Thus, main focus and the goal of these actions are to stimulate further development of, not only the port, but of local (in the case of Zadar County, frequently island) communities in general as well.

The establishment of the Port Authority is based on the state laws and regulations (ever since Croatia has become a part of the European Union, its strategic documents are also aligned with the Union's strategic goals), that define and determine development needs and guidelines. They are imperative when planning the development of ports open to public transport in Zadar County (as well as other Croatian counties) and

are identified as follows: Transport Development Strategy of the Republic of Croatia 2014 – 2030; Transport Development Strategy of the Republic of Croatia 2017 – 2030; National Development Strategy 2030; National Development Plan of Croatian Ports for Public Transport of Local and County Significance (final draft); Zadar County Development Plan 2021-2027 (draft version).

When planning a port's development, apart from the strategic documents, it is important to analyse all legal acts that influence the development of ports open to public transport in Zadar County with the following legal acts being specially emphasized:

- Regulation on the Classification of Ports open for passenger transportation;
- Regulation on the Classification of Ports open for cargo transportation and;
- Ports for special use (i.e., fishing ports).

To analyse the possibilities of the future development and according to the forementioned legal acts, first important step was analysis of current ports' conditions, with the following elements analysed:

- Geographical position of the port and port area;
- Size of the port area and its connection with hinterlands and nearby port areas;
- Facilities and infrastructure available at the port;
- Technical and technological characteristics of operational shores and berthing;
- Berthing capacities for different vessels types;
- Safety equipment (safe berthing at the port);
- Actual and predicted number of vessels (to be serviced by each port);
- Navigational, meteorological and oceanographic conditions of the port and its anchorages.

Based on the analysis on the current state of ports, and to examine their needs and possibilities of the future development, it is important to (re)evaluate the already existing criteria that determine ports' classification. The classification criteria of ports regarding their importance are determined by the Regulation on the Classification of Ports open for passenger transport in Zadar County, Regulation on the Classification of Ports open for cargo transport and Ports for Special Use. Altogether they define the criteria needed for an area to gain the status of a port open to public transport of county importance:

- The average turnover of over 50 000 tons of cargo per year between years 1998 and 2003;
- The average passenger turnover of over 100 000 passengers a year between years 1998 and 2003 for the solely passenger port;
- The appropriate road connections with hinterlands;
- Wharfs and shores for 4m draft vessels up to 80m long;
- At least three lines in the domestic passenger lines a month for the solely passenger port.

Provision of the Act 8 of the Regulation is important since it prescribes the obligation to meet all the criteria needed for a port's classification [6].

The current criteria for the port classification in the Regulation on the Classification of Ports open for passenger transport in Zadar County, Regulation on

the Classification of Ports open for cargo transport and Ports for Special Use refer to the amount of cargo turnover and the frequency of domestic passenger lines, road and railway connections with hinterlands and installed port capacities. Detailed analysis of all of the forementioned criteria, reveals the fact all of them are related exclusively to technical and technological factors, rather than socio-economic factors which should/must be taken into consideration regarding the Law on Maritime Property and Seaports and the Decree on Establishment of Port Authority. These two legal acts clearly define Port of Zadar County Authority's (as well as any other County Port Authority in Croatia) obligation to take into consideration socio-economic factors as well.

Despite great differences between county ports regarding their location and other attributes along 1.777 km long Croatian coast line, currently defined criteria on the classification of ports open to public transport (all categories) of county importance are rigid and imprecise, and therefore, cannot be a credible element to assess ports open to public transport of county or regional importance not matter of their specific attributes.

Current criteria do not comprise geographical, transport, economic and social particularities of a certain county, i.e., they do not comprise economic interests and needs of the local population. As far as the economic interests and local population are concerned, it is important to emphasize that the local population is the most important stakeholder of the port's development (in a particular county). Furthermore, local population is the regular user of port services; therefore, the port's development can have either, positive or negative impact on the local population.

Regulation on the Classification of Ports Open to Public Passenger Transport in Zadar County 2021 classifies eight ports as ports of county importance whereas 105 ports are classified as ports of local importance [4, 5]. Therefore, this article, based on the conducted analysis, presents new criteria model on the classification of ports open to public transport of county importance – a methodology that can be applied when analysing the current condition of county ports in Croatia based upon eight ports of county importance in Zadar County – Ports of Preko, Biograd, Tkon, Brbinj/Lučina, Fortica, Zaglav, Silba/Žalić and Pag.

## 2 ELABORATION OF THE ASSESSMENT CRITERIA

Successful and sustainable development of county ports implies identification and assessment of all the elements that affect their performance. Several factors out of which the most important one is its position usually in the centre of a settlement determines port's performance. This situation is the most common in the Mediterranean countries, e.g., Croatia and Italy, where small ports are usually located in the centre of a settlement, close to the historic centre. Such a location of ports affects their urban and spatial planning, i.e., it affects planning the development of county and local ports. Development of ports of

county importance depends on the development of neighbouring ports and overall port system of a micro location as well.

To determine a direction of development of a port of county importance, it is important to analyse and assess both the current port conditions and the role and proportion of its operations. Upon concluded analysis two groups of criteria taking into consideration both technical-technological aspects and socio-economic aspects of assessing county's directions or scenarios of development were defined. For every criterion, sub-criteria that could be presented quantitatively or qualitatively by a respective descriptive or numeric variable were defined. They are used to assess and estimate the realisation of possible scenarios. Defined criteria and their respective sub-criteria are described in Table 1.

Table 1. Criteria and respective sub-criteria

Category	Criterion	Sub-criterion
Transport Technology	Location	Natural and Geographical Factors
		Transport Connections
	Transport Capacities	Operational Shore Number of Berths Entering the Port
Socio Economic	Infrastructure	Availability and Condition of Basic Infrastructure
		Condition of Berthing Equipment
		Availability of Additional Port Services
Social Acceptability and Financial Sustainability	Social Acceptability and Financial Sustainability	Local Population's Needs
		Boaters' Needs
		Needs of the Economy
Financial Sustainability	Financial Sustainability	Financial Sustainability

## 2.1 Transport Technology Category of the Criteria

A review of criteria, sub-criteria and indicators belonging to the Transport Technology Category is shown in Table 2.

### 2.1.1 Port location

For the purpose of this paper, Port Location represents a criterion consisting of two sub-criteria: Natural and Geographical Factors and Transport Connections. This criterion is the basis of the port assessment regarding its geographical position and connections with other ports as well as other urban and economic centres of the County and more.

The sub-criterion called Natural and Geographical Factors refers to the acceptability of port development regarding natural factors, primarily winds, waves, tides, currents etc. This sub-criterion implies that the port has a safe access to open seas, waters with unrestricted manoeuvring (depth and width of waters are under current needs and future development), and favourable oceanographic and meteorological conditions during the whole year.

Sub-criterion Transport Connections is important for the islands' development. It also improves the quality of life of the local population living on islands. Therefore, within this sub-criterion, it is important to analyse the existing connections between the land and islands, among the islands as well as the future

development needs and possibilities. Hence, the importance of domestic passenger lines, their number and occasional (charter) passenger transport. When doing the analysis, apart from the current situation and conditions, it is important to consider the need for the additional capacities resulting from the introduction of new domestic passenger lines, the quality improvement of the existing capacities for Ro-Ro ships and the estimated demands for the passenger transport.

Table 2. A review of criteria, sub-criteria and respective indicators belonging to the Transport Technology Category

Criterion	Sub-criterion	Indicator	Measurement system	
Port Location	Natural and Geographical Factors	NG1	Exist/Partially exist/Do not exist (E/PE/DE)	
		NG2	Enabled/Restricted/Disabled (E/R/D)	
		NG3	Not suitable /Partially suitable/Suitable (NS/PS/S)	
Transport Connections	Transport Connections	TC1	Exist/Do not exist (E/DE)	
		TC2	Exist/Do not exist (E/DE)	
		TC3	Do not exist/Restricted/Exist (DE/R/E)	
Port Capacities	Operational Shore	OO	Do not meet needs /Partially meet needs/ Meets needs (DMN/PMN/MN)	
		Number of Berths	BN1	Does not meet needs/ Meet needs (DMN/MN)
			BN2	Does not meet needs/ Meet needs (DMN/MN)
Port Infrastructure	Entering the Port	EP	Acceptable/Not acceptable (A/NA)	
		Availability and Condition of Basic Infrastructure	ACB1	Not available/Restricted/ Available (NA/R/A)
			ACB2	Yes/No (Y/N)
ACB3	Yes/No (Y/N)			
Port Infrastructure	Availability of Additional Port Services	ACB4	Yes/No (Y/N)	
		ACB5	Yes/Restricted/No (Y/R/N)	
		ACB6	Bad/Satisfactory/Good/ Excellent (B/S/G/E)	
Port Infrastructure	Condition of Berthing Equipment	ACB7	Yes/No/Available in immediate surroundings (Y/M/AI)	
		CBE	Does not meet needs/ Partially meets need/ Entirely meets needs (DMN/PMN/EMN)	
		Availability of Additional Port Services	AAP1	Does not meet needs/ Partially meets need/ Entirely meets needs (DMN/PMN/EMN)
AAP2	Yes/No (Y/N)			
AAP3	Yes/No (Y/N)			
Port Infrastructure	Availability of Additional Port Services	AAP4	Yes/No (Y/N)	
		AAP5	Not available/Available/ Available in immediate surroundings (NA/A/AI)	
		AAP6	Yes/Restricted/No (Y/R/N)	
Port Infrastructure	Availability of Additional Port Services	AAP7	Yes/No (Y/N)	
		AAP8	Interventions are not possible within a 30 minute span/ Interventions are possible within a 30-minute span (P/NP)	

It is also very important to determine the level of the port's connections to the road network as well as

its potential development possibilities. Therefore, the sub-criterion Transport Connections implies the existence of domestic passenger lines, of occasional passenger transport and connections to road networks.

### 2.1.2 Port capacities

Within this criterion, the possibilities and needs to increase current port capacities are assessed. This primarily refers to the increase of the number of berths, to the construction and to the extension of operational shores. When assessing this criterion, apart from the possibility and the need to increase current capacities within the above-mentioned sub-criteria, it is important to consider the improvements within the sub-criteria. Thus, it would be possible to determine the improvement direction within the sub-criteria mentioned above.

The sub-criterion Operational Shore implies a shore with certain technical-technological characteristics that enables the vessels to moor and that is at disposal to everyone under the same conditions, i.e., which is not occupied with permanently moored vessels. The advantage is given to vessels maintaining regular liner routes (connections).

Sub-criterion Number of Berths refers primarily to the number of communal and nautical berths. However, the need and possibility to increase the number of fishing berth is being considered.

Sub-criterion Entering the Port refers to the average number of vessels entering the port daily.

### 2.1.3 Port Infrastructure

This criterion implies the assessment of the achieved functional and technical level of service i.e., functionality of port infrastructure, condition and quality of berthing equipment, level and quality of the port's facilities and other services in the port's area.

Availability and Condition of Basic Infrastructure – these elements are assessed: port equipment with basic elements for providing transport services and accessibility for different vessels. It is also important to analyse water and electricity availability, port lights, towing availability, availability of shore cranes, onshore area for passengers and vehicles, the quality of access roads and fuel supply possibilities.

Condition of Berthing Equipment – Technical and functional condition of berthing equipment is analysed within this sub-criterion. When analysing this criterion, it is important to consider port's development possibilities.

Availability of Additional Port Services – Within this sub-criterion, the current conditions are assessed and the possibility and need to develop value added services in a certain port area. This sub-criterion implies the size of the port's land area, port reception facilities, collection and disposal of oily waters, area for technical maintenance of vessels, accessibility of basic supplies, Wi-Fi availability, security services, and emergency services.

## 2.2 Socio Economic Category of the Criteria

### 2.2.1 Social Acceptability

Within the above-mentioned criterion, the end users' need for a certain port service is assessed i.e., demands for domestic passenger lines, demands referring to nautical tourism, excursion tourism, demands for communal and fishing berths. The impact of potential development directions on port system's users could be assessed as well.

In addition, a difference between positive and negative effects of a certain development direction is assessed.

The list of the described criteria, sub-criteria and respective indicators referring to the Socio-Economic Category of the Criteria is shown in Table 3.

Table 3. The list of criterion, sub-criteria and indicators referring to the Socio-Economic Category

Criterion	Sub-criteria	Indicator
Social Acceptability	Local Population's Needs	Meet needs/Do not meet needs
	Boaters' Needs	Meet needs/Do not meet needs
	Needs of the Economy	Meet needs/Do not meet needs

Sub-criterion called Local Population's Needs calls the local population the regular user of port's services.

Boaters' Needs – Within this sub-criterion, boaters' needs referring primarily to the port's nautical function are assessed.

Needs of the Economy – This sub-criterion refers to needs resulting from economic activities, primarily from fishing.

Financial Sustainability – Within this sub-criterion, the need for the financial close is assessed based on the realized income and expenses, i.e., expenses referring to the port infrastructure and its maintenance. The complexity of needed interventions must be considered (construction, remodelling, improvements, modernisation etc.) when assessing this sub-criterion.

## 3 THE ANALYSYS OF CURRENT CONDITIONS IN THE PORTS OF COUNTY IMPORTANCE

Based on the above-mentioned criteria and sub-criteria, the analysis of the current conditions of every port of county importance was made. Ports of Zadar County importance, included in this research, are shown in Figure 1.

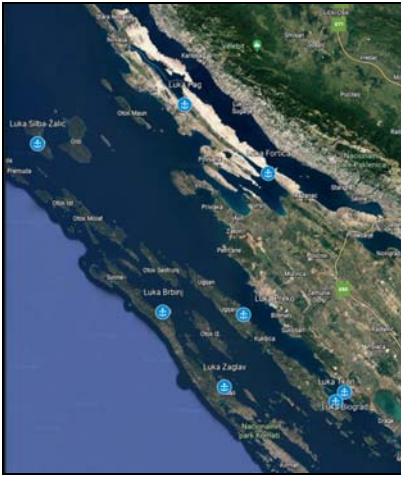


Figure 1. Ports of the Zadar County Importance [7]

The analysis of current conditions (Table 4.) was made after visiting and inspecting every port. Besides from data gathered in the inspection, the data obtained from CIMIS (Croatian Integrated Maritime Information System), from Croatian Bureau of Statistics, Ministry of Maritime Affairs, Transport and Infrastructure, and Coastal Shipping Agency [8] were analysed as well.

### 3.1.1 Port of Preko

Port of Preko is known for one (out of three) of the busiest lines on the eastern shore of the Adriatic Sea [8]. Its full capacity the port gained in 2011 after the

reconstruction. The size of the operational shore satisfies the needs of the current lines. Its size, technical solutions, depth and other facilities make it suitable for passenger transport, vehicles of all categories and purposes, for Ro-Ro passenger vessels of different sizes and frequencies as well as for the local populations' needs. The condition of the port's infrastructure is entirely satisfying. Road access to the port, parking lots and waiting area satisfy the current needs. The port is relatively well protected against bad weather.

### 3.1.2 Port of Biograd

Current condition of the Port of Biograd is characterized by a good and functional port infrastructure suitable for Ro-Ro passenger vessels, fishing vessels and smaller passenger vessels. The level of equipment for safe berthing in this part of the port is good; the same could be said for additional facilities, as well. However, the port is in the very centre of the settlement, which makes the car access to the port difficult.

The level of equipment for safe berthing at the whole port area can be assessed as good and the availability of additional facilities. The capacity of communal berths is not satisfactory, whereas the capacity of nautical berths is compensated with the neighbouring marinas' capacities. The port's protection against bad weather can be assessed as satisfactory although its openness to west winds can make manoeuvring as well as berthing more difficult.

Table 4. The Analysis of Current Conditions of Ports of Zadar County Importance

Criterion	Sub-criterion	Indicator	Estimate								
			PP	PB	PT	PBL	PF	PZ	PS	PP	
Port Position	Natural and Geographical Factors	NG1	E	E	E	E	E	E	E	E	E
		NG2	E	E	E	E	E	E	E	E	E
		NG3	S	S	S	S	PS	S	PS	S	
	Transport Connections	TC1	E	E	E	E	DE	E	E	E	DE
		TC2	E	E	E	E	DE	E	E	E	E
		TC3	E	E	E	E	E	E	E	R	E
Port Capacities	Operational Shore	OO	MN	MN	MN	PMN	DMN	MN	MN	PMN	
	Number of Berths	BN1	MN	DMN	MN	DMN	DMN	MN	MN	MN	
		BN2	MN	MN	MN	DMN	DMN	DMN	DMN	MN	
Port Infrastructure	Entering the Port	EP	A	A	A	A	NA	A	A	A	
	Availability and Condition of Basic Infrastructure	ACB1	A	A	A	NA	NA	R	A	A	
		ACB2	Y	Y	Y	Y	Y	Y	Y	Y	
		ACB3	Y	Y	Y	Y	N	Y	Y	Y	
		ACB4	N	N	N	N	N	N	N	N	
		ACB5	Y	Y	R	R	N	R	N	R	
		ACB6	G	S	G	G	B	G	S	S	
		ACB7	Y	AI	AI	AI	N	Y	N	AI	
	Condition of Berthing Equipment	CBE	EMN	EMN	EMN	PMN	DMN	PMN	EMN	PMN	
	Availability of Additional Port Services	AAP1	EMN	EMN	EMN	PMN	DMN	PMN	PMN	PMN	
		AAP2	Y	Y	N	Y	N	N	N	N	
AAP3		Y	Y	Y	N	N	N	N	N		
AAP4		N	N	N	N	N	N	N	N		
AAP5		AIS	AIS	AIS	NA	NA	AIS	AIS	AIS		
AAP6		R	R	N	N	N	N	N	N		
AAP7		N	N	N	N	N	N	N	N		
AAP8		P	P	P	P	P	P	P	P		
Social Acceptability	Local Populations' Needs	LPN	MN	DMN	MN	MN	DMN	MN	MN	MN	
	Boaters' Needs	BN	DMN	DMN	MN	DMN	DMN	DMN	DMN	MN	
	Needs of the Economy	NE	MN	MN	MN	MN	DMN	MN	MN	MN	

### 3.1.3 Port of Tkon

During 2022 the new part of the port was opened and it includes ferry port, nautical and transit berths, as well as a breakwater that protects the inner part of the port. The facilities for ships, boats and yachts' berthing are available. Based on its characteristics, the port is primarily intended for Ro-Ro passenger vessels. The current condition of the port is characterized by a good level of the built port infrastructure, whose quality itself can be assessed as good. Car waiting areas are of adequate sizes. The level of equipment for safe berthing can be assessed as good, whereas the level of additional facilities is mediocre.

### 3.1.4 Port of Brbinj/ Lučina

Facilities for berthing of ships and boats are available at the Port of Brbinj. At the ferry port, a part close to the operational shore is reserved for ferries and fast lines. The inner part of the operational shore, between the pier and the shore, is the operational shore for vessels in transit. Protected, southern part of the port is intended for communal berths. The quality and capacity of the port infrastructure, intended for the Ro-Ro and other passenger vessels, satisfy the needs. Car access to the port area is adequate whereas parking lots and waiting area satisfy the current needs. However, additional port facilities are below average.

The quality and capacity of the port infrastructure referring to communal berths is below average, whereas some parts of the shore must be reconstructed. The level of equipment for safe berthing in this part of the port can be assessed as below average, too. The same could be said for the availability of additional facilities as well. Port area is well protected against bad weather.

### 3.1.5 Port of Fortica

Shore, fenders and berthing equipment are average. Port equipment and the level of additional facilities are not satisfactory. The port itself is exposed to Northeast (NE) winds and to Southeast (SE) winds and waves.

Port infrastructure is poor; the level of additional facilities is below average, whereas the condition of access roads is extremely bad. Therefore, its status of the port of county importance could be revoked i.e., port's current condition and demands for the port capacities do not justify the status of the port of county importance.

### 3.1.6 Port of Zaglav

The current condition at the Port of Zaglav is characterised by a mediocre level of port infrastructure and relatively small berthing capacity for ships and boats. The quality of port infrastructure could be assessed as mediocre. Parts of the shore should be reconstructed.

The level of equipment for safe berthing is also mediocre. Port area and the whole bay are relatively

well protected against bad weather so safe berthing is possible.

Capacities intended for the nautical tourism could be assessed as not satisfactory especially during the summer season whereas the capacity of communal berths is adequate. The capacity of the operational shore is partially inadequate especially during the tourist (summer) season. But outside the tourist season it surpasses the actual berthing needs.

### 3.1.7 Port of Silba/Žalić

Current level of maritime transport and the number of domestic passenger lines make the Port of Silba the most important one in the wider area. The port was rebuilt and reconstructed in 2020. Therefore, the current condition of the port is characterised by the high-quality port infrastructure that meets the requirements for safe berthing of Ro-Ro and other passenger vessel on the existing lines. The capacity of the port is satisfactory as well. The operational shore is large enough to ensure commercial vessels' berthing (fishing, tourist and smaller cargo ships) under the condition that they do not interfere with passenger transport. The equipment of the communal part of the port is mediocre, whereas the level of additional facilities is below average.

### 3.1.8 Port of Pag

The current condition of the Port of Pag is characterised by the standard port infrastructure suitable for smaller passenger vessels and local populations' boats. Due to its natural position, it is relatively well protected from all winds. Sea area of the port is relatively wide making the maritime safety satisfactory. Port infrastructure is mediocre. The level of equipment is mediocre too, whereas the level of additional facilities is good.

## 4 CONCLUSION

The analysis of the current conditions of the ports of local and county importance of Zadar County was made after visiting and inspecting every described port. Besides from data gathered during the inspection, the data obtained from CIMIS, Croatian Bureau of Statistics, Ministry of Maritime Affairs, Transport and Infrastructure, and Coastal Shipping Agency were analysed as well.

The importance of the majority of ports of county importance is based on domestic passenger lines that are extremely important for the local population. The exception is Port of Fortica whose current condition of the port area and port capacity's requirements do not justify its status as the port of county importance.

Emphasise that ports of Tkon, Silba and Biograd have been reconstructed and extended. Therefore, their port capacities have been increased; quality of port infrastructure has been improved; the level of additional facilities has been increased. These interventions have met the public and coastal line transport. As far as the ports of Brbinj/Lučina and Zaglav are concerned, it is important to emphasise

that capacities intended for the public, coastal line transport are satisfactory, whereas capacities intended for the nautical and communal berthing are average or below average. The analyses include also the port of Pag whose level of port infrastructure and the level of equipment are mediocre, whereas the level of additional facilities is adequate.

Importance of proposed model of classification of ports open to public transport of the county importance is presented through addition of new socio-economic criteria group of factors instead of currently exclusively used technical-technological factors which exclusively used obviously have become inadequate. Importance of new classification model becomes even more highlighted upon taking into consideration both national and EU strategies with explicit highlights on socio-economical factors.

Additionally, importance of the proposed model can also be seen through defining basic criteria needed for assessment of ports' future development. Conducting of such research and assessment using multi-criteria methodology like Analytical Hierarchy Process (AHP) can provide valuable insight into all aspects needed for planning and implementation of

sustainable development of both port and populated areas.

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