D.4.4.3 FEASIBILITY PROJECT ON ABRUZZO-CROATIA SEA LINK WITH AN LNG-POWERED SHIP

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Introduction

This study was carried out within the framework of the strategic project MIMOSA (MarItime and MultimOdal Sustainable pAssenger transport solutions and services, Interreg V-A Italy-Croatia CBC Programme 2014-20) as an integral part of the cross-border cooperation strategy between Italy and Croatia, which, among other things, envisages the implementation of pilot actions aimed at improving services to make passenger mobility more accessible, low-carbon and sustainable throughout the programme area.

The main strategic aims of the MIMOSA project are aimed at:

- strengthen cooperation between relevant actors in Italy and Croatia towards sustainable cross-border and multimodal passenger transport between the two countries;
- increase knowledge of the demand for transport services at local, regional and cross-border levels
- improve the provision of information and services.

In addition, the project intends to set up a permanent cross-border network to foster an ongoing dialogue necessary to strengthen cooperation between stakeholders, providing them with in-depth and up-to-date information useful to develop a better planning capacity supported by a higher awareness of passenger habits and the impact on the environment and transport services.

The topic is therefore part of a broader context concerning transport systems and intermodality.

In this context, maritime transport is of strategic importance for the economy as a fundamental part of the international supply chain: in economic terms, 77% of European foreign trade and 35% of trade between EU Member States takes place by the sea. Given its important socio-economic and strategic role, maritime transport has a strong impact on the environment in terms of greenhouse gas emissions, sulphur dioxide, underwater noise pollution and hydrocarbons. In 2020, shipping was estimated to account for 13.5 % of all greenhouse gas emissions from transport in the EU.

The International Maritime Organization (IMO) has adopted a strategy that aims to reduce greenhouse gas (GHG) emissions from international shipping by at least 15 per cent by 2030 compared to 2008, and by 50 per cent by 2050, and then phase them out. The 2030 GHG emission reduction targets can be achieved through the use of available technology, with a combination of short- and medium-term measures, including the use of low-carbon fuels. To achieve these goals, maritime transport will undergo a global transition

towards the use of advanced ship propulsion systems and fuels produced from alternative energy sources. This transition will also be addressed from an economic, social and environmental perspective.

Even more ambitious GHG emission reduction targets are contained in the European Green Deal ('Fit for 55' document).

Within the above-mentioned reference context and in the framework of the MIMOSA project, the Abruzzo Region and the Interdepartmental Centre for Transport and Sustainable Mobility (CITraMS) of the University of L'Aquila are called upon to carry out an innovative study aimed at analyzing and verifying the feasibility of a low-impact passenger maritime connection between Italy and Croatia, with particular reference to the use of a Liquefied Natural Gas (LNG) fueled naval carrier.

The study, therefore, is based on a systemic methodological approach that contemplates, across a broad spectrum, the aspects (planning, infrastructural, vehicular, technological, energy, operational, economic, environmental, social, etc.) that interact with the subject matter.

To combine the scientific methodological approach with the more strictly technical-operational one, the study was carried out with the support and participation of a qualified group of stakeholders consisting of:

- Snam S.p.A
- Caronte & Tourist S.p.A
- Società Unica Abruzzese di Trasporto (TUA S.p.A.)
- Consortium company INOLTRA S.r.l.

The contents of the study are divided into four chapters. The first is focused on the analysis of the reference framework of transport planning declined concerning territorial levels of type: European, macro-regional, national and regional.

In the second chapter, with particular reference to the national maritime transport sector, the environmental interactions and emission reduction targets of the sector contained in the European Green Deal, the 'Fit for 55' document and the Italian National Strategic Framework are analysed. Following this, this study on the one hand analyses the use of LNG for shipping, and on the other identifies Bio LNG as a suitable fuel to capture emission reduction targets.

The focus of the third chapter is on the analysis of the performance characteristics of the main Abruzzo and Croatian’s ports and their relations with the reference territory assessed through the introduction of

specific indicators of accessibility (both local and territorial) and of potential users that have guided the identification of the pair of ports on which to establish a new maritime passenger transport link between Abruzzo and Croatia.

The last chapter compares the operational characteristics of a wide range of LNG-fuelled vessels (operating in the Mediterranean or under construction) with the technical and performance characteristics of the Abruzzo and Croatian ports. The comparison leads to the identification of the most suitable ship to carry out the transport service once the demand analysis has been carried out. Thus, the chapter contains service sizing, cost analysis and emission estimation of LNG and Diesel Boating (MDO) powered vessels as well as comparison with emissions associated with transportation by passengers' cars.

Therefore, in more general terms, the aims of the study are aimed at increasing cross-border connectivity between Italy and Croatia to promote multimodality, the environmental sustainability of transport systems and the accessibility of the territories.

Chapter 1: Framework of transportation planning at the territorial level

This first part of the study summarizes the most recent infrastructural planning arrangements for different spatial levels such as:

- European
- macro-regional
- national (with reference to Italy and Croatia)
- regional (with reference to Abruzzo)

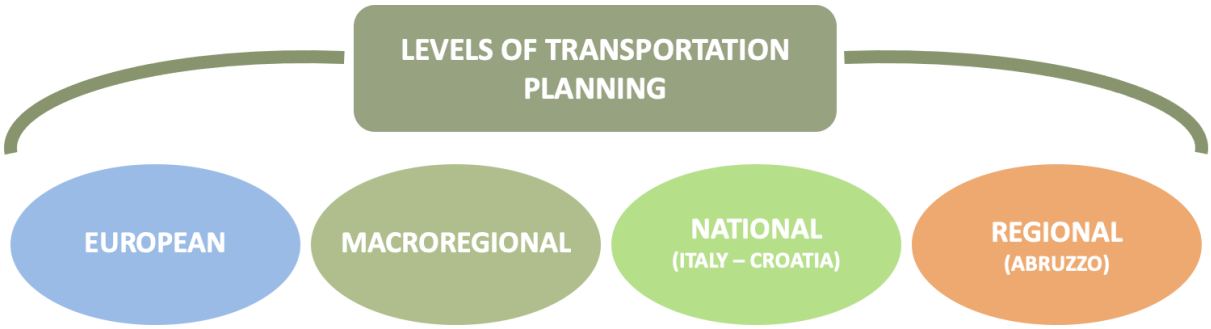

Figure 1: Planning levels

1.1 - European planning

This section reviews the main current planning experiences in Europe concerning transport networks, highlighting, where necessary, their main relationships with maritime transport.

1.1.1 - TEN- T - Trans-European Network Transport

The TEN-T (Trans-European Networks Transport) network is an integrated infrastructure system created to support the single market by ensuring the free movement of trade and population within the European territory. It also aims to increase employment and the level of competitiveness of the Member States. The synergy between transport infrastructure and telematics applications, which make up the transport network, is aimed at promoting the sustainable and efficient use and management of transport infrastructure and services.

The TEN-T network is structured on two levels:

- The core network consists of those sections of the comprehensive network that are of the highest strategic importance for the development of the TEN-T network;
- The comprehensive network includes all existing and planned transport infrastructures in the TEN-T programme, promoting their efficient and environmentally and socially sustainable use.

Core networks play a key role in achieving the objectives of European transport policy by tackling rising demand and ensuring high-quality safety standards and reducing carbon emissions. The first layer of the TEN-T network is to be completed by 2030. The core network comprises point elements - nodes - and linear elements - corridors - that generate a network of connections between the European inland regions and neighboring countries.

The nodes that make up the core network are:

- urban nodes, including their ports and airports;
- seaports and inland ports;
- border crossings with neighboring countries;
- rail and road terminals;
- airports for passengers and cargo.

The network consists of transport infrastructures of types:

1. railway;
2. road;
3. maritime and inland waterways;
4. plane;
5. multimodal.

The TEN-T network is designed to strengthen social, economic and territorial cohesion and to create a single, efficient and sustainable European transport system for the benefit of users and the inclusive growth of the Member States. The European Council set the following four macro-categories of objectives for the realization of the single system

<u>Cohesion:</u>

- accessibility of all European regions;
- minimizing quality gaps in the infrastructures of the Member States.

- interconnection between long and short-distance transport infrastructures;
- balanced cooperation between all European regions.

Efficiency:

- elimination of bottlenecks and completion of missing links;
- interconnection and interoperability of national transport networks;
- promotion of economically and qualitatively sustainable transport;
- efficient use of new and existing infrastructure;
- application of new technologies and innovations.

Sustainability:

- sustainable, economic and environmental development of transport through the reduction of greenhouse gases and carbon emissions;
- increased fuel security and reduced costs;
- reduction of CO_2 emissions by 2050.

Benefits for the user:

- ensure security standards for users;
- meet the needs of internal mobility and with third countries;
- improve network accessibility for the elderly and users with reduced mobility or disabilities.

The seaports included in the core networks need to be connected to land transport infrastructures such as rail, road and inland navigation by 2030, while major airports need to be connected by 2050.

Core Network Corridors

The linear network elements that complement the core network are the corridors, which, through their branching across Europe, facilitate multimodal transport coordination and resource efficiency. The corridors consist of linear rail, maritime and road transport infrastructure.

The essential requirements for corridors are:

- modal integration;
- interoperability
- coordinated infrastructure development.

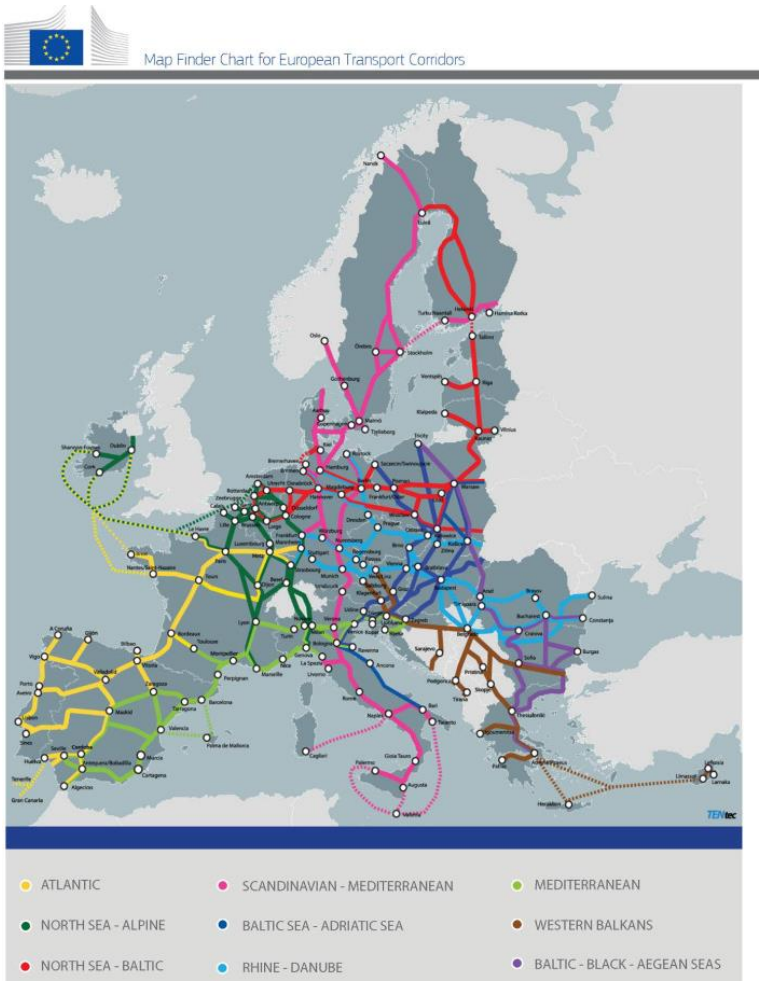

Figure 2: TEN-T network. Source: https://ec.europa.eu/transport/infrastructure/tentec/tentec-portal/map/maps.html

Core network corridors (Figure 2) cover the most important long-distance flows of the core network and are intended to improve cross-border connections within the Union; they are also multi-modal and open to the inclusion of all transport modes covered by the TEN-T network. They cross at least two borders and, where possible, involve at least three transport modes, including Motorways of the Sea.

1.2 – Macroregional planning

A 'macro-regional strategy' is an integrated framework endorsed by the European Council, which may be supported, inter alia, by the European Structural and Investment Funds, to address the common challenges of a defined geographical area involving Member States and third countries located in the same

geographical area and thus benefiting from enhanced cooperation contributing to the achievement of economic, social and territorial cohesion. EU macro-regional strategies are initiated and requested by interested EU Member States (and in some cases third countries) located in the same geographical area through the European Council. Following the latter's request, the strategies are drafted and adopted by the European Commission. Thus, the strategies are purely intergovernmental initiatives, and their implementation largely depends on the commitment and goodwill of the participating countries. The process is as important as the outcome: it must be inclusive and structured from the bottom up to ensure ownership. So far, four EU macro-regional strategies have been adopted (Figure 3), covering different policies for the following regions:

- Baltic Sea (2009);
- Danube (2010);
- Adriatic and Ionian (2014);
- Alpina (2015).

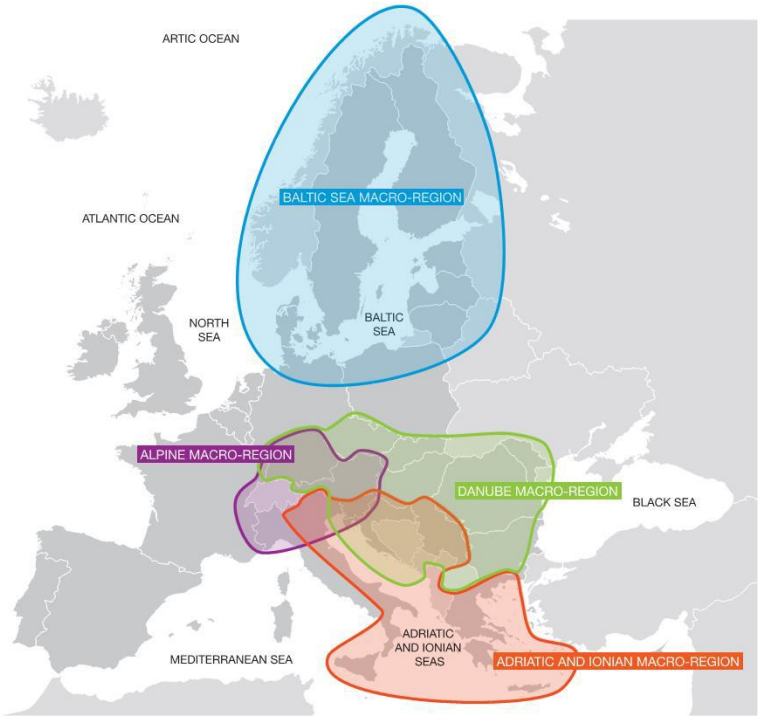

Figure 3: 4 macro-regional strategies on European territory

Each strategy involves a wide range of actors at various levels (international, national, regional, local), sectors (public, private, civil society) and fields of expertise, thus providing a platform for coherent, multinational, multi-sectoral and multi-level governance. All adopted macro-regional strategies are also accompanied by an ongoing action plan to be regularly updated according to new emerging needs and changing contexts. The MIMOSA project is concerned with the Adriatic and Ionian Macroregion (Figure 4), whose strategy is called EUSAIR, which stands for 'EU Strategy for the Adriatic and Ionian Region, which aims to address the current differences in the economic and administrative capacity of the region. It includes four EU Member States and four candidate countries. The overall objective of EUSAIR is to improve the level of interconnection between EU Member States and third countries by increasing their integration. The strategy is divided into four transnational/cross-border strategic lines: blue growth, transport and energy networks, environmental quality and sustainable tourism.

Figure 4: Adriatic and Ionian macro-region

1.2.1 - Eusair Targets 2021-2027

EUSAIR's 2021-2027 strategy includes a list of objectives for each line of interest. Below is a summary of the objectives that relate to transport and in particular maritime transport:

The Adriatic-Ionian Multimodal Corridors

The development of an interconnected and integrated transport system in the Adriatic-Ionian Region presents itself as a challenge of macro-regional relevance, consistent with national priorities and with the EU

objectives of a more connected, greener and low-carbon Europe, which aims at strengthening North-South and East-West relations by using the identification of multimodal corridors alongside the TEN-T network. This aims to reduce infrastructural, technological and legislative gaps and improve accessibility to facilitate cross-border demand flows and transport operations, as well as to strengthen North-South and East-West (physical and digital) interconnections between the region's logistic and urban nodes.

Development and management of logistics for the direct use of LNG as a clean fuel for the Adriatic-Ionian Region

The development of the direct use of small-scale LNG can contribute to a more secure, competitive and sustainable energy system in the Adriatic-Ionian region. The deployment of LNG scale in the transport and other sectors could enable two challenges to be addressed in the medium term: reducing environmental impact and combating climate change. The direct use of LNG as a fuel, both for maritime and land transport, would allow for diversification and reduction of greenhouse gas emissions compared to petroleum-based hydrocarbon fuels. The development of LNG infrastructure would contribute to the use of LNG in maritime transport to meet the emission limits proposed by the European Union and the International Maritime Organization.

1.3 – National planning

In this section, we examine the salient features of the current planning at the national level in Italy and Croatia. In particular, the following planning experiences are analysed:

- Motorway of the Sea (Italy)
- Strategic Plan for Ports and Logistics (Italy)
- Infrastructure Annex to the Economic and Financial Document (Italy)
- National Integrated Transport System (Italy)
- Transport System Development Strategy of the Republic of Croatia

1.3.1 - Motorway of the Sea

Motorways of the Sea (MoS) are the maritime pillar of the TEN-T. They consist of short sea routes, ports, associated maritime infrastructure, equipment, facilities and relevant administrative formalities. The MoS (Figure 5) contributes to the realization of a European maritime transport space without barriers, connecting core network corridors and integrating maritime connections with the hinterland. Therefore, it

aims to provide more efficient, commercially viable and sustainable alternatives to road-only transport and in particular to:

- improve access to markets throughout Europe;
- reduce the pressure on European road systems.

The MoS introduces new intermodal logistics chains based on maritime transport that contribute to integrated door-to-door transport systems.

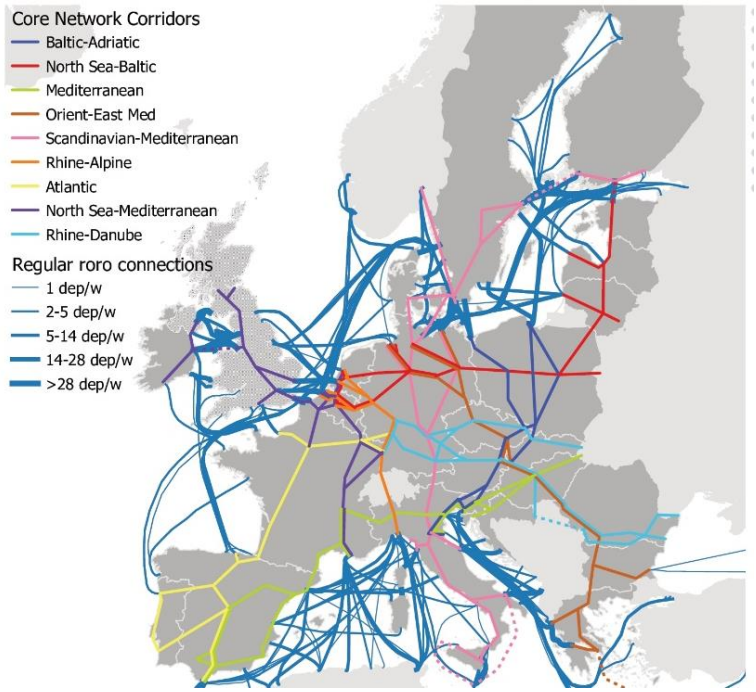

Figure 5: Affected regions. Source: https://transport.ec.europa.eu/transport-modes/maritime/motorways-sea_en

The Motorway of the Sea is designed to eliminate bottlenecks in the EU transport system. This is to be achieved through the creation of more efficient and frequent high-quality maritime logistics services between Member States. The main bottlenecks and missing links are:

- compliance with Annex VI of MARPOL 2015 (Regulations for the Prevention of Air Pollution from Ships) for fleets operating in Sulphur Emission Control Areas (SECAs);
- Creation of a viable alternative fuels network, including the development of relevant alternative fuels technologies, infrastructure, safety provisions and regulatory frameworks;
- development of technologies to tackle operational pollution, such as exhaust gas purification systems and on-board water treatment systems;

- implementation of critical port infrastructure and intermodal connections, both at sea and on land.

1.3.2 - Italy - National Strategic Plan for Ports and Logistics (2015)

The objective of the National Strategic Plan for Ports and Logistics (PNSPL) is to maximize the added value of the sea resource, not only for the maritime, port and logistics cluster per se but for the entire country system. The basic idea is that there is a value chain of the Sea System, which is expressed as:

- in the harbor;
- in the surrounding area;
- in the national territory;
- in Italy's relations with the Mediterranean;
- in Italy's relations with the rest of the world.

The Plan, taking into account the current situation of maritime ports and logistics, sets out to achieve strategic objectives and proposes as many actions as possible, the implementation of which will take place through regulatory and/or administrative interventions consistent with the guidelines provided by the PSNPL.

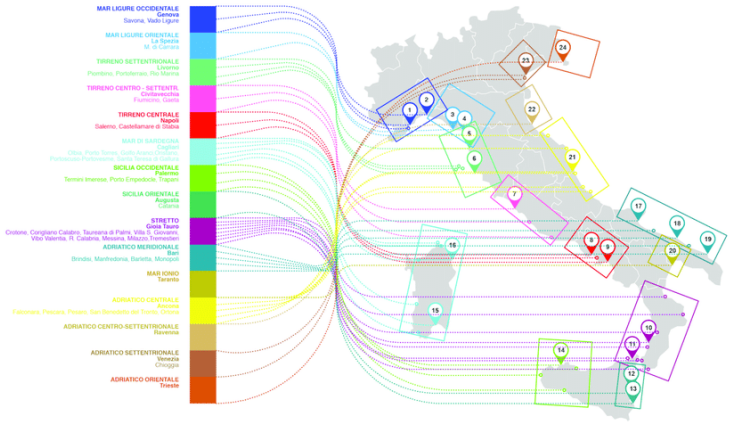

Figure 6: Italian Port System Authorities. Source: Italian Ministry of Infrastructure and Transport - MIT, graphic re-elaboration B. Moretti.

1.3.4 - Italy - Infrastructure Annex to the Economic and Financial Document (2021)

The Infrastructure Annex to the Economic and Financial Document is the policy document that describes the Government's choices in the area of infrastructure and mobility. It defines the selection of priority works for the country's development, also anticipating the long-term strategy of the General

Transport and Logistics Plan (GTP) and the Multi-year Planning Document (DPP) with a view to sustainable development. It feeds an integrated planning process of infrastructures and mobility based on reforms, connection, safety, equity and sustainability, also based on the investments (Figure 7) and reforms envisaged in the PNRR.

Figure 7: Strategies and tools

A dynamic approach involving updates, insights and step-by-step decisions:

- The General Transport and Logistics Plan (GTP) defines multi-sectoral objectives, strategies and actions for the long term;
- the Multi-year Planning Document (DPP) defines the programming and selection of works in compliance with expenditure constraints and line with the objectives and strategies of the LTMP;
- public debate, which is obligatory for major works, is necessary to arrive at the realization of shared works;
- the possibility of reviewing choices (project review) according to changed contextual conditions;
- ex-ante (guidelines) and ex-post (monitoring) evaluations for more rational choices and the achievement of objectives.

The Annex to the DEF is the policy document that, year by year, feeds the entire planning process: it anticipates some decisions pending the LTMP and the DPP, details/modifies some priority choices, and updates others in addition to the general objectives and strategies.

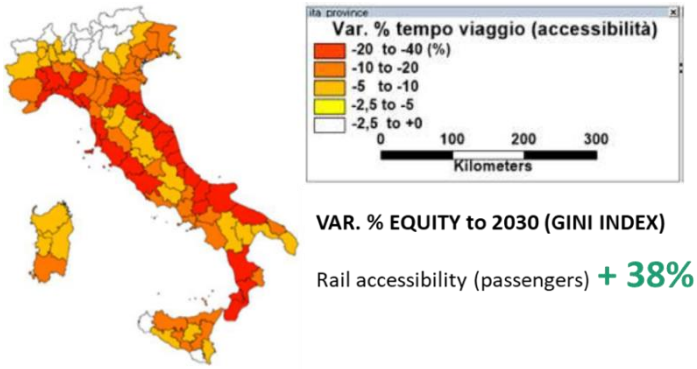

Figure 8: The impact of the NRP on the quality of infrastructure, mobility and the reduction of territorial disparities.

1.3.5 - The National Integrated Transport System (SNIT)

The National Integrated Transport System (SNIT) represents the system of infrastructures, both point and network, of national and international interest, which forms the backbone of the Italian passenger and freight transport system.

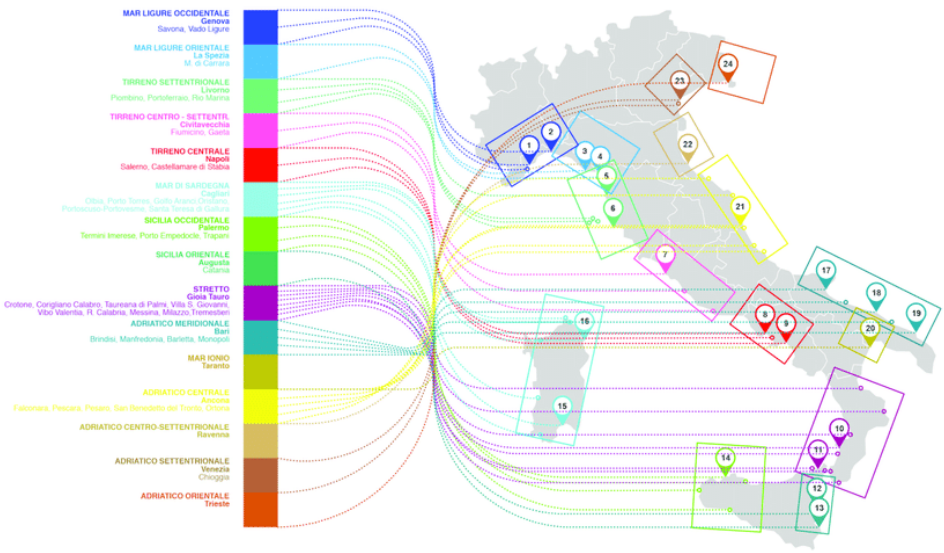

Figure 9: Italian Port System Authorities, Source: Italian Ministry of Infrastructure and Transport - MIT

The national port system (figure 9) does not end with the first-level SNIT and the 58 ports of international and national importance that make up its backbone but also includes the category I seaports referred to in art. 4 of the new law 84/1994 (i.e. ports and specific port areas aimed at military defense and State security), as well as 217 other minor ports of call mainly dedicated to pleasure boating, fishing activities and local passenger and tourist transport. The seats of the Port System Authorities (AdSP) identified in the

SNIT as first-level ports correspond to the central (core) port nodes of the Trans-European Transport Network (TEN-T).

1.3.6 - Croatia - Transport System Development Strategy (2017 - 2030)

The development of transport infrastructure in the Republic of Croatia is considered essential for economic and social development and the promotion of interregional trade. It is an instrument of regional development, facilitating the flow of goods and people's access to employment, health, education and recreation. The authority responsible for the development of the National Transport Development Strategy is the Ministry of Sea, Transport and Infrastructure (MSTI). The Croatian Ministry has already taken steps to fulfil the ex-ante conditions by creating a Transport Development Strategy for the Republic of Croatia for the period from 2014 to 2030. The Transport Development Strategy of the Republic of Croatia for the period from 2017 to 2030 evaluates and defines future measures (infrastructure, operation and organisation) in the field of transport-related to international and domestic transport, regardless of the source of financing. It also provides the framework for the development of measures and defines interfaces with other strategies or evaluations; it takes into account European strategies and requirements (TEN-T, ERTMS, ITS, environmental protection, climate protection, etc.) based on a thorough analysis of the Croatian situation. The Croatian Transport Development Strategy is based on the analysis of the country's situation, the identification of opportunities and problems, and the identification of the best solutions for realizing and responding to existing needs. It is therefore a document that determines the medium- and long-term development of the country and constitutes a positive development of the existing situation and the achievement of a new phase in which the objective will be to increase the quality of the transport system and infrastructure. As a result of the EU/CRO policies and strategies, a list of general objectives has been defined. A further list is made up of specific objectives derived from the analysis of the Croatian transport system.

<u>General Objectives:</u>

1. GO1 - develop the modal split of passengers in favor of public transport (PT) and zero-emission modes. This includes public transport (trams, local buses, etc.), rail, maritime and inland waterways (boats), regional and long-distance buses, as well as pedestrians and cyclists;
2. GO2 - develop the modal split of freight transport in favor of rail, sea and inland waterway transport;

3. GO3 - develop the transport system (operation, organisation, development and maintenance of infrastructure) according to the principle of economic sustainability.
4. G04 - reducing the impact of Croatia's transport system on climate change;
5. G05 - reducing the environmental impact of Croatia's transport system (environmental sustainability);
6. G06 - improving traffic safety in the Croatian transport system;
7. G07 - improve the interoperability of the Croatian transport system (PT, rail, road, sea, river and air);
8. G08 - improving the integration of transport modes in Croatia (operation, ITS, P&R, etc.);
9. G09 - further develop the Croatian TEN-T network (core and comprehensive).

Specific objectives that apply across sectors:

1. SO - harmonize transport operations with neighboring countries (BiH - Port of Ploče, road and rail connections BiH, Slovenia, Serbia, Italy, Montenegro and Hungary);
2. SO - complementing the development of the tourism sector as the main economic factor in parts of Croatia, where relevant, with appropriate transport development, particularly in favor of environmentally friendly mobility and public transport;
3. SO - improve access to remote areas of Croatia (e.g., islands, southern Dalmatia...);
4. SO - to develop the potential of the main logistics centres (seaport of Rijeka, seaport of Ploče, seaport of Split, inland port of Vukovar, inland port of Osijek, Zagreb hub);
5. SO - strengthening Croatia as a logistical hub for the entire region, with a focus on Zagreb;
6. SO - improve the integration of the transport sector into the social and economic development of the regions (regional functional concepts);
7. SO - address the specific situation in Croatia related to the seasonality of traffic.

Maritime transport

- SO - to improve the development and competitiveness of the port of Rijeka as Croatia's main seaport;
- SO - reduce the environmental impact of maritime transport (fleet development, measures to prevent and suppress pollution from maritime installations, environmental protection);
- SO - improve the modal split of freight transport across the Adriatic Sea or along the coast;
- SO - improving the reliability of maritime transport (PT and supply chains) in difficult weather conditions.

1.4 – Regional level (Abruzzo)

This section analyses the main characteristics of the transport infrastructure network in Abruzzo (Figure 10). In the north-south direction, the main road infrastructure routes are the infrastructures of the Adriatic corridor, i.e., the A14 motorway and the SS16 state road, as well as the Abruzzo-Marchigiano hinterland (SS 81), the Samnite Abruzzo Apennines (SS 260 and SS 17) and the Liri motorway. The east-west route is made up of the A 24 and A 25 motorways, as well as the Tiburtina Valeria (SR ex SS 5), the Fondovalle Sangro (SS 652) and the Fondovalle Trigno (SS 650).

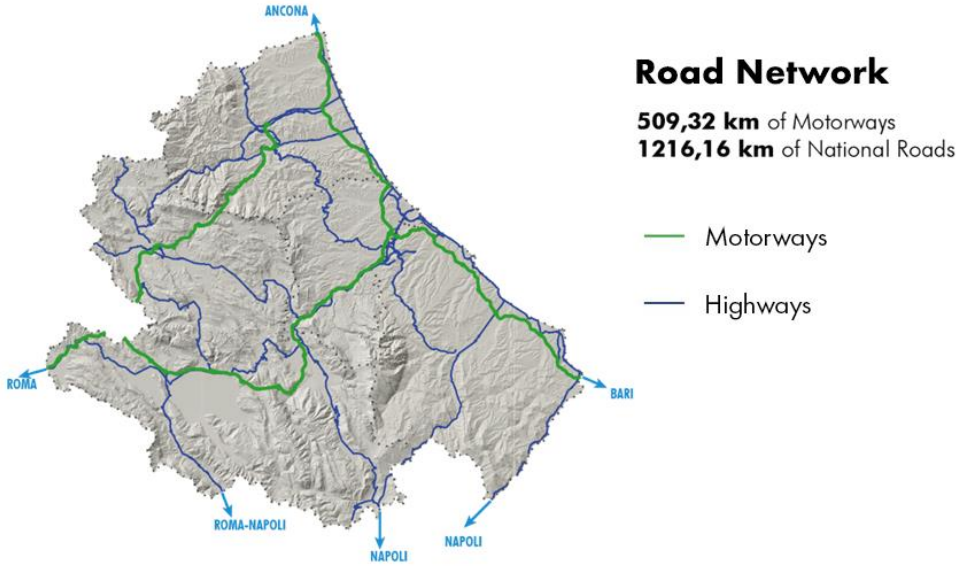

Figure 10: Road network of regional importance in Abruzzo

As far as the railway network is concerned (Figure 11), it is essentially the same as that built between 1862 and 1928. All subsequent interventions concerned doubling and variations of the line, track construction, electrification, plant technology and stations. The overall regional railway endowment to date is in line with the national average, in terms of territorial extension, while it is approximately double in terms of population.

The data can be summarized as follows:

1. 49.3 km per 1000 sq. km of territory, against a national average of 52.9 km.
2. 4.2 km per 10,000 inhabitants, compared to a national average of 2.8 km.

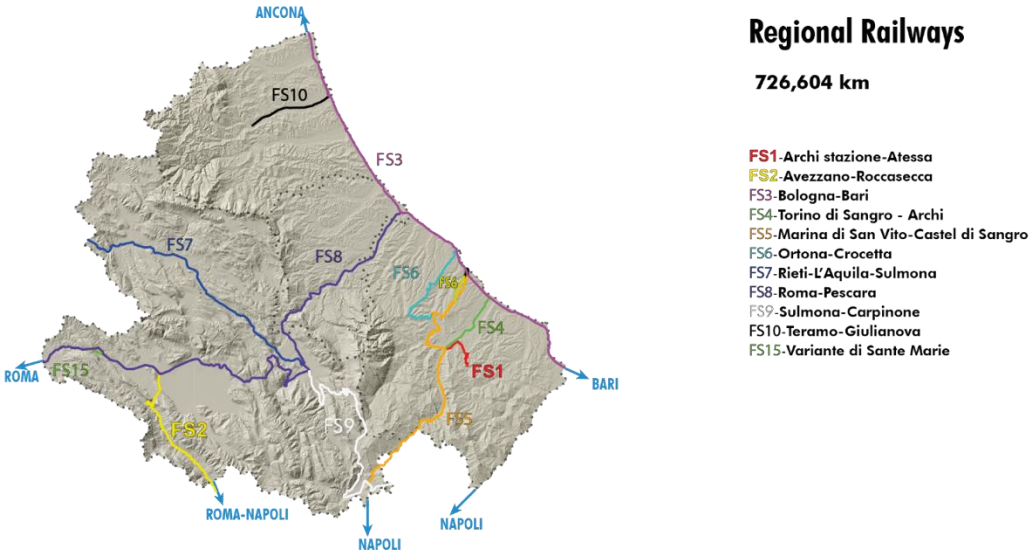

Figure 11: Regional railway network in Abruzzo

Analyzing then the port and airport endowments (figure 12), we can see that they are on average well below the national average, except the province of Chieti, as far as ports are concerned, and the province of Pescara, as far as airports are concerned.

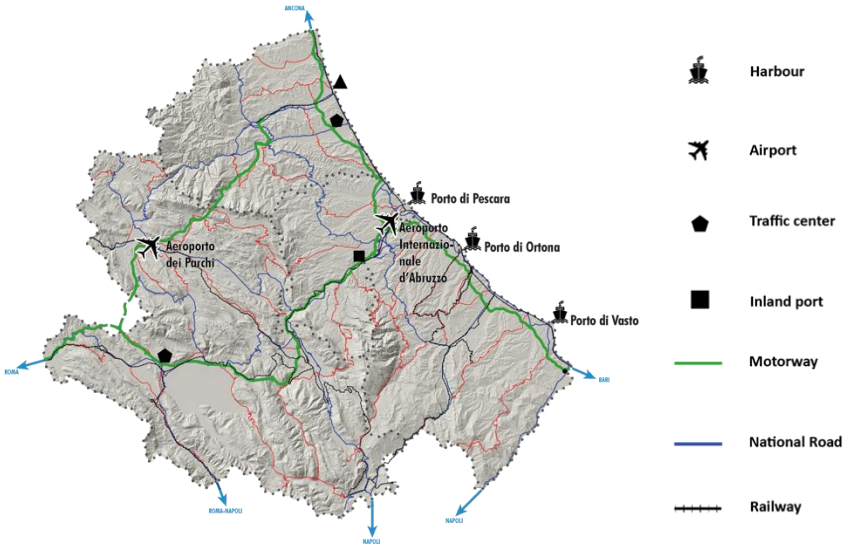

Figure 12: Infrastructures of regional importance in Abruzzo

1.4.1 - PRIT - Integrated Regional Transport Plan

The objectives of the Integrated Regional Transport Plan (PRIT) are set in compliance with financial, regulatory and environmental constraints and are in line with the indications of the General Transport Plan (GTP), about the peculiarities of the territory and its vocations for social and economic development and in compliance with the indications of national and regional planning.

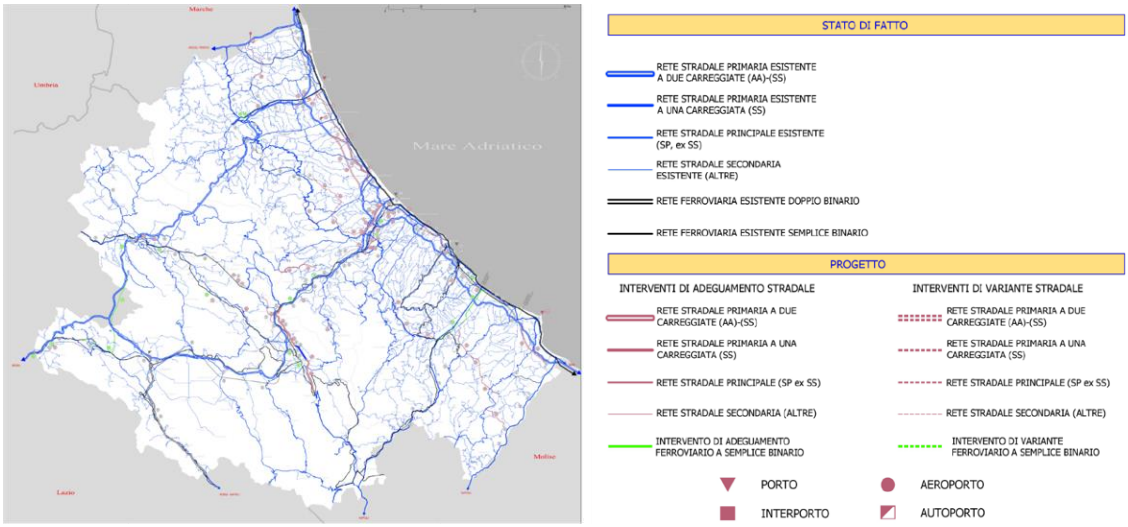

Figure 13: Integrated Regional Transport Plan

As shown in the Integrated Regional Transport Plan (figure 13), published in 2011, the Abruzzo Region's strategies concern, among other things, the consolidation of Abruzzo's role in the TEN networks. This and other objectives find their declination in integrated and intermodal lines of action that are grafted into national and transregional dynamics without isolating themselves from the potential of local contexts. In the document itself (PRIT), Abruzzo is described in a pivotal position at the centre of the Adriatic corridor and the desire to connect the regional infrastructure network with the Adriatic corridor itself, on the one hand, and with the Tyrrhenian route on the other and, via the Adriatic Sea, with the Balkans is emphasized (figure 14).

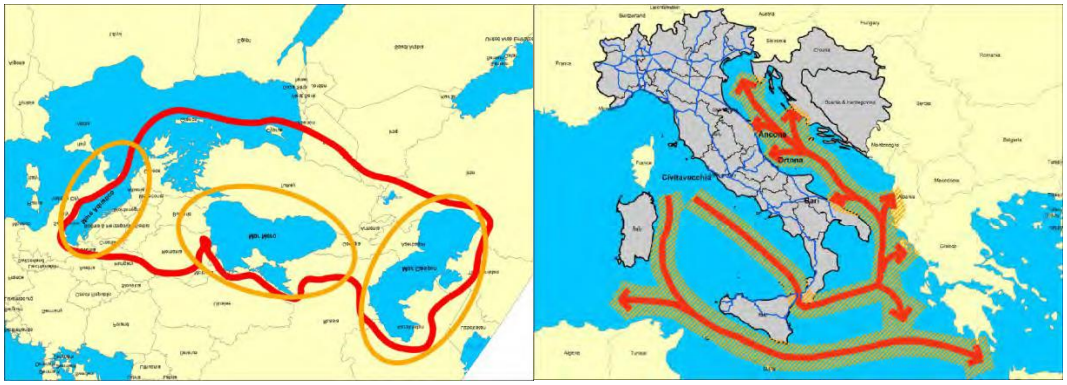

Figure 14: The Three Seas System. Source: PRIT, 2011

In particular, through the interconnection between the primary road infrastructure A/14, the Adriatic Corridor system and the European Corridor 1 Berlin-Palermo, which affects the Tyrrhenian side, the PRIT outlines a scenario in which the regional infrastructure system will be able to network the local system with the national SNIT network and with the major European infrastructures.

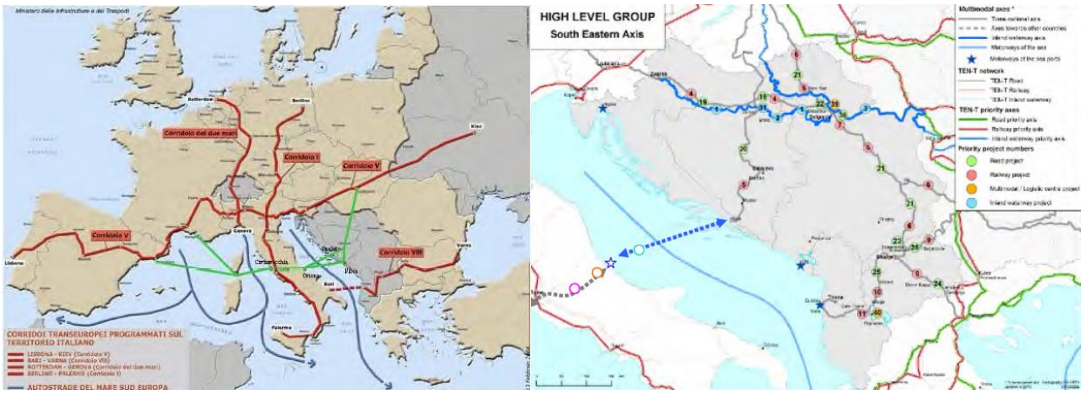

Figure 15: Cross-connection between the Iberian Peninsula and the Balkans. Source: PRIT, 2011

The PRIT, therefore, identifies, to make Abruzzo a 'bridge' between Corridors 1, 5 and 8, the development and implementation of transversal connections between the Adriatic and Tyrrhenian seas with priority actions for the safety of existing infrastructures as pivotal objectives of regional infrastructure planning (Figures 15 and 16).

Figure 16: Regional proposal

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Chapter 2: The environmental interactions of maritime transport

This chapter will briefly explore the main environmental interactions of maritime transport and what measures the EU has put in place to reduce maritime transport's environmental impacts.

2.1 – European Green Deal and the "Fit for 55" package.

Combating climate change and defending the environment are key points in Europe's strategy for the coming years. In line with its commitments under the Paris Agreement, the EU decided to become a climate-neutral economy by 2050. In 2019, it adopted the European Climate Act, which made legally binding targets to keep the global temperature increase well below 2°C and to continue efforts to keep it at 1.5°C. The goal for 2030 is to reduce greenhouse gas (GHG) emissions by at least 55 percent from 1990 levels. This implies contributions from all sectors of the economy.

Thus, the European Green Deal takes the form of a program comprising diverse and wide-ranging actions that aim to achieve, among other things, three main objectives:

- Achieve Europe's climate neutrality, by 2050, with zero net greenhouse gas emissions;
- Making economic growth become sustainable and not focused on resource exploitation;
- Making this change happen equitably, that is, without creating job losses (but on the contrary creating jobs) and reducing social inequality on our continent (the "just transition" mechanism)

On July 14, 2021, the European Commission adopted the "Fit for 55" climate package, which contains legislative proposals to achieve the Green Deal goals by 2030. Specifically, reducing greenhouse gas emissions by 55 percent from 1990 to achieve "carbon neutrality" by 2050.

For the transport sector, in particular, the goal is to reduce greenhouse gas emissions (which currently account for more than a quarter of EU emissions) by 90 percent.

As reported in the Ministry of Infrastructure and Sustainable Mobility (MIMS) document "Climate Change, Infrastructure and Mobility (put in the bibliography)" of 2021, in Italy, in the last inventoried year (2019) the transport category was responsible for 25.2 percent of the total national greenhouse gas emissions, corresponding to 31.4 percent of the energy sector emissions (ISPRA, 2021). Within transportation, about 93% of emissions came from road transport, 4.3% from shipping, 0.75% from domestic

aviation, 0.65% from pipelines, 0.15% from railways, and the remaining about 1.52% from other systems. Emissions from transportation In Italy grew by 26.8 percent from 1990 to 2007, then decreased by 18.6 percent from 2007 to 2019 due to efficiency improvements, although the trend was always uneven and the trend in the last two years monitored (2018 and 2019) was upward.

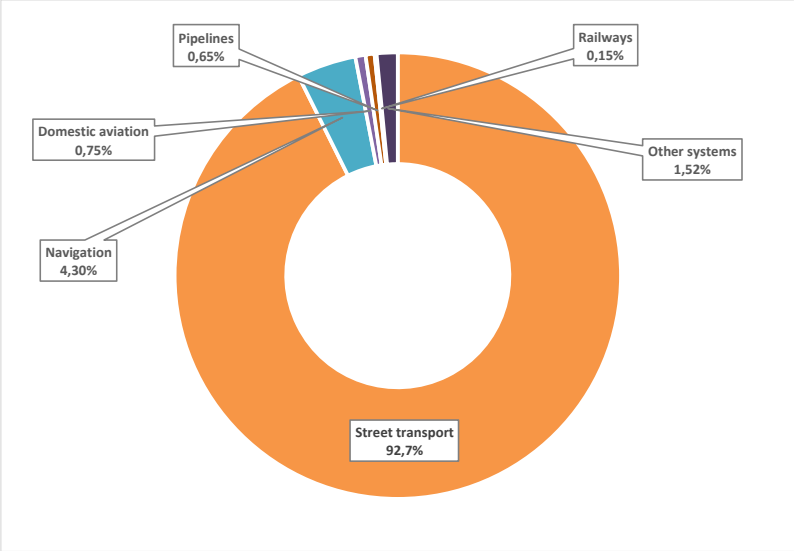

Figure 17: Trend of direct GHG emissions and reduction indices in the national transport sector according to the European Green Deal, Source: CITraMS processing – UnivAQ

Emissions from transportation in Italy are more than three times those of the entire industrial sector, more than three and a half times those of agriculture, and almost six times more than those from waste. Moreover, the contribution of the operational phase of transportation to climate-changing emissions is mainly related to the use of energy for traction. EU policies on Energy Transition and Sustainable Development, aimed at mitigating global warming, have a goal of zero greenhouse gas emissions ("net zero emission") by 2050, as set out in the European Green Deal (EGD) (EC, 2019a). The EU has, in addition, proposed a revision of the short/medium-term targets, increasing the percentage of total greenhouse gas (GHG) emissions reduction from 40 percent to 55 percent (compared to 1990) by 2030 (EC, 2021). In the transport sector, the EU strategy includes a two-step pathway, as summarized in Figure 15:

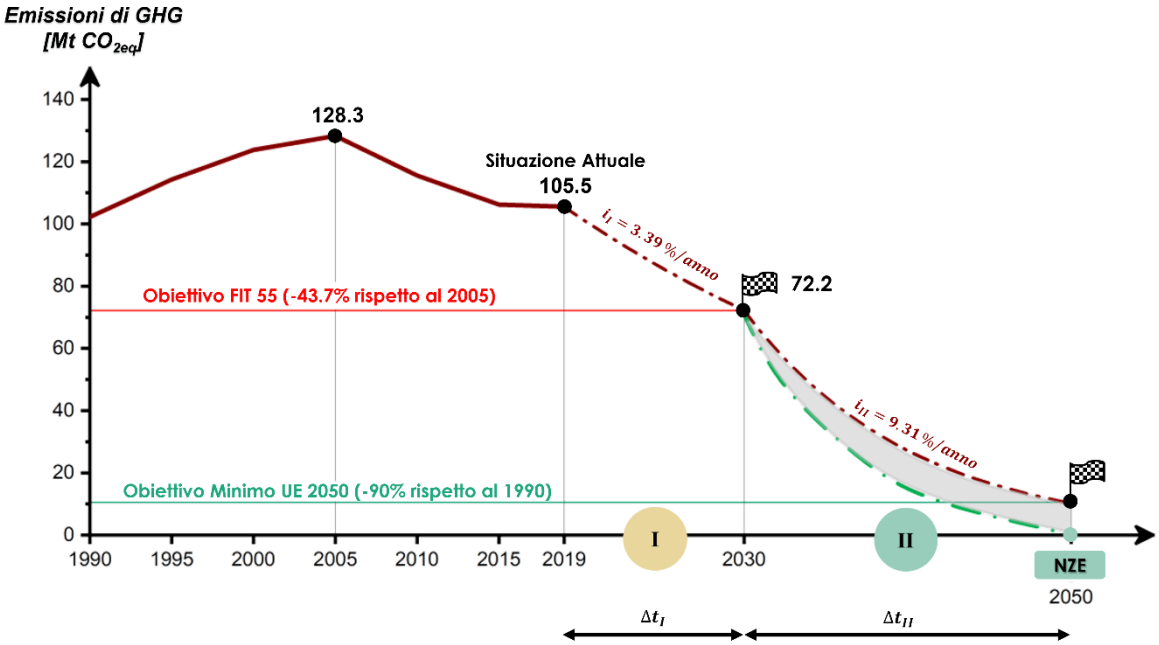

Figure 18: Trend of direct GHG emissions and reduction indices in the national transport sector according to the European Green Deal, Source: CITraMS processing – UnivAQ

• Phase I: short/medium term (2020-2030): the objectives of this phase aim to contain direct transport emissions in 2030 to about 72 Mt CO2eq, corresponding to a decrease of 43.7 percent compared to 2005, according to the proposed revision to Regulation (EU) 2018/842 ("Effort Sharing Regulation"), communicated by the European Commission in July 2021 (EC, 2021), a proposal integrated into the "Fit for 55" package.

• Phase II: medium/long term (2031-2050): the minimum targets for this phase under the EGD tend to achieve a level of direct GHG emissions in transport at about 10.2 Mt CO2eq (this remaining share will be almost all concentrated in the aviation sector), corresponding to a 90 percent decrease compared to 1990, in line with the projections resulting from the European Commission's analysis of the EGD for transport (EC, 2018). More ambitious targets achieve "Net-Zero Emissions" (NZE) in the transport sector by 2050. In this case, however, the undoubted difficulty in eliminating, for the entire transport sector, the residual portion of GHG emissions, which can be highlighted especially from a "Life Cycle Assessment" (LCA) perspective, must be considered.

2.1.1 – Maritime transport

The shipping industry exerts pressures on the marine environment that can lead to changes in its state. In turn, this can lead to impacts on human health and ecosystems. Maritime transport, internationally, is

regulated by the International Maritime Organization (IMO). The IMO is not new to the idea of reducing greenhouse gas emissions from shipping. Indeed, in 2018, ships calling at ports in the EU and the European Economic Area emitted about 140 million tons of CO2. This accounts for 18 percent of global CO2 emissions from international shipping. Of the total CO2 emissions, about 40 percent come from travel between ports in EU member states and while ships are at berth (EMSA, 2018). As much as 60% is produced during voyages in and out of the EU. The IMO adopted its initial strategy in this regard in 2018, setting a goal of reducing average carbon intensity (CO2 per ton-mile) by at least 40 percent by 2030 and 70 percent in 2050, as well as cutting total emissions by at least 50 percent by 2050 (compared to 2008) and phasing them out as soon as possible.

The maritime transport system is a strategic sector for the EU's economy because, in economic terms, 77 percent of European foreign trade and 35 percent of trade between EU member states is by sea. For this reason, maritime transport is a key part of the international supply chain.

With its strategic socio-economic role, maritime transport implies a significant impact on the environment. The European Maritime Transport Environmental Report (EMTER), jointly published on September 1, 2021, by the European Environment Agency (EEA) and the European Maritime Safety Agency (EMSA), reveals that ships accounted for 13.5 percent of all GHG emissions from transport in the EU, behind road transport (71 percent) and aviation (14.4 percent) emissions (Figure 17).

The same report points out that the main impacts on the environment of shipping include:

- Greenhouse gas emissions: in 2018, ships calling at ports in the EU and European Economic Area generated about 140 million tons of CO2 emissions (about 18 percent of all CO2 emissions generated by shipping worldwide that year).
- Air pollution: in 2019, sulfur dioxide (SO2) emissions from ships calling at European ports totaled about 1.63 million tons, about 16 percent of global SO2 emissions from international shipping.
- Underwater noise pollution: ships create noise that can affect marine species in different ways. Total accumulated underwater radiated acoustic energy is estimated to more than double in EU waters between 2014 and 2019. Container ships, passenger ships, and oil tankers generate the highest acoustic energy emissions from propeller use.
- The impact on habitats and species.

- Oil pollution: of a total of 18 major accidental oil spills worldwide since 2010, 3 occurred in the EU (17%). More appropriate monitoring, enforcement and awareness actions are helping to reduce oil pollution events, even though the amount of oil transported by sea has been steadily increasing over the past 30 years.

From the above, it follows that the EU maritime transport system faces a crucial decade of transition to a more economically, socially, and environmentally sustainable sector.

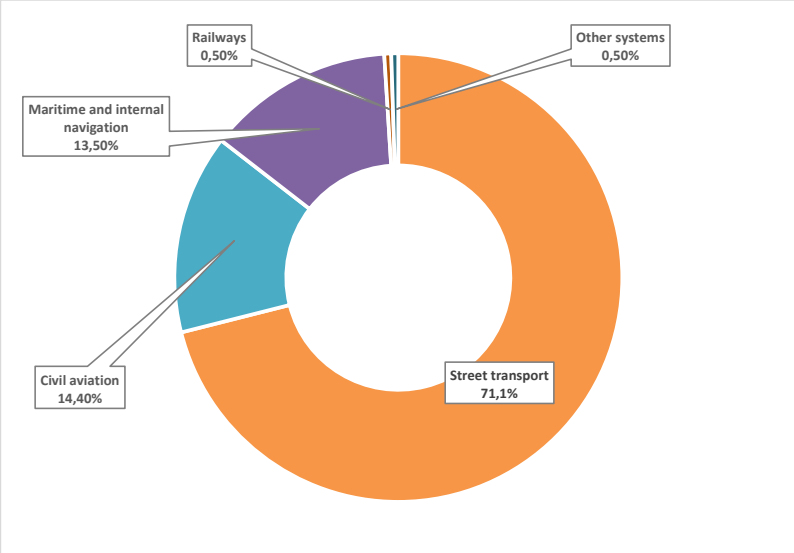

Figure 19: Reprocessing Source: European Environment Agency (EEA) and European Maritime Safety Agency (EMSA)

In 2018, the International Maritime Organization (IMO) (the United Nations body that regulates international shipping) adopted an initial GHG strategy for international shipping. This strategy aims to reduce GHG emissions from international shipping and phase them out as soon as possible.

A recent study by the ICCT, the International Council on Clean Transportation, calculates that to meet the IMO's goal of reducing global shipbuilding emissions by at least 50 percent by 2050 from the 2008 level, emissions would have to fall at least 15 percent by 2030 (Rutherford et. al., 2020).

IMO 2030 reduction target can be achieved with available technology, with a combination of short- and medium-term measures, including operational measures such as lower speeds, operational efficiency improvements through data analysis, limited use of low-carbon fuels, and energy-efficient projects. Shipping will undergo a global transition to alternative fuels and energy sources I order to face the demands of 2050. However, all alternative fuels known today have some limitations; many solutions are not yet mature and

there is no obvious choice of "one fuel" for the global fleet. The decarbonization of shipping will therefore require great effort, investment, and time, with a clear focus on innovation, digitization, port and ship adaptation, and the necessary infrastructure for onshore energy supply, both in inland and seaports.

It can be seen from the aforementioned MIMS study that the considerations developed here for phases I and II of the transition have concrete consequences for infrastructure development needs. The minimum requirements of the proposed Regulation on alternative fuels infrastructure (EC, 2021e) cover ports that are part of the European TEN-T network with frequent calls by container ships, ferries, high-speed passenger vessels, and other vessels with tonnage above 5,000 gross tons, to have 90 percent coverage of the electricity demand needed for their port operations by 2030. However, significant investments will also be relevant for ports with traffic below the minimum specified in the regulation and other ports with significant large vessel traffic. Similar considerations should also be applied to cases of passenger transport on fast ships to islands, partly because of developments in emission reduction policies (including those related to vehicle and energy use).

System Authorities (SAs) are then widely involved in research networks, both national and international, on the development of new renewable sources and the development of the circular economy. The crucial issue in this regard is the ability of projects to generate effects that continue beyond the end of the project itself. Also high is the focus on the topic of hydrogen and its possible implications for both shipping and port handling facilities. The use of advanced or hydrogen- and carbon-derived biofuels may (or may not, in the case of "drop-in" solutions) require the development of port infrastructure to enable their use and should be thought of in a context that promotes the parallel development of ships (and thrusters) with high energy efficiencies and capable of securing demand for them. The case of methane is also relevant to Liquefied Natural Gas (LNG), although both have limited emission abatement capacity and require technological arrangements that can abate fugitive emissions. LNG produced as a synthetic fuel (electrofuel, or e-fuel) also has higher costs than ammonia, due to the liquefaction required for storage, which requires very low temperatures and the recovery of methane losses emitted to the atmosphere as a result of venting operations, which are necessary to maintain the low temperatures during storage (not necessary for ammonia). The National Strategic Framework (NSF), an annex to Legislative Decree No. 257/2016, calls for the establishment of an efficient LNG infrastructure by 2030.

2.2 - Annex of Legislative Decree No. 257/2016 (NSF)

The National Strategic Framework (NSF), an annex to Legislative Decree No. 257/2016, envisions the construction of an efficient LNG deployment infrastructure by 2030, consisting of 5 coastal storage facilities of 30000-50000 m^3, 20 refueling points for ships operating in seaports and inland ports, 3 cabotage ships, and 4 bunkers for LNG sea transport between neighboring ports and off-shore bunkering of ships.

2.2.1 – Liquefied natural gas (LNG) for maritime transport.

The international community, through individual administrations and cooperation channels, is expressing increasing sensitivity to the impact of human activities on the environmental system, showing interest and encouraging the shipping industry toward the use of natural gas as a primary source of energy for propulsion and electricity generation on board ships. This trend is reinforced by the development of international, EU, and national legislation. The International Maritime Organization (IMO), through Annex VI of the International MARPOL Convention, has established criteria and requirements for the prevention of air pollution from ships, for the control and relative reduction of emissions globally within well-defined maritime areas, the Emission Control Areas (ECAs). The use of natural gas as a fuel is one way for the maritime industry to comply with the increasingly restrictive limits on atmospheric emissions of pollutants, which are harmful and climate-changing, such as nitrogen oxides (NOx), sulfur oxides (SOx) and carbon dioxide (CO2) due to the use of conventional fuels under normal ship operating conditions. There are aspects, including those mentioned below, that make LNG, used as a marine fuel, one of the most promising technological solutions for the maritime industry. Indeed, the use of LNG as an alternative to traditional fuels allows:

The almost zero reduction in sulfur oxide (SOx) emissions

The reduction of nitrogen oxide (NOx) emissions through compliance with the limits applicable since 2016 in "Nitrogen-oxides Emission Control Areas" (NECA)

A 20-25% reduction in CO2 emissions.

The effectiveness of using LNG in reducing GHG emissions to the atmosphere depends on the type of engine and the range of possible measures that can be taken to reduce the unwanted release of methane since it is itself a GHG.

2.2.2 – The LNG distribution network in the maritime sector.

The LNG distribution network in ports must necessarily include both ports belonging to the TEN-T core network and ports outside it. This is to make the distribution on national coasts more homogeneous. Considering the impossibility of equipping every port with a large refueling point, it becomes important to configure a network that takes into account the different intermodal solutions for ship refueling, namely "ship-to-ship," "land-to-ship," "truck-to-ship," and loading/unloading of portable tanks, without neglecting the mutual usefulness and necessity of this network for the land transportation sector. This necessitates the identification of a specific area of focus through the creation of small geographic networks with solutions based on common standards that contribute to the formation of a national network that in turn can interface with the international LNG landscape. In this direction, an LNG distribution network can therefore be envisaged, involving ports already included in the trans-European transport network corridors but also other ports that do not belong to the core TEN-T network but offer the opportunity to adequately complement the refueling network with small or medium-sized storage and refueling points that could also serve heavy road transport, where port districts and road connections allow. The assessment of whether a port should be included in the LNG distribution network (regardless of whether it belongs to the TEN-T core network) is made based on:

- The presence or absence of traditional fuel storage and distribution services in the port, whether for transport or other uses.
- The sustainability of the development of the infrastructure needed for LNG in terms of economic investment, projected and prospective demand, accessibility for the means of transportation that would benefit from the infrastructure, and availability of space suitable for bunching operations.

2.2.3 – The characteristics of LNG

Liquefied natural gas (LNG) is a fuel that is obtained by subjecting natural gas (NG), after appropriate purification and dehydration treatments, to cooling and condensation. The result of these processes is an odorless and transparent liquid consisting mainly of methane and, in smaller quantities, ethane, propane, butane, and nitrogen. The liquefaction process involves the removal of certain substances, such as helium, water, heavy hydrocarbons, dust, and acid gases, which could cause difficulties in the subsequent stages of fuel processing and utilization. Natural gas, in liquid form, is usually stored by cooling it to about -162°C, at a

maximum transport pressure of about 25 kPa, and stored in insulated containers that keep it in liquid form. Compared to its gaseous counterpart, LNG has about three times more energy content per unit volume: 1 liter of diesel fuel corresponds to 4.7 liters of natural gas at 200 bar and 1.6 liters of LNG. This is because it achieves a greater volume reduction than compressed natural gas (CNG), which means that, for the same volume occupied, a greater amount can be transported over a greater distance. Liquefied natural gas is transported, usually from the Middle East, in special ships to Europe and the United States. Please refer to Annex X for more details on the technical characteristics of LNG.

2.3 – Maritime transport vehicles

As shown in the MIMS (2021) document, although maritime transport is considered along with rail transport to be one of the most sustainable modes in terms of CO2 per passenger km (km) or ton-km (km), reducing greenhouse gases and the various environmental impacts that shipping produces is an essential goal to combat climate change and the degradation of coastal and marine ecosystems and air quality in port areas. Greenhouse gas emissions (expressed in CO2 equivalents) from the entire shipping sector (international, domestic, fishing) increased from 977 to 1,076 million tons in the period 2012-2018 (+9.6 percent). The share of maritime transport in total anthropogenic emissions remained between 2.8% and 2.9% between 2012 and 2018. Considering only international maritime transport, the contribution is 2.51 percent (IMO, 2021) As for the EU, maritime transport is believed to be responsible (2018) for about 13.5 percent of the GHG emissions of the entire transport sector (EMSA, EEA, 2021). Also important is the sector's contribution to emissions of NOx, SOx (24%), and PM2.5 (9%), compared to the total of all sectors. Thus, shipping plays an important role not only in the climate crisis but also in the air pollution crisis. Worth noting in this regard is the importance of the Sulphur cap that came into effect on January 1, 2020, which sets a limit of 0.50 percent for the sulfur content of fuels (while for EU ports and those included in SECAs, Sulphur Emission Control Areas, the limit was already 0.10 percent). Similarly, to aviation, for shipping the references are the activities of the International Maritime Organization (IMO), in the international arena (and in particular the decarbonization strategy for the maritime sector), and the proposals integrated into the European "Fit for 55" package. These include the proposed Regulation to replace the Alternative Fuels Infrastructure Directive of 2014 (EC, 2021e) and the Fuel EU Maritime Regulation (EC, 2021f), combined with the proposed revision of the Renewable Energy Directive and the integration of maritime transport into the

Emission Trading Scheme (EC,2021g), to which should also be added the proposal on the revision of energy taxes (with the inclusion of taxation of fuels used for shipping) (EC, 2021h). The implications of these measures, among others, for Phase I are important for the electrification of ships docked in ports (cold ironing), in line with the proposed Regulations on Alternative Energy Distribution Infrastructure (EC, 2021e) and Legislative Decree 257/2016, which stipulates those major Italian ports (those central to the TEN-T Network) must organize cold ironing infrastructure by the end of 2025.

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Chapter 3: Maritime passenger transport offer in the Adriatic Sea

This chapter analyses the supply of maritime passenger transport in the Adriatic Sea, referring to the Abruzzo and Croatian ports under study. Analyses have been carried out regarding the accessibility of the ports themselves the main transport infrastructure (highways, railways, airports, interports) and the intercepted population.

3.1 – Current offer analysis

The current offer of maritime passenger transport in the Adriatic Sea between Italy and Croatia consists of connecting services carried out on active lines from the following Italian ports: Trieste, Venice, Cesenatico, Pesaro, Ancona, and Bari. Modes and characteristics are shown in the table below.

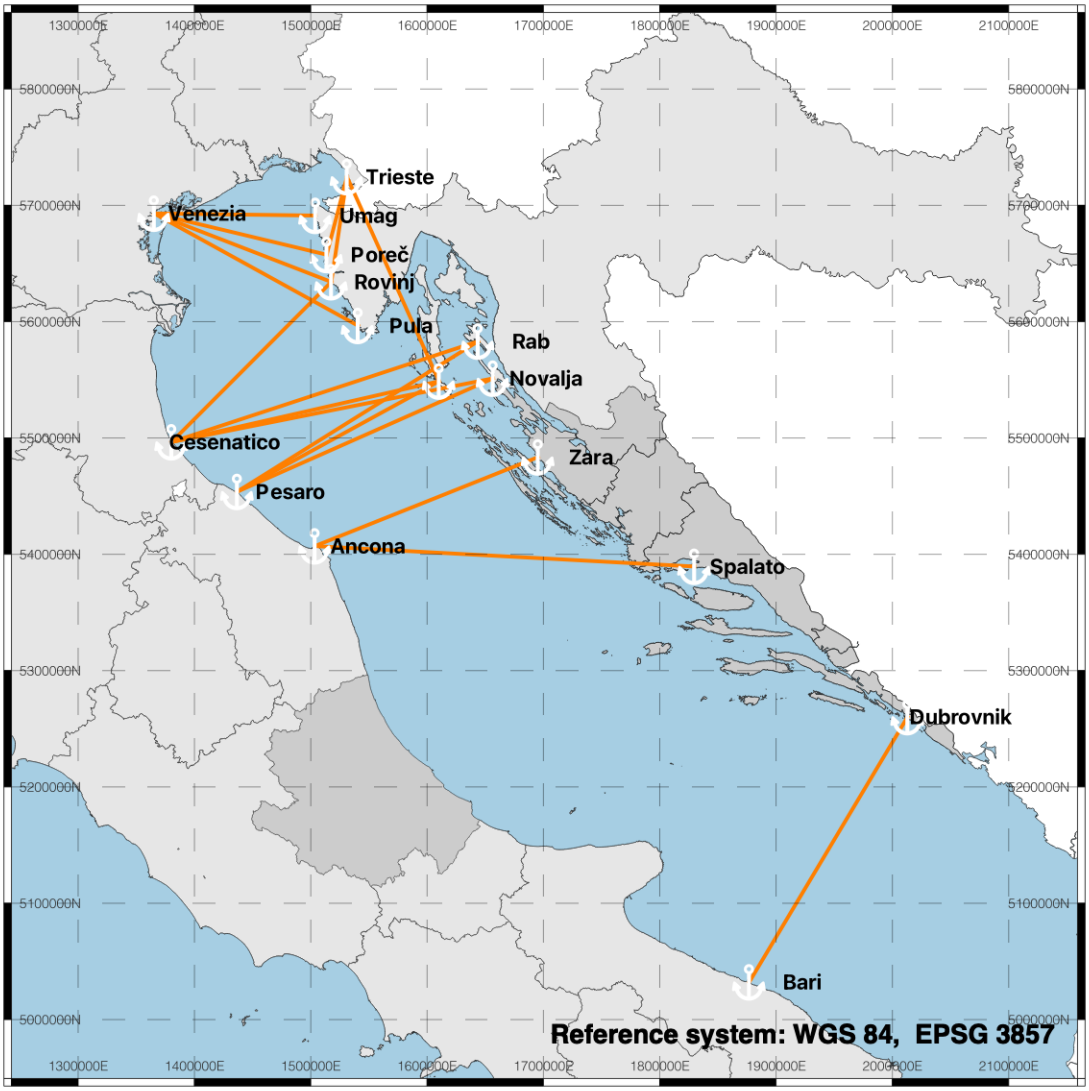


Figure 20: Graph of maritime connections between Italy and Croatia

Below, there is a summary table of the above-mentioned routes broken down by port of departure/destination and operating company. It should be noted that the table does not claim completeness as it refers only to those routes for which documentable data were available.

Origin	Destination	Company	Operativeness	Number of weekly trips
Ancona	Split	SNAV	from 25/05/2022 to 02/10/2022	**4**
Ancona	Split	JADROLINIJA	from 01/01/2022 to 31/12/2022	**2 - 4**
Ancona	Zadar		from 23/06/2022 to 09/09/2022	**2**
Bari	Dubrovnik		from 03/06/2022 to 24/11/2022	**4**
Pesaro	Lussino	NAUTILUS	from 16/07/2022 to 28/08/2022	
Cesenatico	Lussino			
Pesaro	**Novalja**			
Cesenatico	**Novalja**			
Cesenatico	Rovigno			
Trieste	Pirano - Parenzo	LIBERTY LINES	from 28/05/2022 to 25/09/2022	
Trieste	Rovigno-Lussino			
Venezia	Umag	VENEZIALINE- KOMPAS		
Venezia	Porec			**4**
Venezia	Rovigno			**6**
Venezia	Pula			**3**

Table 1: Maritime passenger transport connections between Italy and Croatia

For the port of Ancona, the following graph shows the historical series (years 2006 - 2021) of passenger flow (landings and embarkations) to and from Croatia.

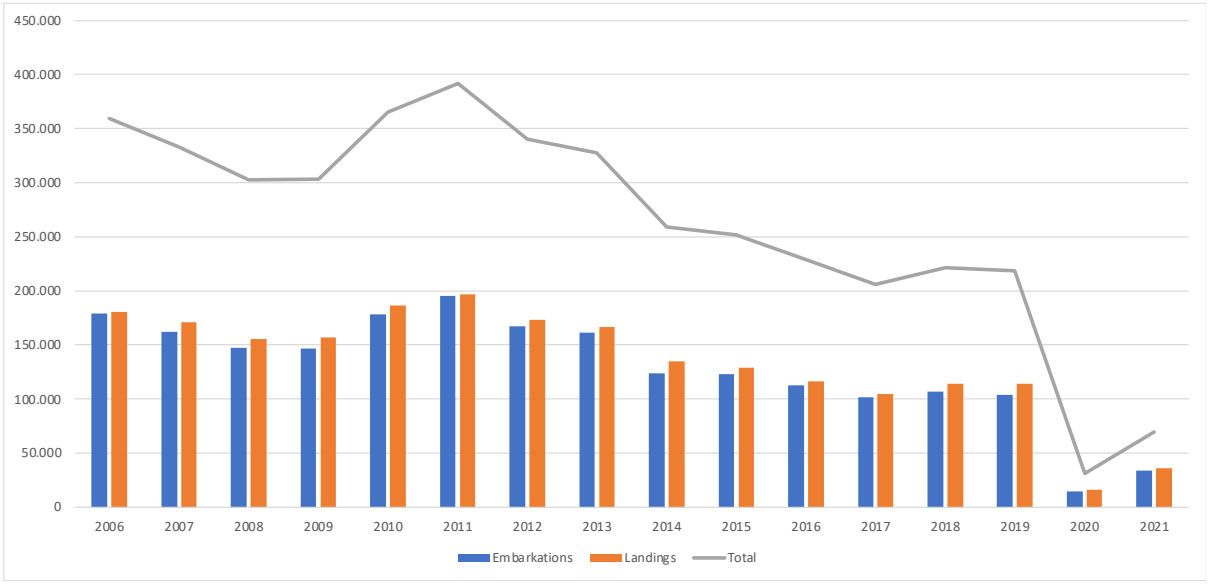


Figure 21: Historical series of passenger flows from the port of Ancona to and from Croatia (Source: Ancona Port Authority)

3.2 – Abruzzo's portuality

In the following chapter we analyse, the ports of Pescara, Ortona and Vasto, their performance characteristics, current planning regarding also future arrangements, territorial catchment areas and accessibility. It is specified that the methodological approach used for the latter issue, involves the measurement of accessibility times, starting from the individual port infrastructure to the surrounding territory. The calculation is carried out through computerized procedures of the Geographic Information System (GIS) type, considering the road network and the automobile as the means of travel, setting 10 isochrones with time intervals equal to 5, 10, 15, 20, 25, 30, 35, 40, 45, 50 minutes. Moreover, the accessibility analysis contemplates the connection times of port infrastructures with access to major transportation infrastructures, such as highway toll booths, airports, interports, and railway stations. Distances between Abruzzo's and Croatian ports under consideration are, in addition, preliminarily calculated. Figure 22 shows the pattern of population density (inhabitants/km^2) on the Abruzzo's territory (Eurostat 2018 data), preparatory to the accessibility analyses. The total regional population, as of 2018 (the reference year of the most recent data available) is 1,315 million.

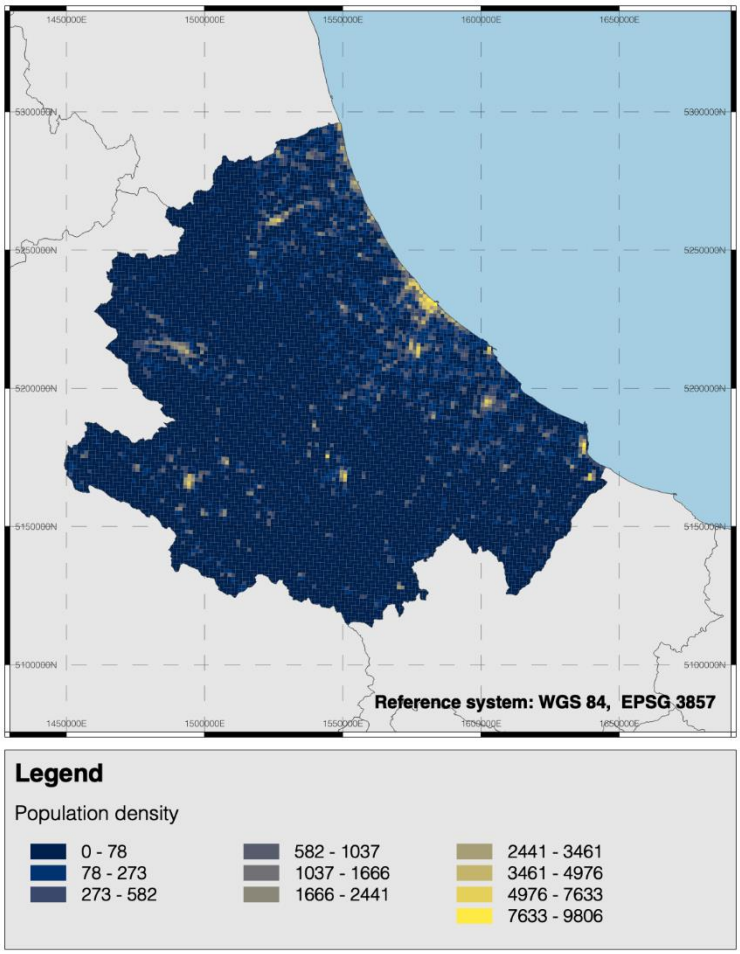


Figure 22: Population density, Source: Eurostat 2018

3.2.1 – Port of Ortona

3.2.1.1 – Current configuration

The current planimetric configuration of the port of Ortona is marked by two breakwaters rooted on land with convergent orientations between them and such as to delimit the port mouth with a median axis oriented to the east according to the typology called "converging piers." The original north pier, following the recent construction work on the new breakwater, by the plan layout of the current PRP, has a total extension of about 2,000 m, while the south pier has a development of about 1,100 m.

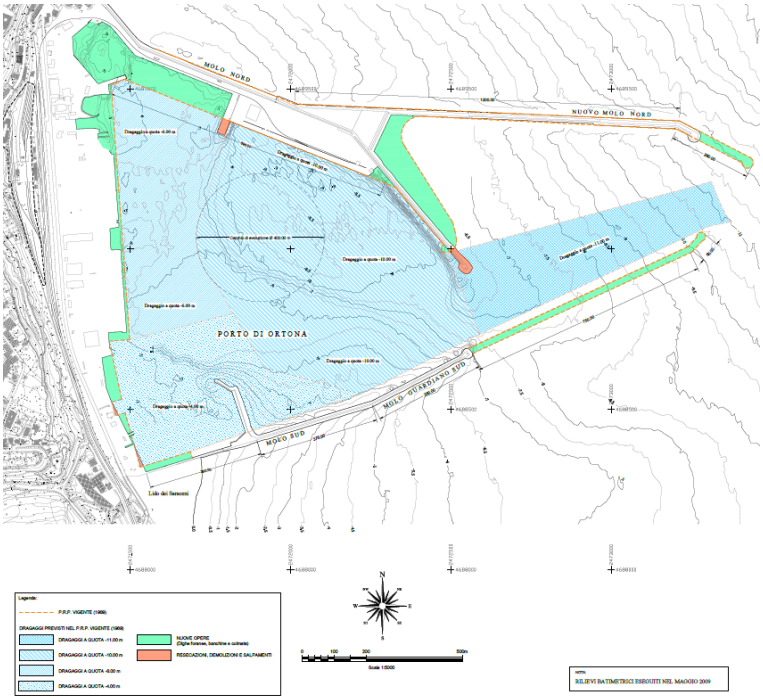


Figure 23: Current configuration of the Port of Ortona (PRP 1969)

The port's main activities are commercial ones developed on the North quay and partly on the shoreline quay. Also located in the port is a berth for petroleum products that are piped to tanks located outside the port area. In addition to spaces for the direct conduct of port activities, those behind the docks are also used for port organisation and management activities. Fishing boats are in the dock (Mandracchio) near the shore entrenchment of the North Pier, in front of the fish market and the Ortona Harbor Master's Office. Pleasure boating is in the South area near the Saraceni Lido. The main features of the port infrastructure, in its current configuration, are summarized below:

- Surface area of the body of water: 1.000.000 m^2;
- Maximum depth of natural seabed (at the mouth of the harbor): -8,0/-8,5 m a.s.l.;
- Average depth of the access channel: -7,0/-7,5 m a.s.l.;
- Average depth of the inner dock: -6,5 m a.s.l.;
- Ground surface: circa 260.000 m^2;
- Overall development of operational docks: 1.350 m.

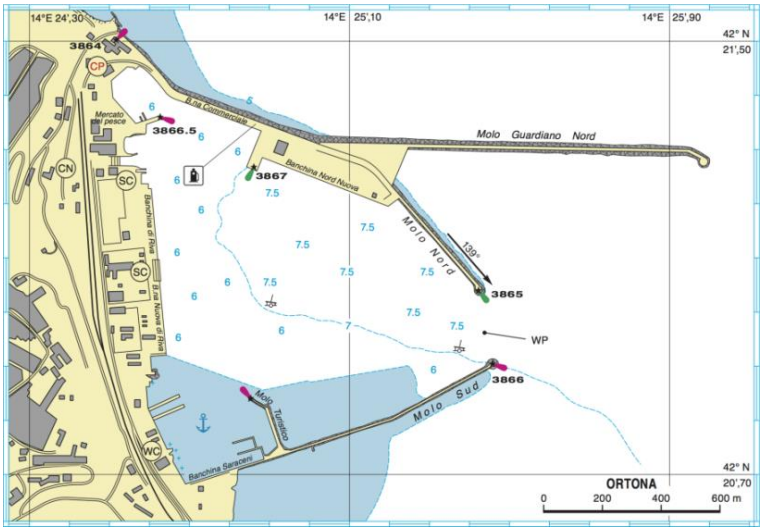


Figure 24: Map of the current depths of the Port of Ortona

Figure 25 distinguishes the port areas of the infrastructure under consideration. The southern part of the shore quay, where there is also a slipway, is used as a shipyard for the refurbishment of vessels up to 40/50 m long. Adjacent to the shipyard, part of the quay is occupied by the mooring of vessels serving the offshore platforms operated by ENI. The new shore quay, except for the non-banked part, accommodates ships for various goods. The embankment behind the quay is partly occupied by sheds and warehouses to support industrial activities related to offshore activities and the assembly and handling of large steel and engineering elements.

Area	Quay	Lenght (m)	Depth (m)	Width (m)	Storage area (m^2)	Destination
A	Nord	463	-8,5	107	47030	Commerciale
B	Martello	130	-7,5	34	3365	Commerciale
C	Commerciale	325	-7	25	8120	Commerciale - Pescherecci
D	Motopescherecci	490	4,10/2,50	26	\	Attività di Pesca
E	Di Riva	230	-6,5	110	22560	Commerciale - Cantieristica
F	Riva Nuova	260	-6,5	120	24200	Commerciale
G	Saraceni e molo turistico	182	-3	8	2500	Turistico - Diporto

Table 2: Port areas of the port of Ortona

Figure 25: Port areas of the port of Ortona

3.2.1.2 – Configuration according to P.R.P. 2010

The PRP of the Port of Ortona (Figure 26) includes the definition of a more functional port configuration for the purpose of increasing nautical traffic. To enable future development of the port, the following objectives have been defined:

- Secure the harbor mouth by creating an adequate forebay that solves both the problems related to siltation and those related to internal residual agitation;
- Increase land space to enable the development of both container traffic and ro-ro and ro-pax traffic;
- Preserve present port activities in addition to commercial activities, upgrading and increasing those related to recreational boating, improving operating conditions for fishermen and other operators including shipyards;
- Move the oil berths to an isolated area possibly close to the port mouth to address obvious safety reasons;
- Restoring continuity between the north and shore docks;
- Physically separate different port activities to avoid dangerous interference and regulate access and consequently increase standards related to security;
- Improve the road system within the port area, and upgrade and strengthen the road and rail connection infrastructure system.

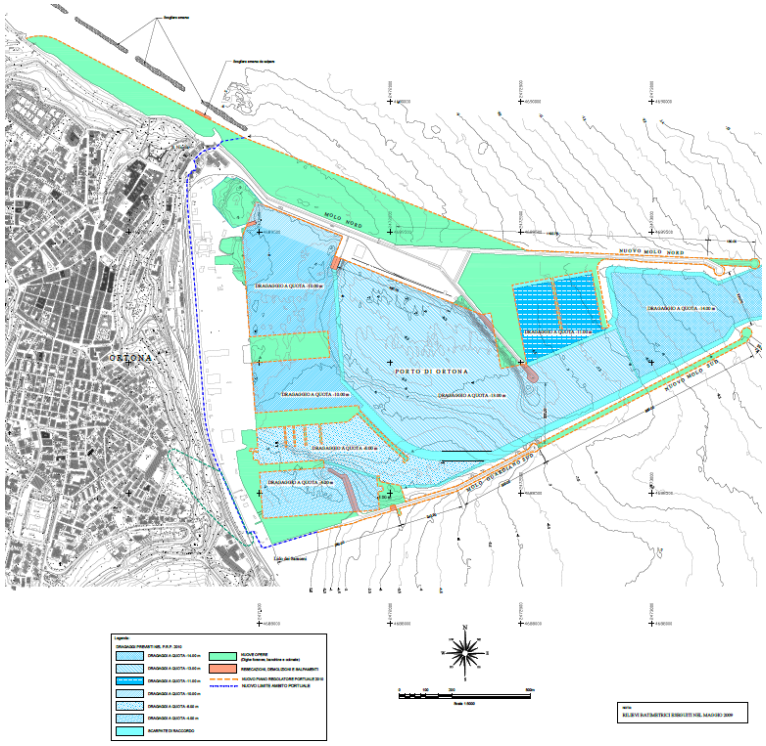


Figure 26: Port of Ortona P.R.P. 2010 Configuration

Briefly, the main interventions included in the PRP proposal are:

- Redevelopment of the north pier;
- Extension of the south pier;
- Construction of the new north dock to be used for dangerous goods;
- Redevelopment of the north quay;
- Shoreline dock redevelopment;
- Reconfiguration of the existing basin with redistribution of space;
- Redevelopment and redistribution of floor space;
- Redevelopment and upgrading of road and rail connection infrastructure;
- Environmental upgrading and compensation interventions.

3.2.1.3 – Accessibility

The analysis concerning the accessibility of the Abruzzo ports under study tends to construct indicators through which direct comparisons can be made by returning numerical values concerning the topic. The following indicators were introduced: territorial accessibility (Iat), local accessibility (Ial), and potential population interception (Ip).

The accessibility analysis covers basins of two types:

1. territorial (of extra-regional scope) for which 6 isochrones with a progressive interval of 30 minutes (30, 60, 90, 120, 150, 180) were adopted (Figure 27).
2. local (of regional scope) for which 10 isochrones with a progressive interval of 5 minutes were adopted (5, 10, 15, 20, 25, 30, 35, 40, 45, 50) (Figure 28).

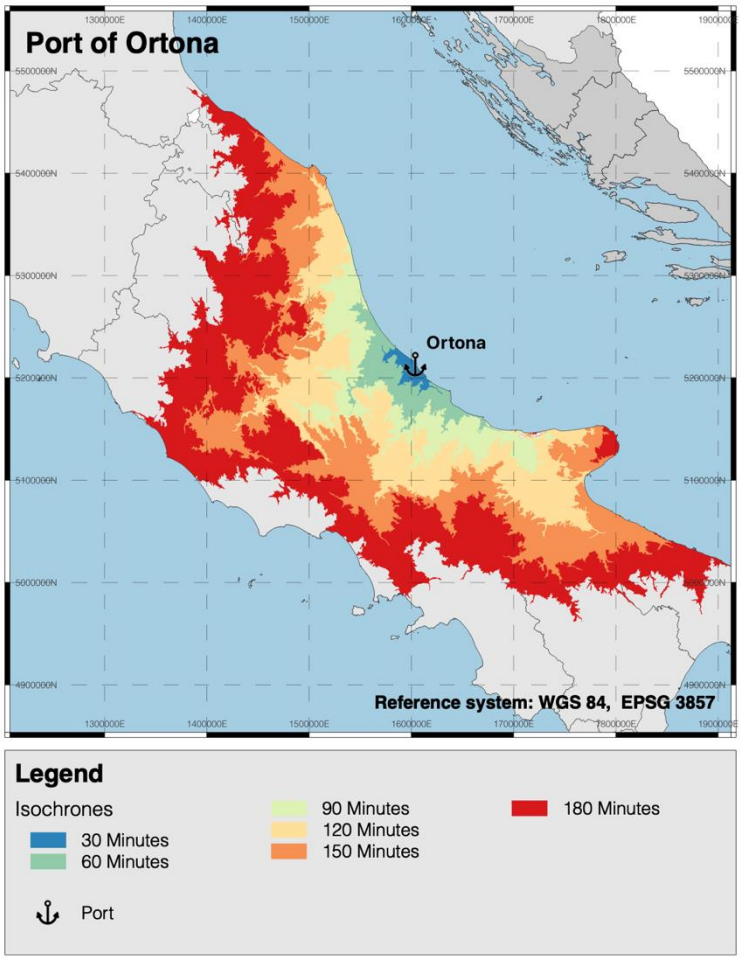


Figure 27: Indicator Ia_t - Accessibility of the extra-regional basin from the port of Ortona

Figure 28 illustrates, in terms of accessibility, the relationship between the isochrones and the number of accesses to major transportation infrastructure from the Port of Ortona.

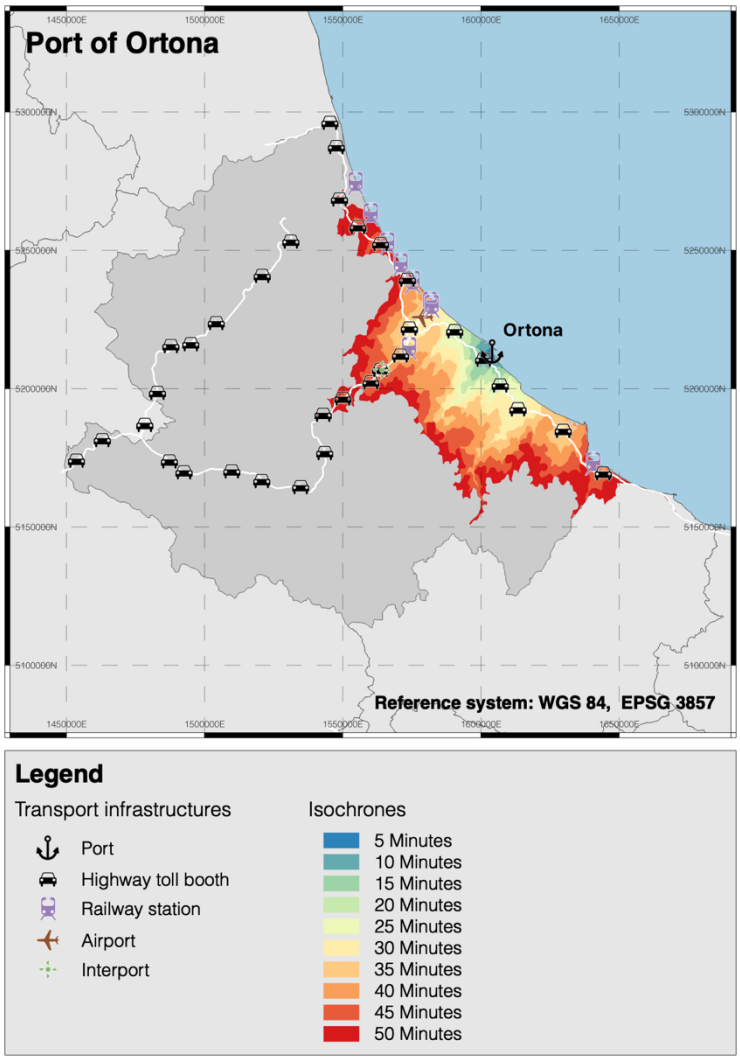


Figure 28: Indicator Ia_l - Accessibility of the local basin from the port of Ortona

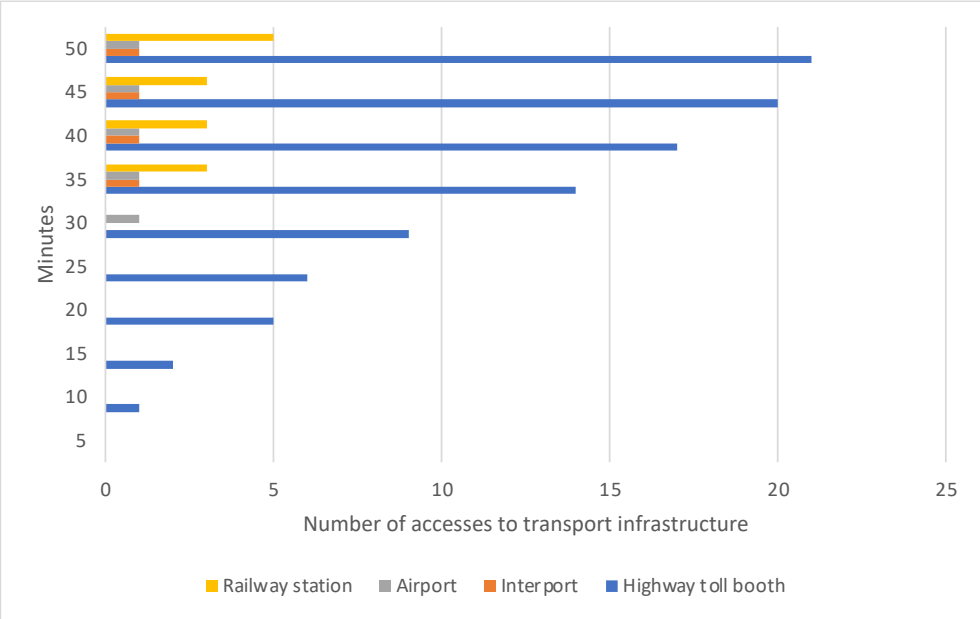
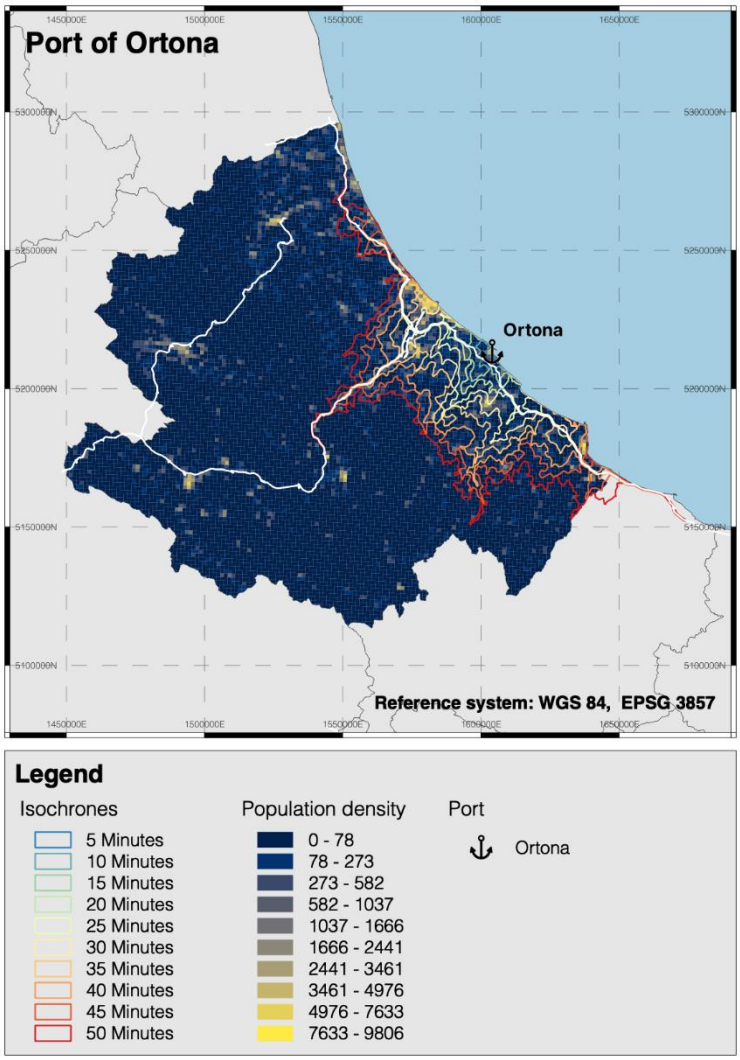


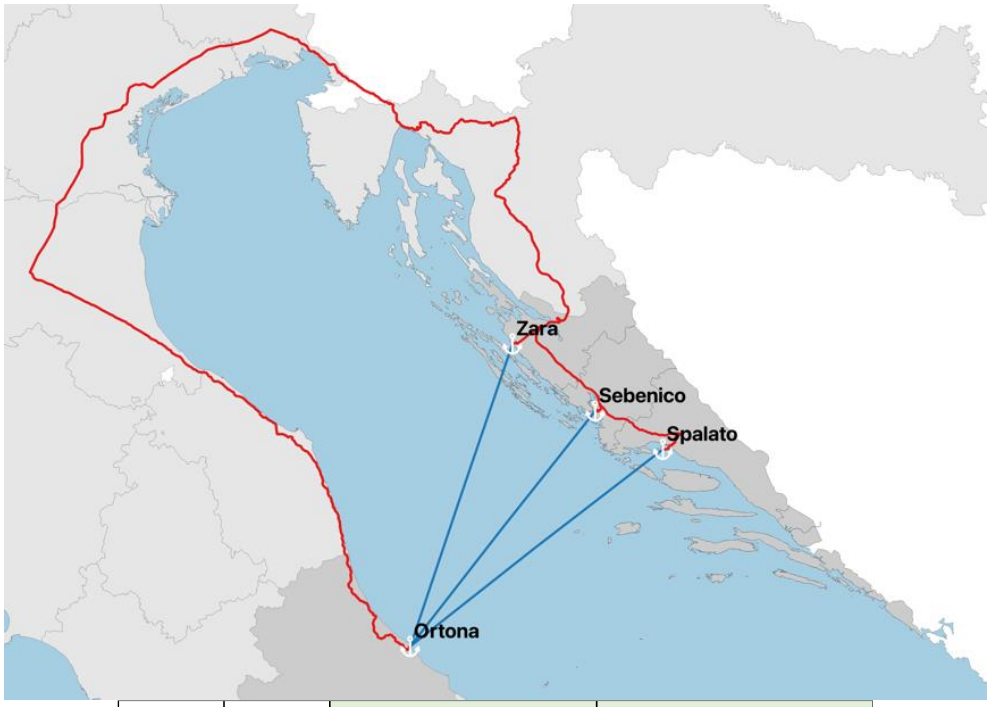
Figure 29: Accessibility to transportation infrastructure from the port of Ortona



Number of people intercepted in isochrones									
5 Minutes	10 Minutes	15 Minutes	20 Minutes	25 Minutes	30 Minutes	35 Minutes	40 Minutes	45 Minutes	50 Minutes
11.432	17.327	26.334	42.941	82.692	161.983	317.375	473.888	590.056	673.901

Figure 30: Indicator Ip (intercepted population) at different isochrones from the port of Ortona

Figure 31 shows the graph of land and sea connections between the port of Ortona and the 4 Croatian ports under analysis. For the former, the shortest road routes were considered; the latter were plotted as a first approximation using geodetic distances increased by 5 per cent.



		Land	Sea	
From	To	Distance [Nautic miles]	Distance [km]	Time [hours]
Ortona	Spalato	124	1.390	12
	Sebenico	115	1.205	11
	Zara	122	1.081	11

Figure 31: Graph of land and sea connections between the port of Ortona and distances and travel times

3.2.2 – Port of Vasto

3.2.2.1 – Current configuration

The current planimetric conformation of the harbor (Figure 32) is marked by two breakwaters rooted onshore: the west breakwater at Punta della Lotta and the east breakwater at Punta Penna. The under-billow breakwater known as the Levant Pier, about 550 m long, has a straight course with a longitudinal axis oriented at about 330 °N; the over-billow breakwater known as the Ponente Pier has a pseudo-curvilinear course with a total development of about 780 m; the harbor mouth bounded by the end heads of the two breakwaters has a width of about 250 m with a median axis oriented to the east. About 110 m from the end of the breakwater, on the inner side of the breakwater, the Martello Pier about 125 m long is arranged orthogonally. Along the breakwater, on the axis with the Martello Pier is arranged the Mandracchio Pier about 100 m long; these two piers separate the harbour dock from the forebay by delimiting an entrance

mouth about 125 m wide. The inner dock, pseudo-square in shape, is completely docked although with distinct structural types because of works carried out over the past decades.

Figure 32: Current configuration of the Port of Vasto

The main technical characteristics of the port (Figure 33) at present are:

- Water surface area of about 198,000 m^2 of which 121,000 m^2 is port basin and 77,000 m^2 is forebay;
- Maximum depth of the seabed is equal to about -13.0 m a.s.l. at the harbour mouth;
- Average depth of the seabed in the inner dock is equal to about -7 m a.s.l. with minimum pulls of -6.0 m and maximum pulls of -8 m. a.s.l.;
- Ground surface of 76.000 m^2;
- Total development of operational docks of about 1000 m.

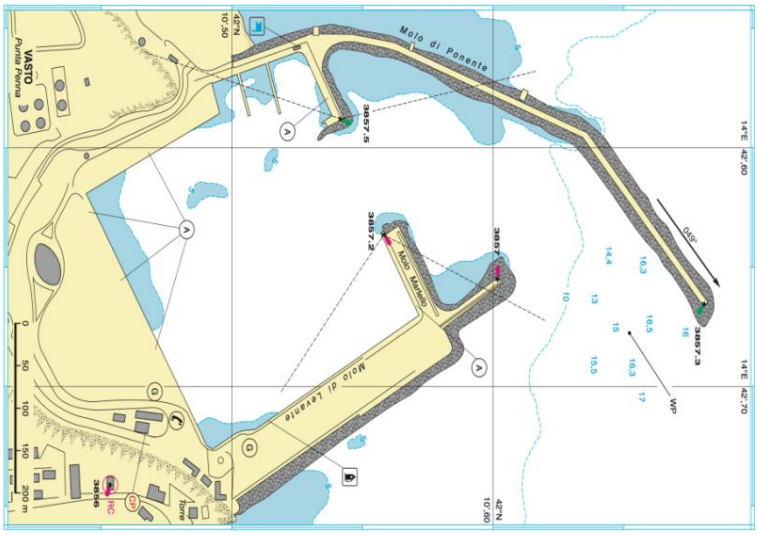


Figure 33: Map of the current depths of the Port of Vasto

In the current port configuration, 4 berths can be considered, hereafter referred to as A, B1, B2 and C:

- Berth A: intended for the traffic of liquid products.
- Berth B1 and B2: intended for solid product traffic;
- Berth C: intended for Ro-Ro (Roll on - Roll off) traffic, with peak mooring.

The 530 m of the commercial dock (Riva and West) can accommodate vessels either side-by-side or in swaths. The port also currently has a small dock dedicated to recreational boat traffic (about 100 boats) on the West Pier, and a terminal for fishing vessels with about 10 fishing boats and 20 small vessels, on the East Pier.

The port of Vasto, over the past decade, has experienced increasing merchant traffic in terms of size, a number of vessels and tons of cargo handled. The maximum dimensional characteristics of the merchant vessel that can enter the port of Vasto are length 180 m, width 28 m and draft 6.85 m.

Figure 34 illustrates the port areas of the infrastructure under consideration.

Figure 34: Vasto port areas

3.2.2.2 - Configuration according to P.R.P. 2007.

The main contents of the 2007 P.R.P. for the port of Vasto include the following:

- Extension of the breakwater for a total development of about 650 m in the form of an arc of a circle to achieve adequate shelter against the most intense sea states from the mistral and bora;
- Construction of a new sub-billow seawall for a total development of about 600 m in the form of an L to provide a viable shelter against the sea states coming from the east and sirocco and at the same time to delimit the new harbor dock;
- Elimination of the Martello pier and the concomitant extension of the east quay that will be used for Ro-Ro traffic and various goods by transferring fishing boat moorings along the west quay. The redevelopment of the shore quay (about 350 m long) includes a widening and regularization towards the harbor mirror which will allow for gaining more areas of the backyard. The shore quay for a development of about 230 m will be used for Ro-Ro traffic and various goods, while the remaining section towards the west quay will be used for the mooring of fishing boats and at the same time will allow the mooring of ferries for tourist routes in the summer period.
- The new dock, planned to the east of the historic one, is achieved through the construction of the new sub-billow dyke, which by rooting itself to the current one allows its full redevelopment as the main pier of the port along which the track bundle for the rail link will also be developed. The end of

this pier will be docked for a development of 150 m to be used for the port's service berths. The docks of new dock will be used for miscellaneous cargo and bulk traffic.

- The redevelopment of the current shore spaces involves the demolition of the fish market building and the simultaneous redevelopment of the complex of minor buildings located at the customs gate. In this way, it will be possible to fully recover the spaces of the current shore yard to the needs of handling and storage of goods.
- The new Port Services building will be located at the port gateway and will replace the Fish Market building, constituting the natural hub of traffic sorting (commercial, tourist, administrative). It will house the fish market, the offices of the Maritime Authority, the Guardia di Finanza, Customs, the ferry ticket office, and any other activities necessary for the daily life of the port. The facility will have a total area of 1,000 m^2, 450 of which will be used as a fish market and the remainder for offices and services. It will also have appurtenant areas totaling 2,500 m^2 for internal roadways, parking, and areas for public weighing. A building will also be built at the edge of the Port Services building to be used as offices and guest quarters for the Maritime Authority;
- Construction of complementary buildings for control and management activities of the port area and the needs of boating and industry;
- Environmental rehabilitation and compensation interventions. The particular orography of the promontories of Punta Penna and Punta Della Lotta within which the port is developed and which delimit the adjacent SIC areas require the implementation of hydrogeological and environmental rehabilitation interventions of the ridges that coincide with the customs limit of the port. It will thus be possible to create a "transition" strip between the external environment and the port environment that will be able to accommodate a nature trail ensuring the connection between the SCI area of Punta Aderci and the top of the promontory of Punta Della Penna.

Figure 35 illustrates the port areas of the infrastructure under consideration.

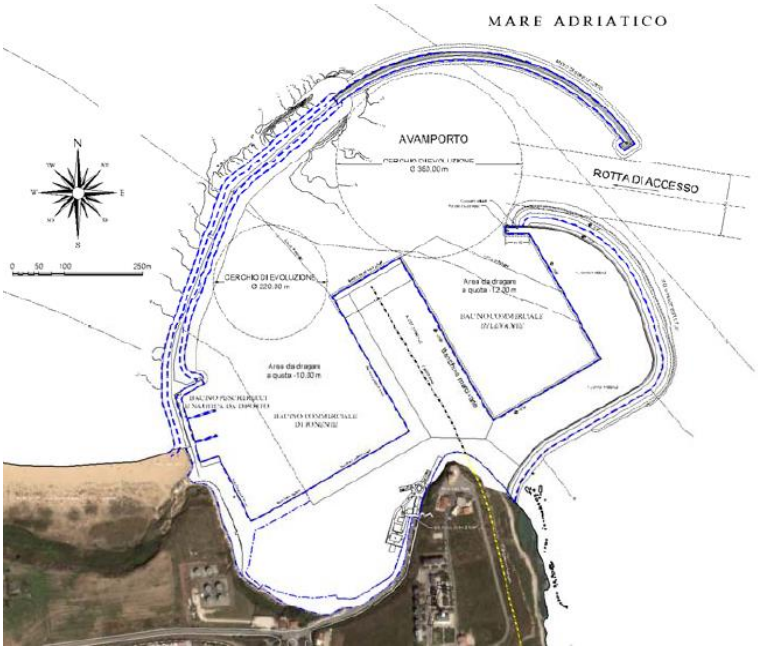


Figure 35: Vasto port areas

In the particular case, for the new port of Vasto envisaged by the P.R.P. 2007, design vessels were preliminarily chosen, about the two different basins that characterize it, to which reference was made for the determination of all the parameters necessary for the definition of the access channels and spaces (evolution circles) required for the maneuvering of the same vessels in safe conditions. The following table shows the main characteristics of the project vessels assumed for the different basins.

Quay	Ship type	Lenght (m)	Width (m)	Depth (m)	Gross flow rate (ton)
Commerciale di ponente	General Cargo	150	25	8,6	15000
Commerciale di levante	Ro-Ro	200	30	10	20000
Pescherecci e diporto	Pescherecci	35	7	3	\

Table 3: Main characteristics of the project vessels assumed by the 2007 P.R.P.

3.2.2.3 – Accessibility

Figure 36 illustrates the analysis of the accessibility of the extra-regional basin of the port of Vasto.

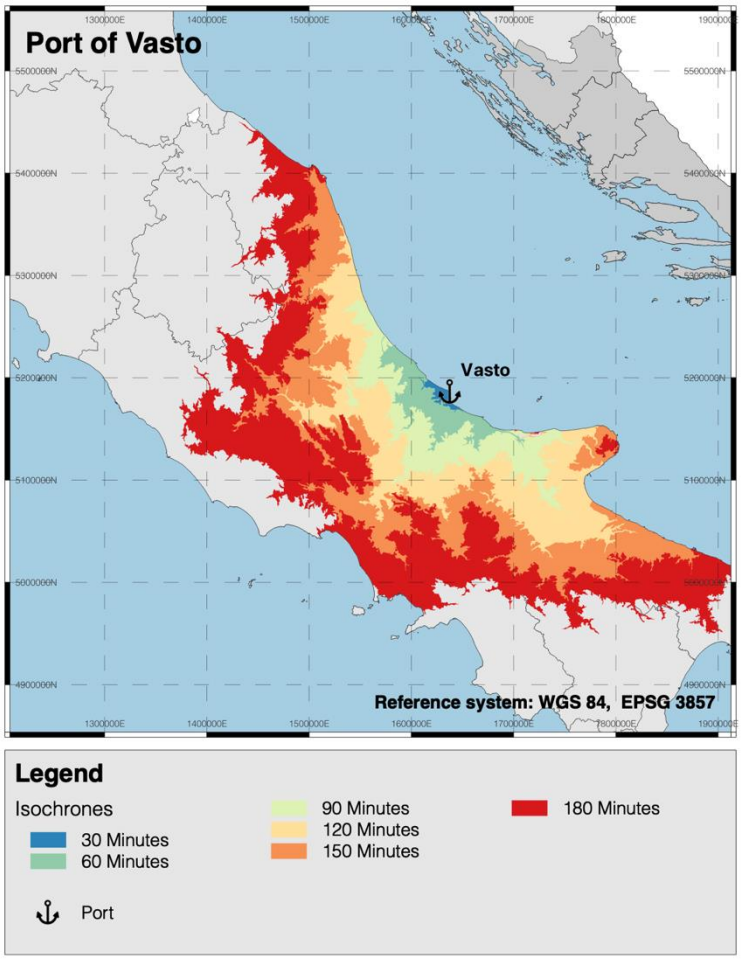


Figure 36: Indicator Ia_t - Accessibility of the extra-regional basin of the port of Vasto

Figure 37 illustrates, in terms of accessibility, the relationship between isochrones and the number of accesses to major transportation infrastructure from the Port of Vasto.

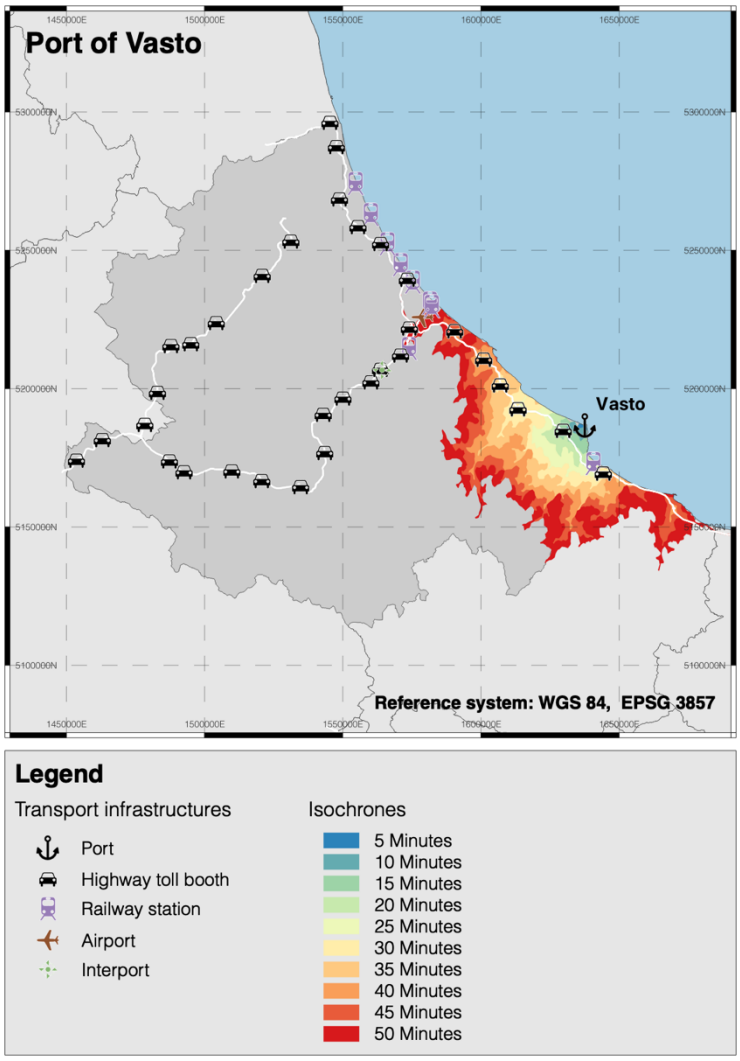


Figure 37: Indicator Ia_l - Accessibility of the local basin of the port of Vasto

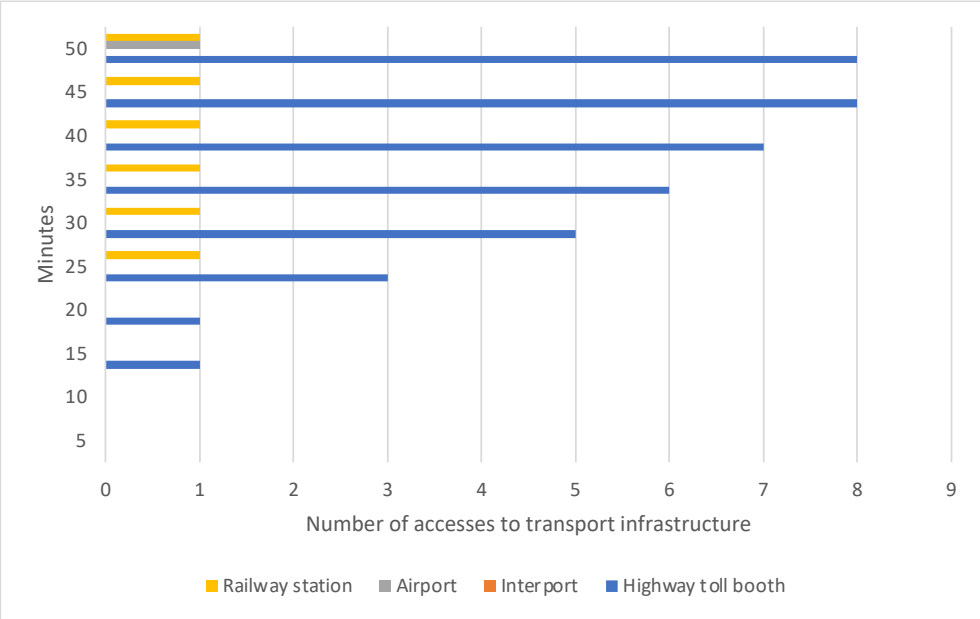
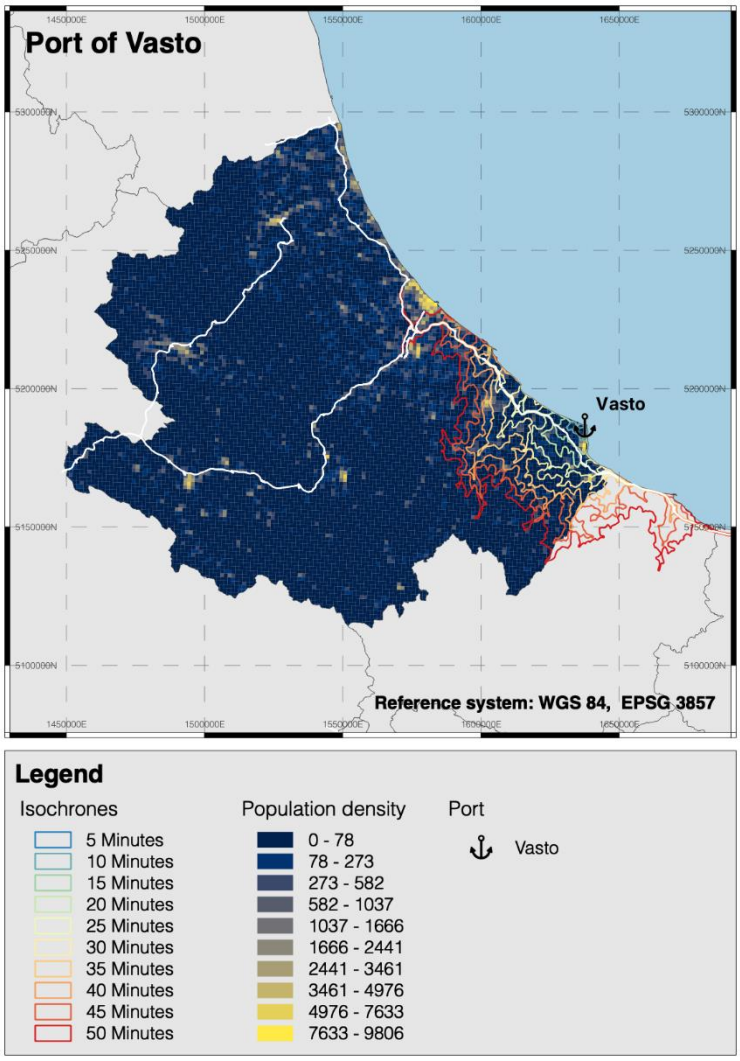


Figure 38: Accessibility to transportation infrastructure from the port of Vasto



Number of people intercepted in isochrones									
5 Minutes	10 Minutes	15 Minutes	20 Minutes	25 Minutes	30 Minutes	35 Minutes	40 Minutes	45 Minutes	50 Minutes
209	3.216	32.431	45.416	62.461	90.522	120.256	189.769	255.593	338.121

Figura 39: Indicator Ip (intercepted population) at different isochrones from the port of Vasto

		Land	Sea	
From	To	Distance [Nautic miles]	Distance [km]	Time [hours]
Vasto	Spalato	121	1.170	12
	Sebenico	117	1.102	11
	Zara	130	1.046	11

Table 4: Distances and travel times by sea and land from the port of Vasto

3.2.3 – Port of Pescara

3.2.3.1 – Current configuration

The current layout of the harbor (figure 40) consists of a channel coinciding with the mouth of the Pescara River and a forebay bounded: to the north by a 700-meter breakwater (built since 1995) with an east-west orientation defending the mouth of the channel; to the east by a new quay rooted to the marina's breakwater. In its central part, the canal has an expansion basin (in the widest section, the distance between the two opposite docks is 140 m) capable of allowing the maneuvering of small vessels (on the docks on the right bank of the canal docked the ferry Tiziano for Split later recalled in the text). At its end, the canal juts out into the sea with two guard piers 40 m apart.

Figure 40: Current configuration of the port of Pescara

Within the port area, the different functional activities (sub-areas) of the port are organized, and in particular the sub-areas:

- Fishing boat: in some parts of the north and south quay of the canal;
- Yachting: in some sections of the North and South docks under concession to the Porto Canale Nautical Club, Club Mimadea and Club L'Ancora;
- Commercial (liquid and solid bulk): located on the South quay of the canal, downstream from the fishing berths, near the existing maritime station;
- Passengers: located on a section of the southern quay designated for mooring motor vessels.

Table 5 shows some functional characteristics of the Pescara port's berths.

Port of Pescara: functional characteristics of the berths	
Offer of services	
Number of pull-ins	4 multipurpose commercial pull-ins
Overall length of pull-ins (m)	around 500
Maximum allowable TSL per ship	3000 - 4000
Types of pull-ins present	Passenger - Petroleum products - Dry bulk goods -Freight in packages - RoRo - Fishing- Recreational - Service vehicles
Area of goods yards (m^2)	15000

Table 5: Functional characteristics of the berths, Port of Pescara

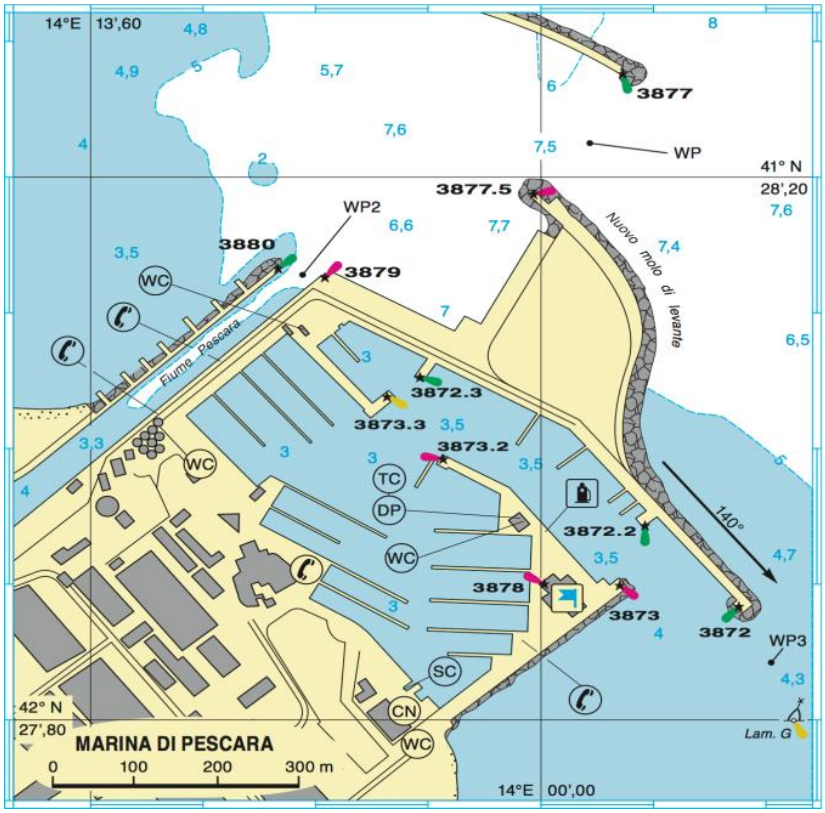


Figure 41: Map of current depths of the Port of Pescara

The terminal part of the canal port is intended for the berthing of passenger, cargo and tanker ships (south pier) and the berthing of fishing units (north pier). In the central area of the canal port (Figure 42) the berthing of passenger and charter vessels is planned on the north pier, and on the south pier that of trawler and seiner fishing units. Also on the south pier, toward the equipped axis bridge, an additional 800 meters are designated for small fishing boats. Stationery and transit pleasure craft are located at the end of the port

perimeter, on the north and south quay between the two bridges d'Annunzio and Risorgimento. The slipway is located on the north quay.

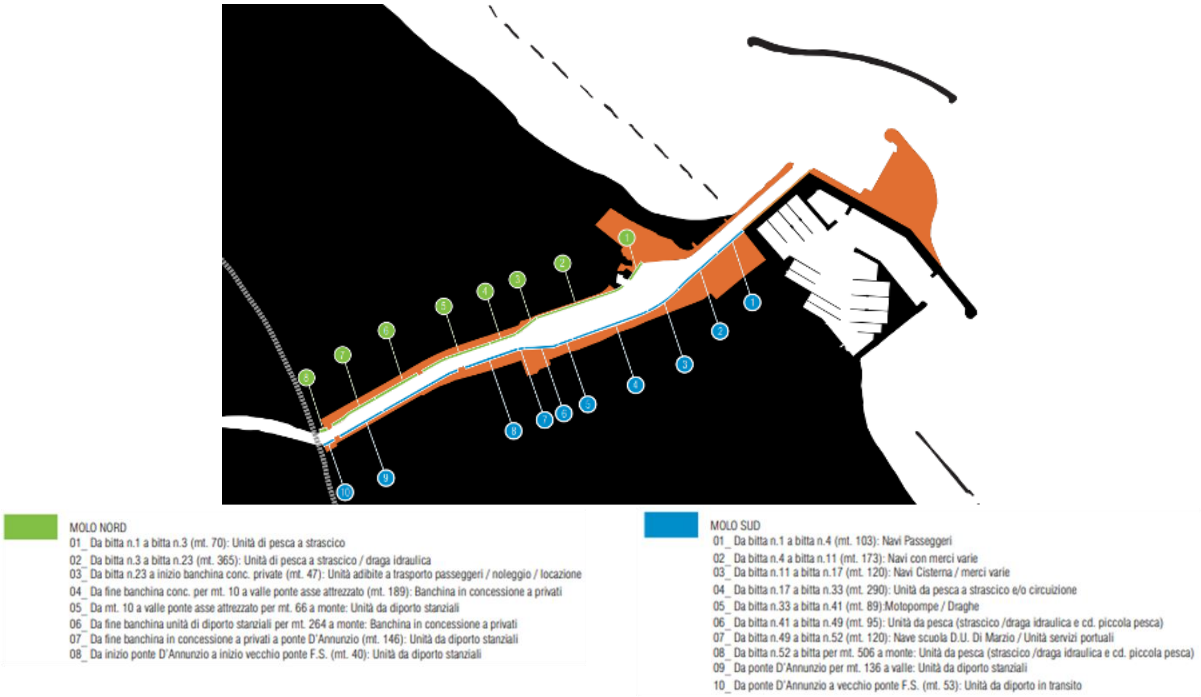


Figure 42: Destination functions of the port of Pescara

3.2.3.2 - Configuration according to P.R.P. 2008

The possible planimetric configurations for the Port of Pescara are shown in Figure 43.

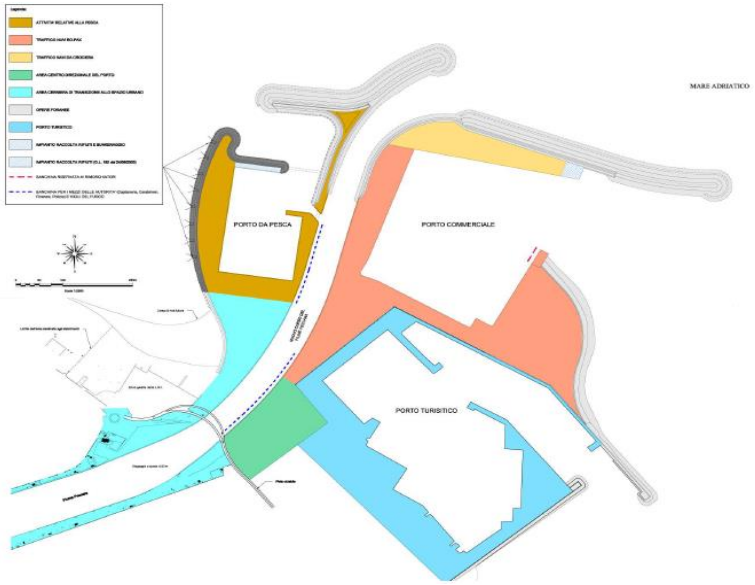


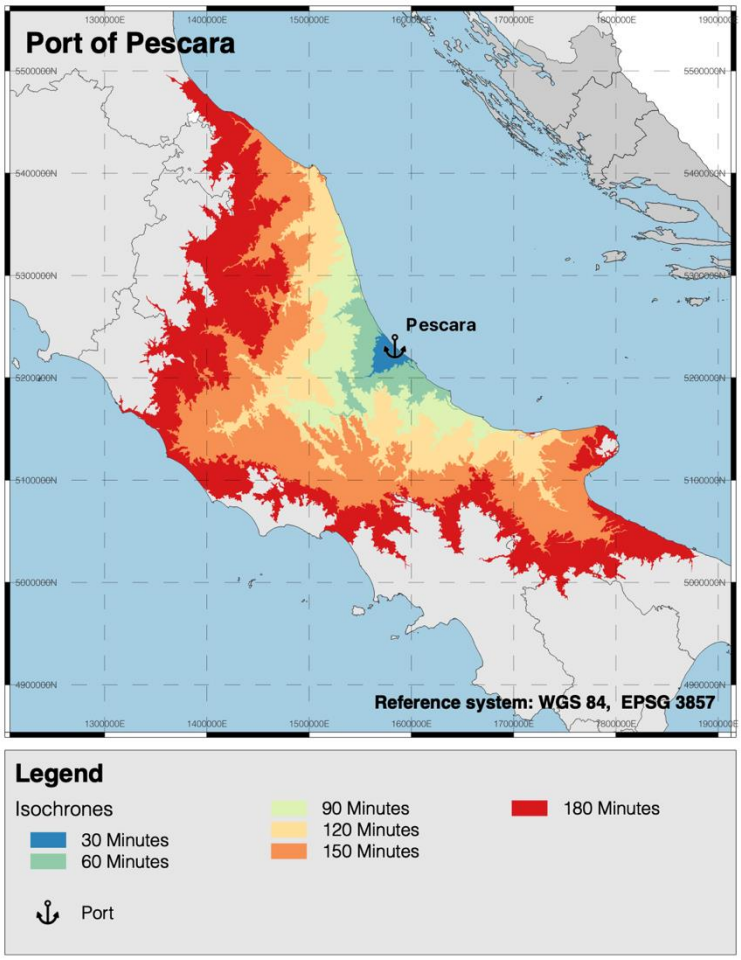
Figure 43: Zoning d P.R.P. 2008 of the port of Pescara

Among the main interventions of the plan is the separation of the river mouth and the commercial harbor to use in a promiscuous mode the two new docks bordering the harbour along the north and west sides. The proposed configuration of the commercial dock offers, in addition to the four docks with a total length of 1165 m and a foot depth of 8.00 (dependable in the future to 10 m), vast embankments with a total area of about 107,000 m^2.

The evolution dock, with a diameter of 285 m (net of francs) to be considered for moored ships, does not allow safe maneuvering for ships longer than 190 m. Therefore, larger ships will necessarily have to perform course reversal maneuvers outside the harbor and be driven to berth along the new docks by tugs.

3.2.3.3 – Accessibility

The results of the spatial and local accessibility analysis of the Port of Pescara are shown in Figures 44 and 45, respectively.



Number of people intercepted in isochrones					
30 Minutes	60 Minutes	90 Minutes	120 Minutes	150 Minutes	180 Minutes
380.539	881.216	1.592.885	2.862.662	7.755.290	11.412.724

Figure 44: Indicator Ia_t - Accessibility of the extra-regional basin of the port of Pescara

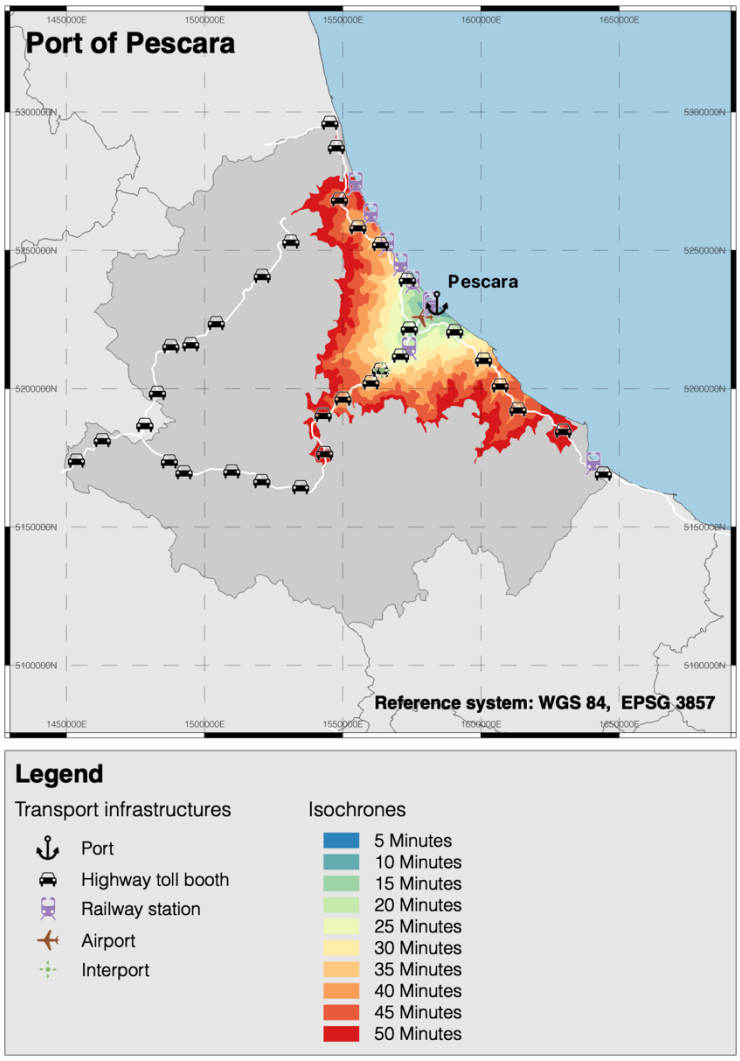


Figure 45: Indicator Ia_l - Accessibility of the local basin of the port of Pescara

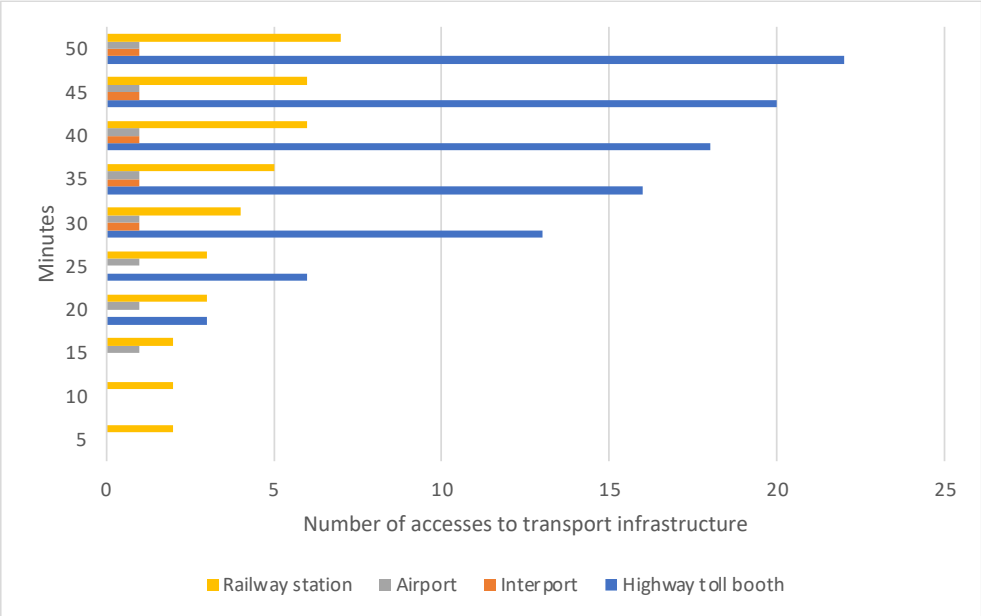
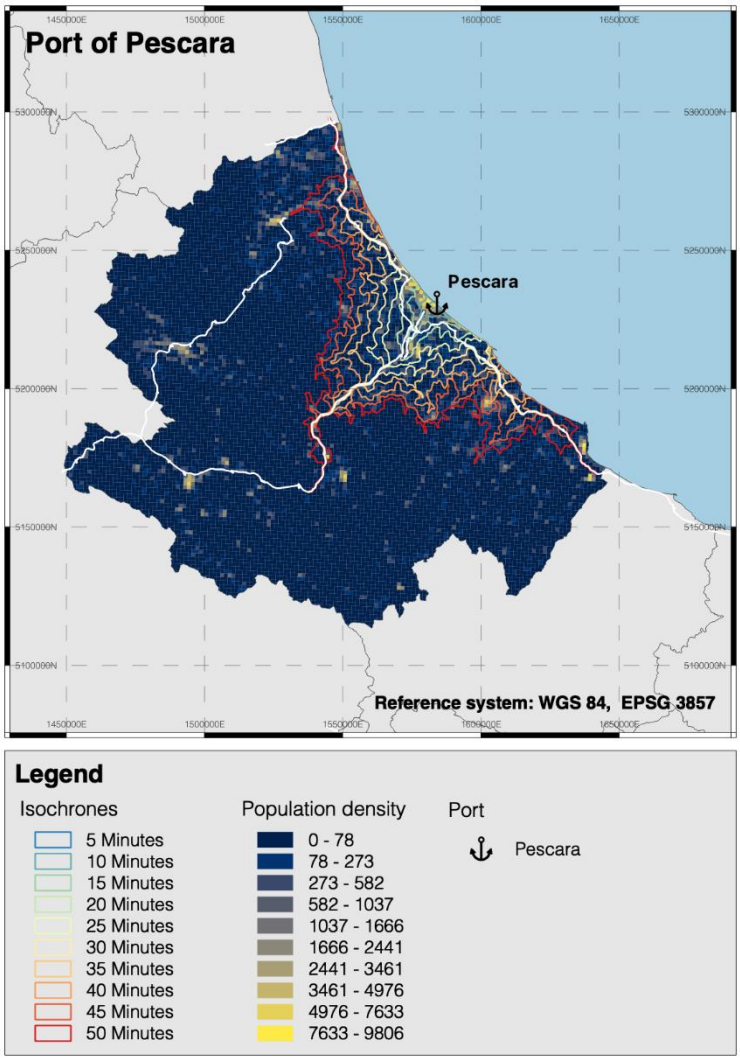


Figure 46: Accessibility to transportation infrastructure from the port of Pescara



Number of people intercepted in isochrones									
5 Minutes	10 Minutes	15 Minutes	20 Minutes	25 Minutes	30 Minutes	35 Minutes	40 Minutes	45 Minutes	50 Minutes
22.132	97.293	171.586	248.880	318.054	365.519	420.388	479.338	583.672	687.547

Figure 47: Indicator Ip (intercepted population) in the different time intervals made from the port of Pescara

Table 6 shows the distances and travel times by sea and land between the port of Pescara and the Croatian ports examined.

		Land	Sea	
From	**To**	**Distance [Nautic miles]**	**Distance [km]**	**Time [hours]**
Pescara	Split	126	1.137	12
	Sibenik	115	1.069	11
	Zadar	118	1.014	11

Table 6: Distances and travel times by sea and land between the port of Pescara and the Croatian ports surveyed

3.2.4 – Accessibility indicators of Abruzzo ports compared

The accessibility indicators calculated for the Abruzzi ports surveyed are compared with each other below. Figures 48, 49, 50, 51 respectively illustrate the comparison between the Abruzzi ports in terms of accessibility to the following types of infrastructure: (i) highway toll booths, (ii) interports, (iii) airports, (iv) railway stations.

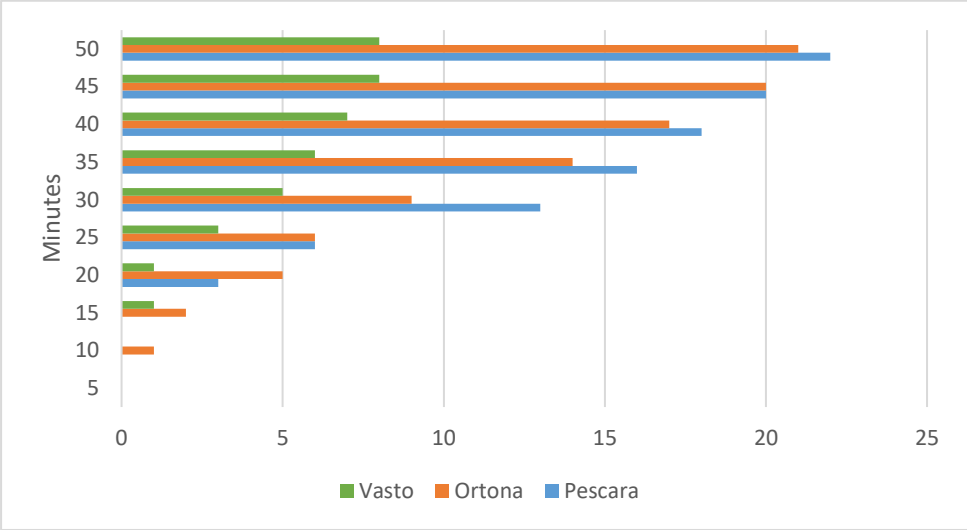


Figure 48: Comparison of accessibility at highway toll booths in the three Abruzzo ports

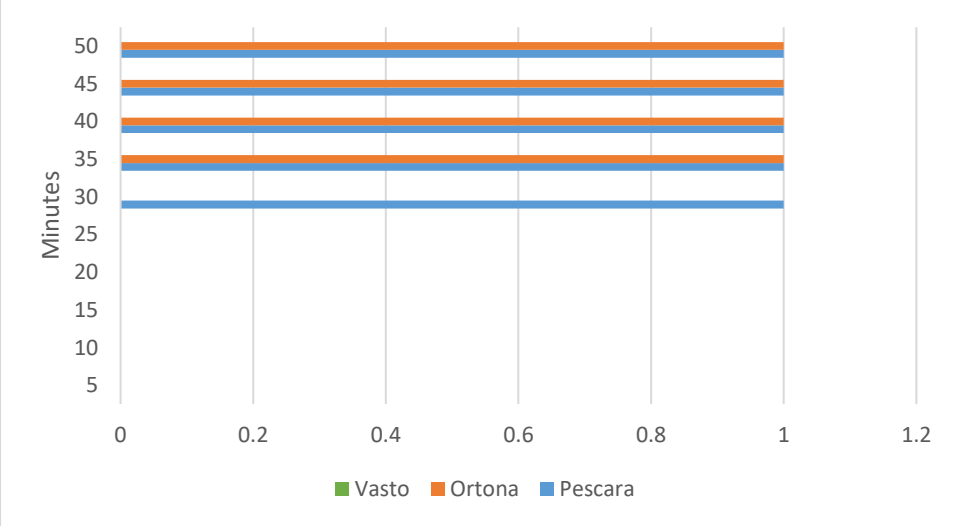


Figure 49: Comparison of accessibility to the interports of the three Abruzzo ports

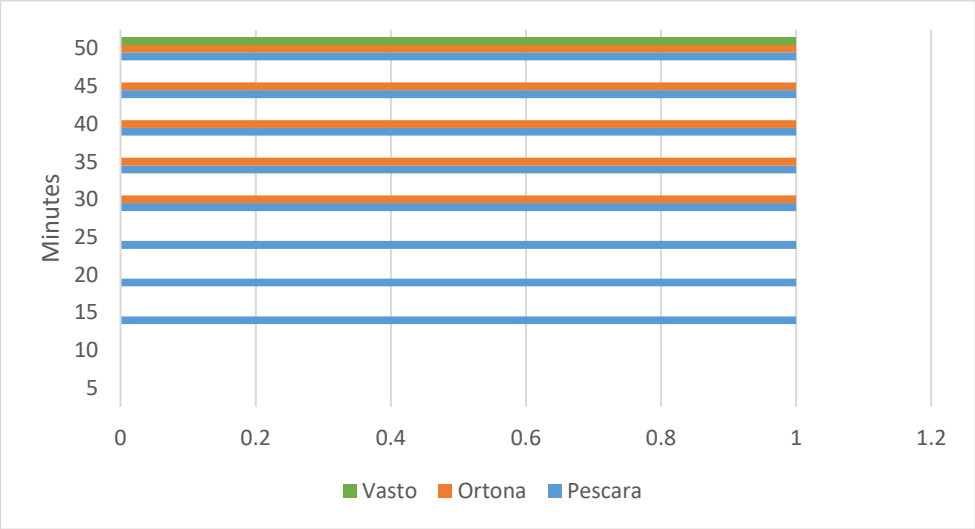


Figure 50: Comparison of airport accessibility of Abruzzo's three ports

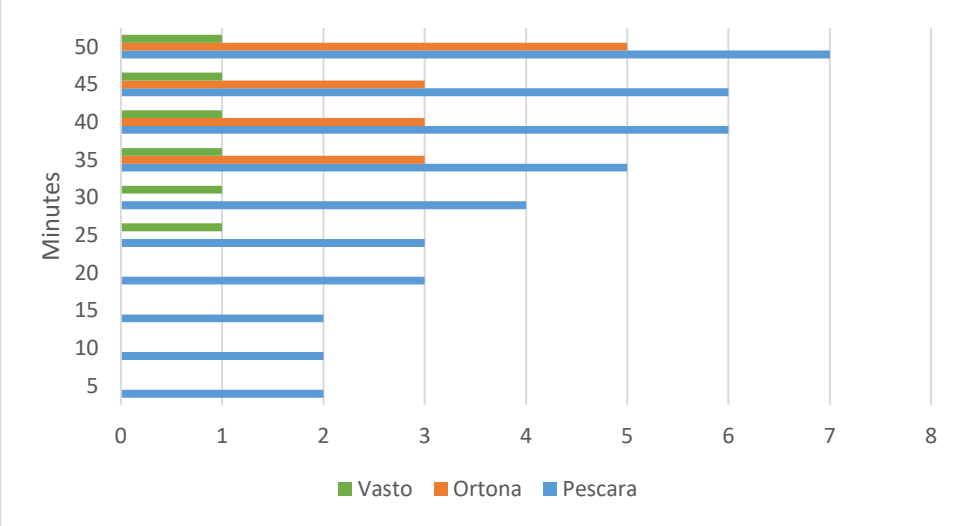


Figure 51: Comparison of train station accessibility of the three Abruzzo ports

Table 7 shows the summary of the results of the accessibility analysis of the 3 ports examined, also in relation to the intercepted resident population. The results show that the port of Pescara has the best accessibility, and the largest number of intercepted population, within the high and medium-high accessibility levels corresponding respectively to the time intervals defined by the isochrones between 5-10 minutes and 15-20 minutes.

		Ports of Abruzzo		
Interports	**Level of accessibility**	**Ortona**	**Vasto**	**Pescara**
Highway toll booths	High (5-10 min.)	✓		
	Medium-high (15-20 min.)	✓	✓	✓
Interports	High (5-10 min.)			
	Medium-high (15-20 min.)			
Airports	High (5-10 min.)			✓
	Medium-high (15-20 min.)			✓
Railway stations	High (5-10 min.)			✓
	Medium-high (15-20 min.)			✓
People intercepted in the two levels of accessibility		**98.034**	**81.272**	**539.891**

Table 7: Comparison of the accessibility levels of Abruzzo's 3 ports and the intercepted population

3.3 – Croatian ports

The following section preliminarily and briefly analyses the main characteristics of the Croatian ports (Zadar, Šibenik and Split) covered by this study (Figure 52). It is specified that, for these ports, the information reported is that received from the relevant authorities and that available on the ports' institutional websites.

Port of Zadar

Port of Šibenik

Port of Split

Main characteristics of Croatian ports analyzed in the study					
Port	Maximum draft	Berths	Maximum dock length	Areas reserved for recreation	Docks available for Ro-Pax boarding
Zadar	7 m	1200	80 m	40 to 80 m	\
Šibenik	10 m	40	240 m	\	\
Split	6.5 m	318	130 m	\	4

Figure 52: The three Croatian ports under analysis

3.3.1 – Port of Zadar

The port of Zadar (Marina Dalmatia) is located in Sukosan Bay, 7 km south of the city centre, and consists of two large docks and a curvilinear embankment (Figure 53). The main technical characteristics of the port are summarised below:

- Depths: at the quay from 2 to 7 m, at the harbour entrance and in the dock from 4 to 10 m;
- Berths: 1200;
- Maximum length: 80 m;
- Areas reserved for recreation: fixed piers 50 to 80 meters long.

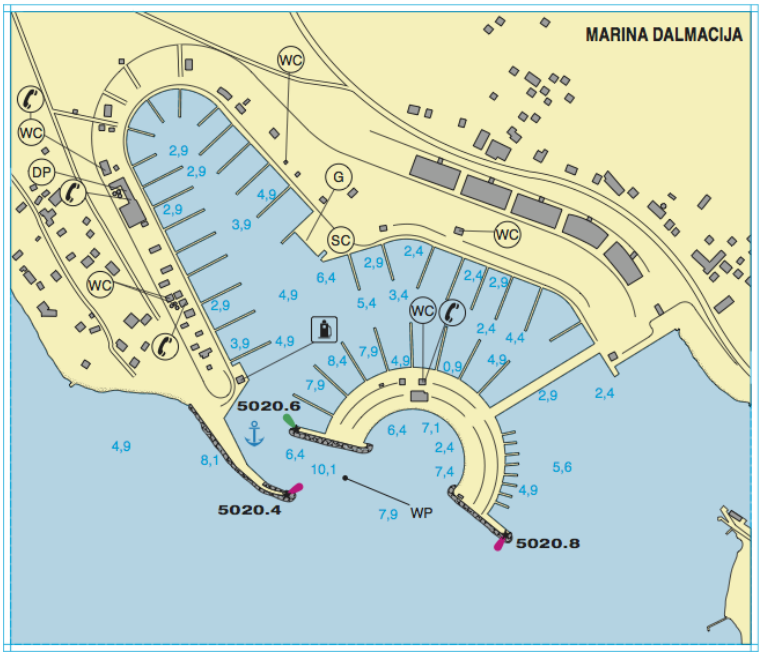


Figure 53: Map of the current depths of the Port of Zadar (Marina Dalmatia)

3.3.2 – Port of Šibenik

The city of Šibenik, located in the region of Dalmatia, has a natural harbour connected to the sea by a channel of about 2.7 km in length and 120 to 300 m in width, which allows the navigation of ships over 50 tons, at the mouth of the Krka River. Access to the port is through the St. Anthony's channel. Along the quay bordering the old town of Šibenik is the dead-body berth with 40 berths equipped with rings and water and electricity services. The main technical characteristics of the port of Šibenik are summarised below:

- minimum draft: about 8 m;
- maximum draft: about 40 m.

Figure 54 shows the main operating quays in the port of Šibenik for both passenger and cargo transport.

Figure 54: Location of the main operational docks in the port of Šibenik and functional characteristics

3.3.3 – Port of Split

The city of Split represents an important cultural, tourist, industrial, commercial, administrative and especially, sports centre of Dalmatia. The port of Split, due to its exceptional geographical position on the Adriatic, is one of the most important centres for local and international maritime traffic. The port is structured as follows:

- Free zone: is located within the Vragnizza and Salona Basin area, and consists of two parts:
    - land zone: includes the area from the Cape of Stinizza to the border of the cadastral municipality of Split and the cadastral municipality of Salona - of the total area of 259,900 m^2
    - Sea area: with an area of 24,000 m^2

The main technical characteristics of the port of Šibenik, as currently configured, are summarised below:
4 quays available for embarkation, specifically for Ro-pax, length 130 m, depth 6.5 m.
In addition, the port of Split used to be the sea link terminal in the past (no longer active today) between Pescara and Croatia.

3.4 - Conclusion

In accordance with the indications and contents related to: i) transport sector planning at different scales (European, macro-regional, national, regional), ii) the European Green Deal with particular reference to the document "Fit for 55," iii) the National Strategic Framework annexed to Legislative Decree No. 257/2016, iv) analysis of the offer of maritime passenger transport in the Adriatic Sea, for the purpose of the maritime passenger transport connection between Abruzzo and Croatia, the following ports were identified:

- for Abruzzo: Pescara, Ortona, Vasto;
- for Croatia: Split, Zadar, Šibenik.

For each port in Abruzzo, the functional and performance characteristics of the infrastructure and the connection with the respective territorial, and local basin were analysed through the introduction of: territorial accessibility indicators (Iat), local accessibility indicators (Ial), potential population interception indicators (Ip). The results of the conducted analyses show that the port of Pescara has the highest values of the above-mentioned indicators and therefore is the most suitable option for the activation of a maritime passenger transport connection with the Croatian shore.

On the other hand, with regard to the identification of the Croatian port of reference, the choice fell on Split because, although the other two ports examined are functionally compatible with the activation of the link under consideration, it has the following characteristics: i) excellent strategic location, ii) it currently serves the highest volume of passenger traffic in Croatia, iii) it is a major cultural, tourist, commercial and sports centre, iv) it used to be the maritime link terminal in the past (no longer active today) between Pescara and Croatia.

In view of the above, the two ports of Pescara and Split are considered for the continuation of this study.

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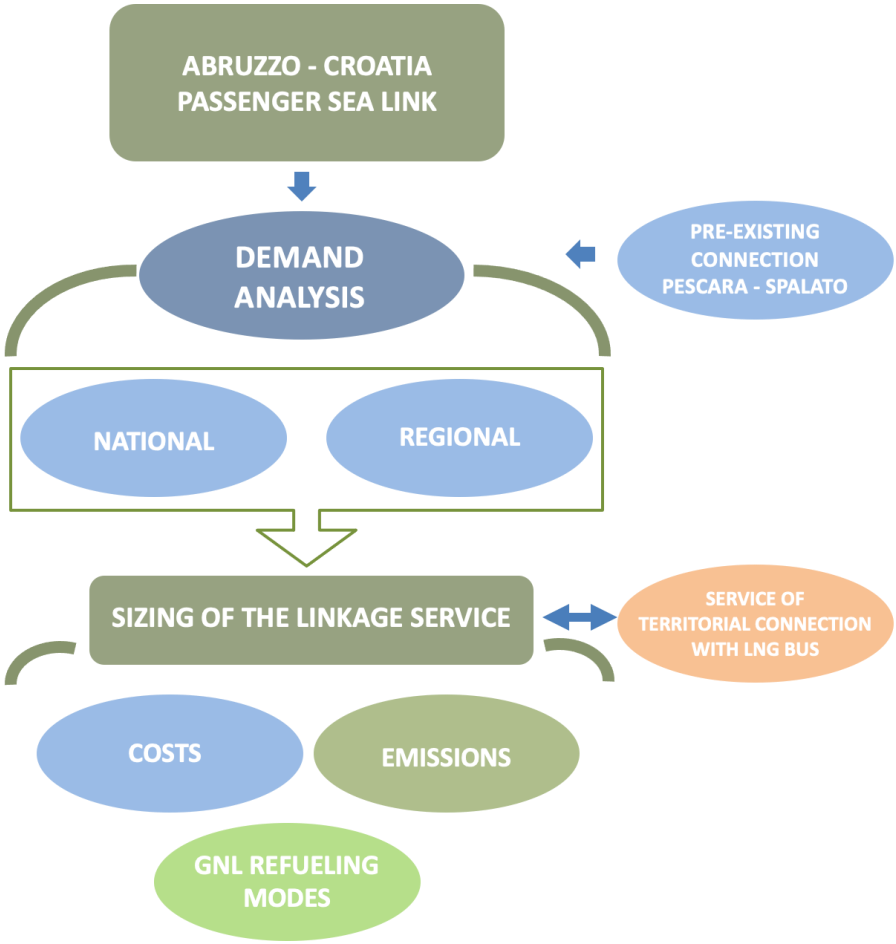
Chapter 4: Study of a maritime link between Abruzzo and Croatia

This chapter describes the study of a passenger sea link between the ports of Pescara and Split based on the previously described analyses. Some LNG-powered vessels, operating in the Mediterranean or under construction, are considered and their technical-performance characteristics are evaluated. We then proceed to verify the compatibility between the characteristics of the vessels and the port infrastructure examined in the previous chapter.



4.1 – GNL Ships

In the shipping industry, the use of fuels with low sulphur content and hazardous pollutants is the theme of the new IMO20 regulations. The goal is to reduce the number of ships using polluting fuels by 60 percent by 2030.

Fuel has a significant impact on emissions, so switching to alternative fuels is one of the strategies being discussed. In this framework, natural gas is a viable alternative to conventional marine fuels. Literature shows that switching to LNG instead of conventional fuels would significantly improve overall environmental performance. To use LNG requires a dual-fuel engine that uses natural gas and fuel to convert chemical energy into mechanical energy. However, this requires retrofitting the entire fleet with appropriate dual-fuel hybrid engines that can use marine diesel oil (MDO) or natural gas (e.g., LNG) as the primary fuel. The use of MDO remains limited to cope with any non-availability of LNG to comply with safe harbour return regulations, which require full redundancy of propulsion and power generation systems. The use of LNG requires tank insulation with highly advanced technologies because when the tank insulation is penetrated by an influx of heat, the temperature/pressure of the LNG gas increases generating vaporisation from liquid to gas (boil-off). The important difference between natural gas and LNG is the specific volume, which is about 600 times higher for gas than for liquid. The comparison of the bunker volume of MDO and LNG is presented in the Table below. The MDO/LNL energy density ratio (for the same volume) is about 1.6. Taking into account the necessary thermal insulation of LNG tanks, the volume of the tanks is about 2-3 times higher than that of MDO.

Fuel	LHV [MJ/kg]	Fuel density [kg/m^3]	Energy density [MJ/m^3]
MDO	42.7	900	38.430
LNG	54.2	442	24.177

Table 8: The bunkering volume between marine diesel oil (MDO) and liquefied natural gas (LNG)

LNG as a fuel can significantly improve a ship's environmental impact compared to conventional fuels. LNG contains no sulphur, which results in negligible SOx emissions: 95% to 100% reduction compared to Marine Diesel Oil (MDO). This therefore meets existing and International Maritime Organization (IMO) emission limits even in Sulphur Emission Control Areas (SECAs). In addition, LNG and Bio-GNL-fuelled ships produce almost no PM emissions (90-100% compared to MDO), while the reduction in NOx emissions depends on the type of engine used but varies between 40% and 80% compared to MDO. In addition, because

LNG has a higher hydrogen-to-carbon ratio than conventional fuels, specific CO2 emissions are about 25% lower than MDO. Bio-GNL is a solution that, depending on the biomass mix and the technology used to produce the biomethane, can zero out carbon emissions over the entire lifecycle to negative. These aspects make BioGNL a green fuel in the long run, among other things without the need to renew ship thrusters and ship refuelling infrastructure.

It should be pointed out, however, that some industry studies report that although LNG contains less carbon per unit of energy than MDO, its use may not reduce lifecycle greenhouse gas (GHG) emissions if the analysis includes upstream emissions, combustion emissions, methane slip (i.e., unburned methane from an engine's combustion process released during ship operation), and climate impacts are assessed using 100- and 20-year global warming potentials (GWPs). Indeed, it has been estimated that over a 100-year time horizon, the maximum lifecycle GHG benefit of LNG corresponds to a 15 percent reduction compared to MDO, and this is only if ships use a high-pressure dual fuel injection (HPDF) engine and if upstream methane emissions are well controlled. Consequently, the real GHG benefits of LNG depend largely on methane leakage rates within the LNG supply chain (fuel production, storage, transport, bunkering) and the "methane slip." The benefits therefore of LNG use are reduced if methane is not adequately controlled, in which case LNG can offer only marginal greenhouse gas emission benefits over conventional fuels. In contrast, combustion of liquefied bio-methane (LBG) has a neutral recirculation cycle for CO2, which has been identified as the main cause of global warming. Literature shows that the use of methane produced from biomass has the potential to significantly reduce lifecycle greenhouse gas emissions. Therefore, LBG could be an attractive low-carbon alternative to LNG.

Tank to Wake (TtW) emissions associated with Bio-GNL are quite similar to those of fossil-derived LNG. However, when evaluating emissions over the entire fuel life cycle by including Well to Tank (WtT) emissions, it is observed that Bio-GNL can significantly reduce total Well to Wake (WtW) emissions to, potentially, zero depending on the type, origin and blend of biomass, in line with the European Fuel EU and REDII directives.

It is highlighted that Bio-GNL represents a transitional fuel to be used mainly in the short to medium term. For the long term it can also be complemented by using synthetically sourced LNG (Hydrogen-Based fuel produced from renewable energy sources using recycled CO2) with near-zero emissions. The latter type of fuel, being compatible with the characteristics of the existing LNG transport and storage infrastructure,

does not involve complexities and construction burdens associated with new dedicated infrastructure. This way, LNG would become an appropriate solution in the long term as well as in the transitional phase.

Because of the above, LNG should be considered as a transitional fuel for all intents and purposes and for the energy evolution that will accompany world shipping towards the green transition. For the above reasons, shipowners and owners of merchant ship fleets tend to adopt LNG-fuelled propulsion as an alternative fuel for new ships or those yet to be built. According to updated estimates, the LNG ship orderbook exceeds 500 vessels by 2028, which is close to double the current LNG-fuelled ship fleet. Most of the ships in service are in Europe, where the infrastructure network for bunkering is also spreading in parallel. In particular, bunkering services in Spain, Great Britain, the Netherlands, Belgium, France and Portugal are provided at LNG regasification terminals. In our country, currently, no regasification terminal can provide Small Scale LNG services and there are no bunkering points for ships. The only two LNG bunkering experiences, considered more experimental and both carried out directly from tankers, concern the port of Civitavecchia and Castellamare di Stabia. The outlook is certainly one of growth, and according to estimates in the National Strategic Framework to 2030, the demand for LNG bunkers is expected to be around 1 million tons per year; bunkering points for ships operating in seaports and inland ports are expected to be 20; newly built LNG-fuelled vessels are expected to amount to 35, while there should be 25 converted ones.

4.1.1 – Analysis of some LNG vessels in the Mediterranean

This study considers a number of LNG-fuelled Ro-Pax type of vessels already operating in the Mediterranean or under construction. In particular, thanks to the collaboration with SNAM and Caronte & Tourist, as stakeholders in the MIMOSA project, 11 vessels were selected, whose special characteristics are shown in Table 9.

	Ro-Pax LNG Ships	Motorization	Lenght (m)	Width (m)	Speed (nodi)	LNG consumption extimation (cbm/h)	LNG tank dimensions	Gross tonnage (tons)	Draft (m)	Passengers	Vehicles (cars)	Linear meters	Cabins	Cost estimation (mln euro)
Operative	Balearia - Abel Matutes	Dual Fuel (MGO-LNG) - Retrofit	190	26	23	5,9	2 tanks of 178 cbm	20.670	6,3	900	625	2.235	92	120 - 130
	Balearia - Bahama Mama	Dual Fuel (MGO-LNG) - Retrofit	154	24	23	5,9	300 - 400 cbm total	20.312	5,5 - 6	1.000	350	n.a.	48	120 - 130
	Balearia - Eleanor Roosvelt	Dual Fuel (MGO-LNG)	124	28	37	n.a.	2 tanks - autonomy 400 N.M.	12.262	3 - 3,5	1.200	450	500 of load + 250 cars	n.a.	90 - 105
	Balearia - Hypatia de Alejandria	Dual Fuel (MGO-LNG)	186	25	24	5,9	350 - 400 total	28.658	6,3	880	608	2.194	120	120 - 130
	Balearia - Marie Curie	Dual Fuel (MGO-LNG)	186	25	25	5,9	350 - 400 total	28.658	6,3	880	608	2.194	120	120 - 130
	Balearia - Martìn i Soler	Dual Fuel (MGO-LNG) - Retrofit	165	25	23	5,9	350 - 400 total	24.760	6,3	1.200	567	n.a.	46	120 - 130
	Balearia - Napoles	Dual Fuel (MGO-LNG) - Retrofit	186	25	23	5,9	350 - 400 total	23.975	6,3	1.600	481	2.000	120	120 - 130
	Balearia - Sicilia	Dual Fuel (MGO-LNG) - Retrofit	186	25	24	5,9	350 - 400 total	24.409	6,3	1.000	481	2.000	120	120 - 130
	Caronte & Tourist - Elio	Dual Fuel (MGO-LNG)	134	22	15	2,9	1 tank of 150 cbm	8.778	4	1.500	290 (or 38 trucks)	300	n.a.	35 - 40
	Adria Ferries - AF Claudia	Conventional propulsion with scrubbers	187	26	22	n.a.	Tanks LNG not installed	24.418	6,3	950	75 cars e 140 trucks	2.040	76	n.a.
In construction phase	Caronte & Tourist - Nerea		109,95	19,5	16,5				4,8	400	114			40

Table 9: Characteristics of the LNG vessels analysed

		
Balearia Bahama Mama	**Balearia Eleanor Roosvelt**	**Balearia Hypatia de Alejandria**
		
Balearia Marie Curie	**Balearia Martìn i Soler**	**Caronte & Tourist Elio**
		
Balearia Napoles	**Adria Ferries AF Claudia**	**Balearia Sicilia**

	
Balearia Abel Matutes	**Caronte & Tourist Nerea**

Table 10: LNG-powered vessels analysed

4.2 – Functional compatibility between waterways and ports

The following is the verification of functional compatibility between vessels and ports analysed and described in the previous paragraphs.

Ship	Vasto	Ortona	Pescara	Zadar	Šibenik	Split
Balearia - Abel Matutes	X	X	?	V	V	V
Balearia - Bahama Mama	V	V	?	X	V	V
Balearia - Eleanor Roosvelt	V	V	V	V	V	V
Balearia - Hypatia de Alejandria	X	X	?	X	V	X
Balearia - Marie Curie	X	X	?	X	V	X
Balearia - Martìn i Soler	V	V	?	X	V	V
Balearia - Napoles	X	X	?	X	V	V
Balearia - Sicilia	X	X	?	X	V	V
Caronte & Tourist - Elio	V	V	V	V	V	V
Adria Ferries - AF Claudia	X	X	?	X	V	V
Caronte & Tourist - Nerea	V	V	?	V	V	V

Table 11: Synoptic compatibility between ports and waterways

Regarding the port of Pescara, it should be specified that functional compatibility with most of the nacelles depends on the seabed dredging works and the implementation of the provisions of the 2008 Port Master Plan P.R.P. . Therefore, except for this case and net of the position of the embarkation hatch in relation to the quay, full compatibility with the ports is verified by 3 out of 11 nacelles. The question mark in the table indicates the potential compatibility of the port only because of the interventions planned in the P.R.P. .

Within the optional range of the examined vessels and the outcome of the compatibility analysis with the performance and functional characteristics of the ports, the ship "Nerea" of the shipowner Caronte &

Tourist was chosen because, being the newest of all those examined in the table, it has the most advanced performance characteristics in both technological and functional terms. Moreover, compared with the others, its innovative features can reduce environmental impact in terms of emissions. The ship is designed to reduce environmental impacts: mixed Diesel-Liquified Natural Gas (LNG) engines have been adopted for this purpose. It has installed batteries on board to enable the functionality of operations in port for about 4 hours without the use of combustion engines thereby zeroing emissions. In addition, it is designed to install a photovoltaic system on the deckhouse deck to cover part of the energy needs of onboard utilities (see section 4.3.2.1 for the description of the technical-performance characteristics of the chosen ship).

The identified naval unit has the characteristics of length and width that would allow it to dock safely at the Riva dock of the Pescara commercial port of call equipped with an existing structure and for which there would be no need to wait for the realization of the works pertaining to the new Port Master Plan of Pescara.

Maneuvering space is a function of the parameters listed below:

- Maximum ship dive: 4.8 m.
- Hatch length: 10.9 m (Figure 1).
- Hatch inclination: +/- 8° (Figure 2).
- Hatch height from the water: 2.7 m.

The hatch is lowered by positioning itself parallel to the longitudinal axis of the ship.

The length of the hatch and 1-meter distance from the side mooring bollards should be considered for the minimum length of the dock.

However, in spite of the limited draft of the unit, at the moment there are no conditions for the practicability of the seabed, which, if adjusted to the PRP quotas, should still be -7 meters. The presence of a tooth at the 'intersection of the Riva and Levante docks would allow easy use of the aft hatch for vehicle embarkation/disembarkation operations. The onshore areas are currently devoid of facilities to serve passenger traffic, if only the spaces close to the mooring dock are considered. Therefore, for the purposes of service activation, the key realizations concern the completion of the apron for vehicle handling and parking, currently occupied by sediments from past dredging, and a structure to house reception and ticketing services as well as institute services (customs, Guardia di Finanza, Police).

Specifically, the main ground facilities to be prepared are as follows:

- Cargo handling services with fifth wheel for semi-trailers;

- Mooring services;
- Ticketing;
- Forecourt service;
- Fire protection service (During Bunkering);
- GPG service (special security guards).

It is specified that the costs of these infrastructures can only be assessed during executive planning. In general terms, for International voyages, the ISPS Code, which regulates ship and port facility security standards, applies. These regulations require the appointment of a ship security officer (SSO) on board and a port facility security officer (PFSO) ashore. The latter is responsible for developing a security plan for the port facility after conducting an appropriate risk assessment (Risk assessment) in the relevant port. Subsequently, appropriate port barriers and access gates, related security equipment (metal detectors, VHF radios, bibs, access badges, etc.) manned by qualified shore personnel will have to be set up. In the present case, an ad hoc study will subsequently have to be carried out for each port where the ship will operate.

As a corollary to these considerations, it should be pointed out that Croatia's recent entry into the Schengen area would make it possible to abolish border controls for vessels bound for Split and/or other Croatian destinations, with significant savings in the ship's turnaround time in port.

The above is derived from preliminary indications, the implementation of which, however, requires further verification and in-depth analysis to be carried out during the executive design phase following the indications of the competent authorities.

4.3 – Maritime link between Abruzzo - Croatia

Following the design choices regarding the pair of ports (Pescara and Split), between which to activate the connection, and the LNG ship (ship "Nerea"), the demand analysis and service sizing is carried out.

4.3.1 – History of the maritime link between Pescara and Split

The Pescara-Croatia Sea route declined over the years through different destinations and with vessels having different characteristics and capacities, carries a history of more than fifty years. Indeed, the activation of the first route between Pescara and Split dates back to 1966 through a small ferry capable of carrying both passengers and a small number of vehicles. In 1971 this first unit was replaced by a newly built ferry whose characteristics were adapted to the conformation of Pescara's canal port. This vessel, equipped with cabins and garages, had the capacity to transport 800 passengers and up to 200 vehicles, including TIRs and coaches. The route in question, operating between April and November, was regularly active until 1992 when the maritime connection was stopped due to the outbreak of the conflict in the Balkans. As early as 1993, connections were re-established by means of small fast craft for purely tourism purposes. In the 1990s, the summer connection was always ensured by fast units, flanked from 1994 to 1996 by the above-mentioned ferry, employed only in the summer on two weekly runs. Beginning in 2004, the link was provided by a fast craft with a capacity of 600 passengers and 100 vehicles in service during the summer period from 2004 to 2011.

For further analysis, please refer to Annex 1 (Santori, B., 2012) of this study.

Figure 55: Passenger ferry. Photograph taken in 1970

4.3.2 – Passenger demand analysis

Against the supply described in the previous chapter, the demand for passenger transport (of tourist type) can be analysed with two distinct levels of depth: national scale (Italy - Croatia) and regional scale (Abruzzo - Croatia). The study of passenger demand at the national scale was carried out within the framework of INTERREG Italy-Croatia, in WP 3, by WP Leader PP2 (Ca' Foscari University of Venice). The results are summarised, taken as a reference and integrated for the demand analysis at the regional scale (Abruzzo). At methodological level, the demand analysis on the maritime route Pescara - Split, was carried out using historical data and trend estimates.

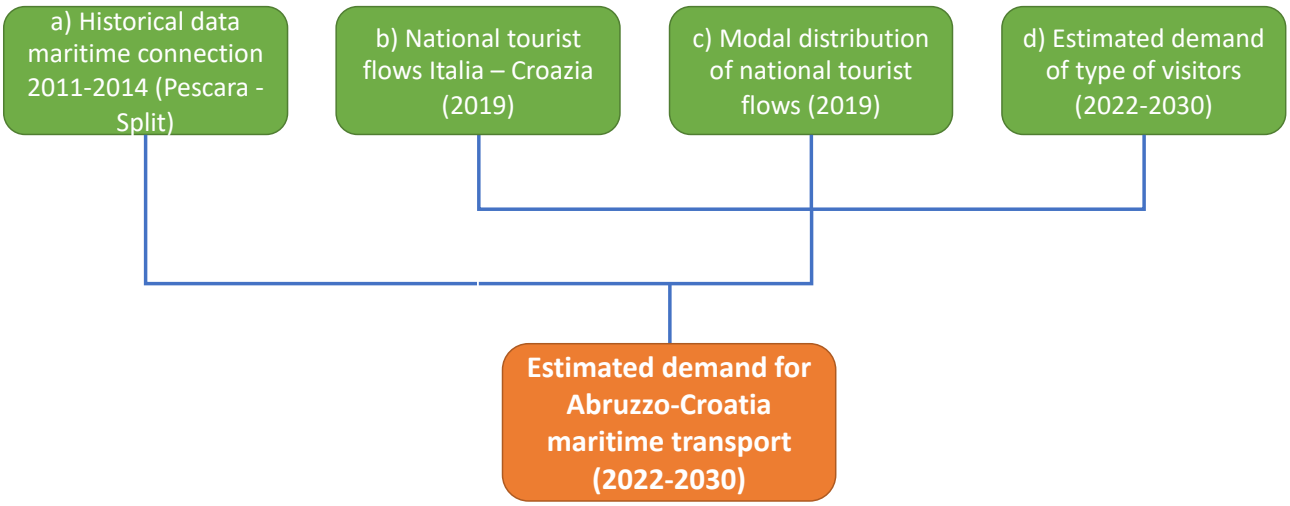
In this regard, the availability of data and information necessary for accurate formulation of demand estimation between Abruzzi and Croatia is very limited. In fact, it is specified that to date, no data have been collected that are useful for deterministic assessment of passenger demand between Abruzzo and Croatia. The data found are uneven and discontinuous over time.

Consequently, it is premised that the demand estimate below is affected by inevitable elements of uncertainty, which therefore also affect the assessment of a balance between costs and revenues/financial resources. That said, the demand analysis was carried out using and cross-referencing available data from different sources, such as:

- a) Trends in the number of Italian passengers divided by national origin over the 3 years the service has been active (Polo Inoltra, 2022)
- b) National tourist flows Italia – Croazia (Infomercatiesteri, 2019)
- c) Modal distribution of tourism flows between Italy and Croatia (Ca' Foscari University of Venice, 2019)
- d) Monthly trends in arrivals to Croatia and Italy (Ca' Foscari University of Venice, 2019)
- Estimated demand by type of visitor between Italy and Croatia (Ca' Foscari University of Venice, 2019)

Therefore, in addition to the uncertainty inherent in any estimate of forecast demand, in this case there is an additional degree of uncertainty due to the lack and discontinuity of current data regarding passenger flow, broken down by transport mode, between Italy and Croatia.

The following block diagram illustrates the method adopted to determine the demand for maritime passenger transport between Abruzzo and Croatia from the available data listed above.



4.3.1.1 – National scale

Ca' Foscari University's study and statistical data (Infomercatiesteri) demonstrates that in 2019, the year before the SarsCov2 pandemic outbreak, nearly 1.5 million tourists travelled between Italy and Croatia, the majority of whom (80%) were Italians heading to Croatia. In 2019, tourist flows between the two countries increased from the previous year (by +2.4%) and were distributed as follows:

- 1.175.000 passengers from Italy to Croatia
- 272.484 passengers from Croatia to Italy

Table 12 shows the modal breakdown of tourism flows.

Modes of transportation	Italian visitors	Croatian visitors	Weighted average of visitors
Car	90,0%	76%	88,2%
Bus	1,0%	16%	2,9%
Airplane	2,0%	6%	2,5%
Traditional ship	5,5%	1%	4,9%
Fast ship	1,5%	1%	1,4%
Total	**100%**	**100%**	**100%**

Table 12: Modal distribution of tourism flows between Italy and Croatia (2019), Source: Ca' Foscari University of Venice

Italian tourism in Croatia takes place mainly during the summer and is mostly concentrated in the coastal regions. Croatian tourism in Italy is more widely distributed both during the year and on the Italian territory.

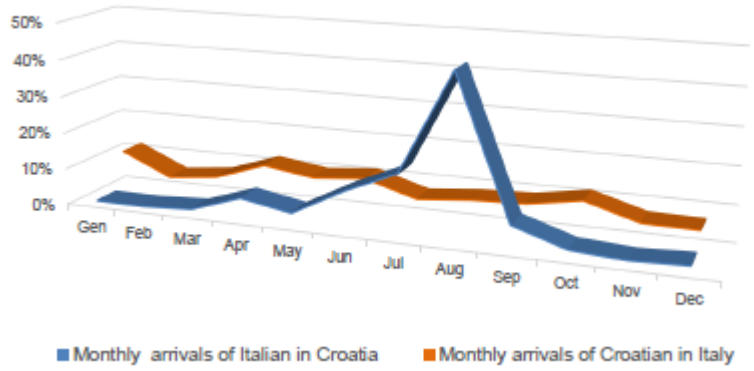


Figure 56: Monthly trends in arrivals to Croatia and Italy, Source: Ca' Foscari University of Venice

The tourist flow between the two countries has increased significantly since 2010 in both directions, and especially from Croatia to Italy (+126% from 2010 to 2019). The study on the nationwide passenger demand, referred to above, contains data on the current demand and the estimated (low and high) passenger demand between Italy and Croatia to 2030, as summarised in the table below.

		Italian visitors		Croatian visitors		Total	
Year	**Visitors**	**Low extimation**	**High extimation**	**Low extimation**	**High extimation**	**Low extimation**	**High extimation**
2019	Tourists	1.175.069		294.825		1.469.894	
2030		1.160.000	1.365.000	430.000	542.000	1.590.000	1.907.000
2019	Hickers	2.750.482	3.300.579	450.986	676.479	3.201.468	3.977.058
2030		2.715.210	3.834.064	657.760	1.243.625	3.372.970	5.077.689
2019	Total	3.925.551	4.475.648	745.811	971.304	4.671.362	5.446.952
2030		3.875.210	5.199.064	1.087.760	1.785.625	4.962.970	6.984.689
variation % 2019/30		-1%	16%	46%	84%	6%	28%

Table 13: Estimated demand by type of visitor between Italy and Croatia, Source: Ca' Foscari University of Venice

As shown in the table, forecasts to 2030 on the total number of tourists and hikers show an increase of 6% (low estimate) and 28% (high estimate), respectively, over 2019 figures.

4.3.1.2 – Regional scale

Figure 57 shows the passenger demand on the Pescara-Split sea route, active in the years 2011, 2014 and 2015 broken down by basin of origin. It is noteworthy that in the three years under consideration the service was operated with a fast ferry. The passenger flows in the three years under consideration are 18,796, 17,093 and 6,258 respectively.

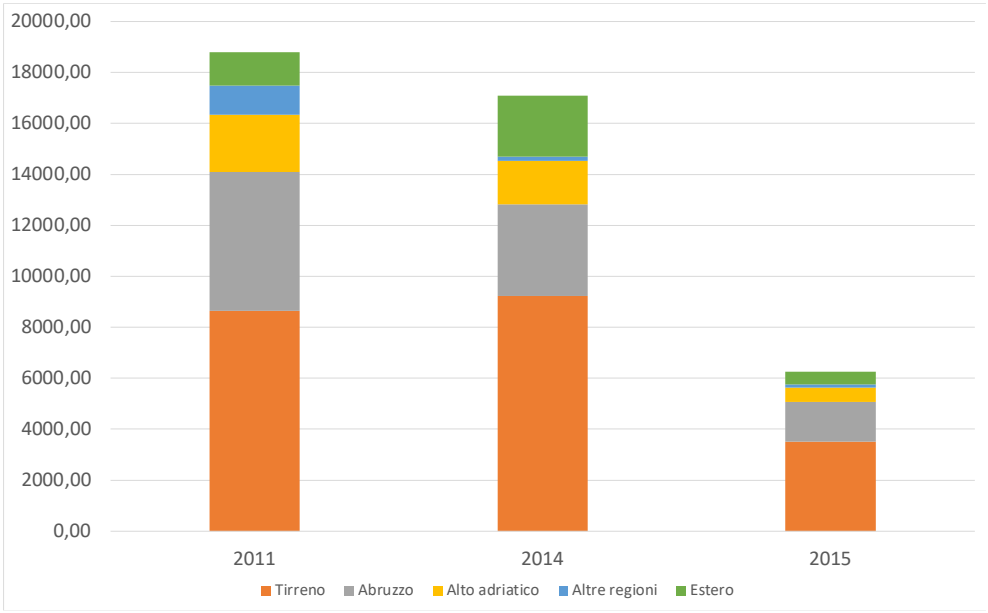


Figure 57: Trends in the number of Italian passengers divided by national origin over the 3 years the service has been active (Source: Polo Inoltra)

Relating these figures to those for domestic flows in 2019, with particular reference to maritime transport, it emerges that the port of Pescara could potentially intercept 16% of passenger demand by sea between Italy and Croatia.

It should be pointed out, however, that in addition to Abruzzo, the catchment area of the Pescara - Split link extends to both the Tyrrhenian (Campania, Lazio and Tuscany) and the Adriatic (Emilia-Romagna, Marche, Molise and Puglia) macro-regions.

Assuming the restoration of a sea link between the ports of Pescara and Split, by relating demand data on a national scale (2019) to historical data (Figure 57), passenger demand by sea in 2019 and 2030 can be preliminarily calculated. It is also assumed that the current potential demand (2022) is similar to that of 2019

as the year before the SarsCov2 pandemic outbreak. The calculations to 2022 were made by considering (i) hypothetically terminating the effects of reduced passenger demand related to the pandemic-related extraordinary circumstances and (ii) evaluating only the regime phase (leaving out the start-up phase).

The projection to 2030 was made as a precautionary measure under the assumption of holding constant the 2019 modal split figures for maritime transport (7% Italy and 2% Croatia) (Table 12) and the share of domestic demand intercepted by the port of Pescara in 2011 (16%) increased by an additional 4% to account for two factors: : (i) possible acquisition of part of the demand presently turning to the ports of Ancona and Bari, (ii) the increase in demand related to both the expected growth in overall travel demand, given Croatia's recent entry into the Schengen and Euro area) and a favourable modal shift that, in the coming years, is expected to favour collective and sustainable transport systems at the expense of private car use.

For this estimate, data for 2011 (Figure 57) were taken as a reference. The years 2014 and 2011 are very similar in terms of share of traffic, while abnormal conditions were present in 2015 that made us lean toward not considering this year as a useful benchmark (i.e.: overall reduction of international traffic and decreased connection services).

	Italy - Croatia		Pescara - Spalato	
Year	**2022**	**2030**	**2022**	**2030**
Italy	1.175.069	1.365.000	17.626	20.475
Croatia	294.825	543.000	1.179	2.172
Total	1.469.894	1.908.000	**18.805**	**22.647**

Table 14: Potential estimate of passenger demand nationwide and on the Pescara-Spalato route in 2022 and 2030

The estimation results show that the reactivation of the sea link between Pescara and Split could potentially intercept about 18,500 passengers/year to date and about 22,500 passengers/year to 2030. Figure 58 shows the monthly trend of estimated demand to 2022, derived through the data shown in Table 6.

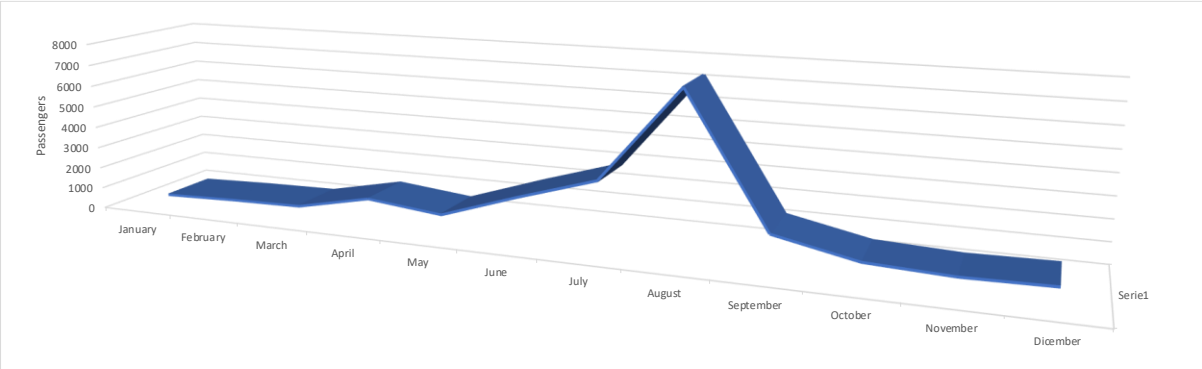


Figure 58: Potential estimate of annual passenger demand trend to 2022 on the Pescara - Split route

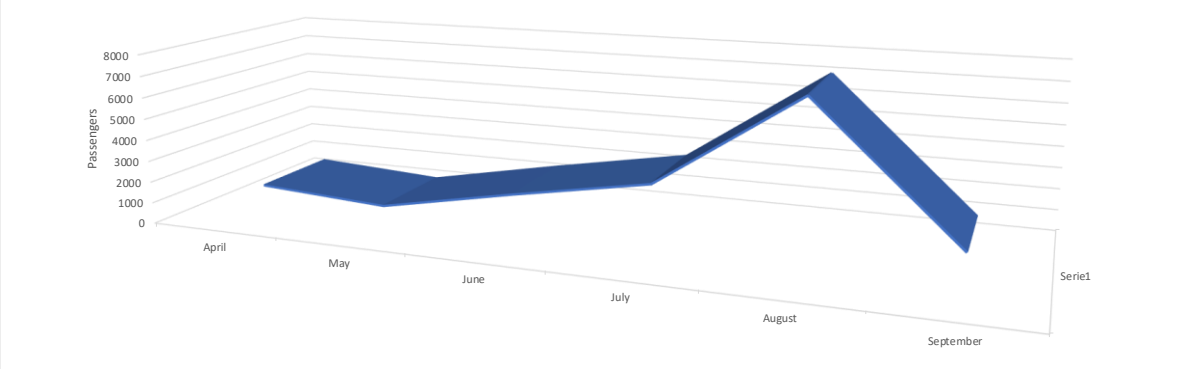


Figure 59: Potential estimate of passenger demand trends to 2022 on the Pescara - Split route referring to the period April - September

In fact It should be noted that this estimate appears conservative, however, considering that In the medium-long term, further potential increases in demand could occur because of the possible acquisition of some of the demand that currently gravitates to Bari and Ancona The port of Pescara is located in an intermediate position, along the Adriatic coast, compared to the ports of Ancona and Bari. For Ancona and Bari together transited about 145,000 passengers in 2019 (see Deliverable D.3.1.1. "Quantitative analysis of existing demand"). It is reasonable to assume that a share of this transport demand can be intercepted by the port of Pescara since there appear to be no other significant sea connections between central Italy and Croatia at the moment.

It should be noted that, given the limited and discontinuous availability of information and data about passenger flows between Abruzzo and Croatia, the results obtained as a result of the estimation based on the above assumptions in the demand analysis are necessarily subject to possible margins of uncertainty that cannot be quantified beforehand.

4.3.2 – Sizing of the maritime link service

The sea link service between the ports of Pescara and Split was sized to meet the estimated transport demand for 2022 in Section 4.3.1.2 considering two alternative operational service scenarios:

- annual (January - December)
- semi-annual (April - September)

The link frequency calculation was derived according to the performance characteristics of the chosen ship ("Nerea"). It should be noted that the analyses below are affected by the degree of uncertainty already highlighted when estimating demand.

4.3.2.1 – Characteristics of the naval carrier

Following the analysis and considerations made in the previous paragraphs, we consider the Ro-Pax ship "Nerea" (dual fuel Diesel + LNG), currently under construction, whose performance characteristics, provided by the Shipowner Caronte & Tourist as a stakeholder in the MIMOSA project, are as follows:

Figure 60: Ship "Nerea" Caronte & Tourist, rendered view

- Draft: 4,8 m
- Length: 109,95 m
- Width: 19,5 m
- Maximum transport capacity: 400 passengers, 114 cars or 23 trucks also allowing for mixed trim.

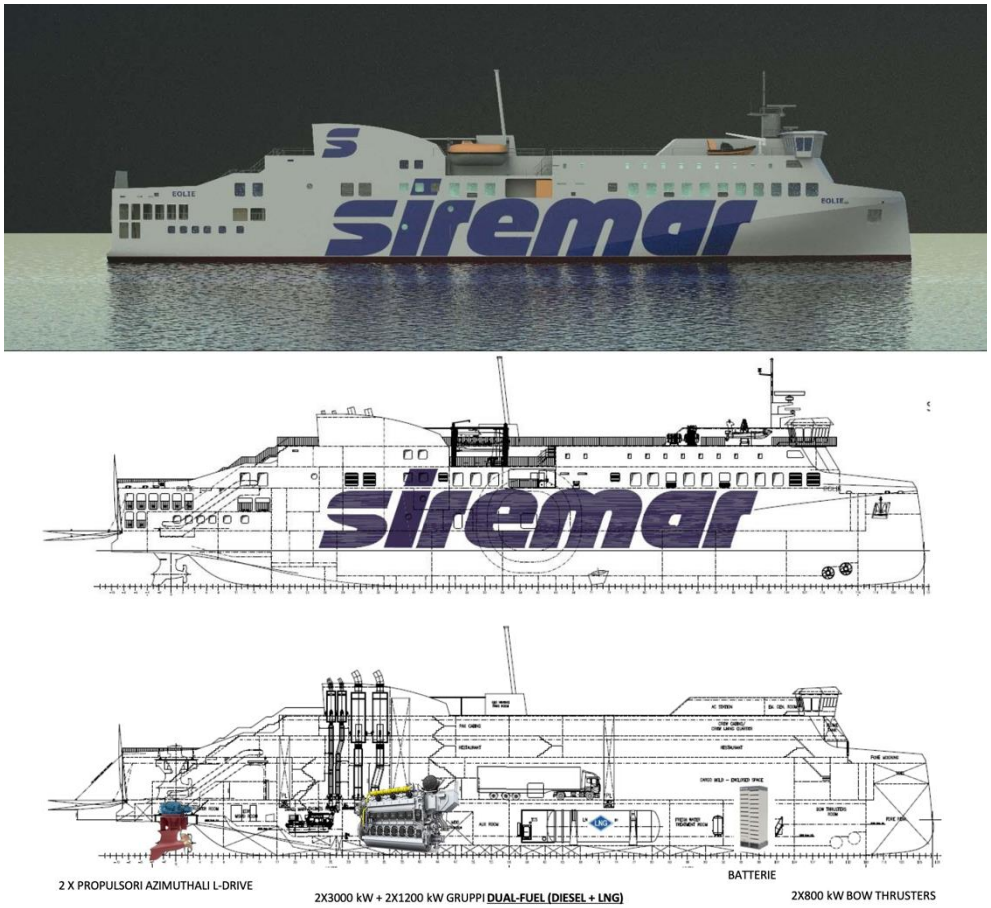


Figure 61: Nave "Nerea" Caronte & Tourist, technical drawings

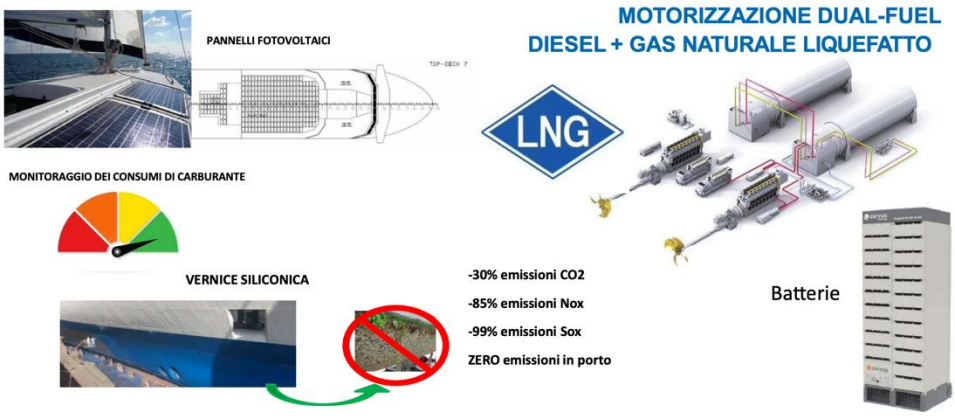


Figure 62: Nave "Nerea" Charonte & Tourist, energy aspects

The ship is designed to reduce environmental impacts: mixed Diesel-Liquified Natural Gas (LNG) engines have been adopted for this purpose. Hull paints are silicone type to reduce the use of biocides harmful to the marine environment and minimise hydrodynamic resistance. It is designed to install batteries on board to

enable the functionality of operations in port for about 4 hours without the use of combustion engines thereby zeroing emissions. In addition, it is designed to install a photovoltaic system on the deckhouse deck to cover part of the energy needs of onboard utilities.

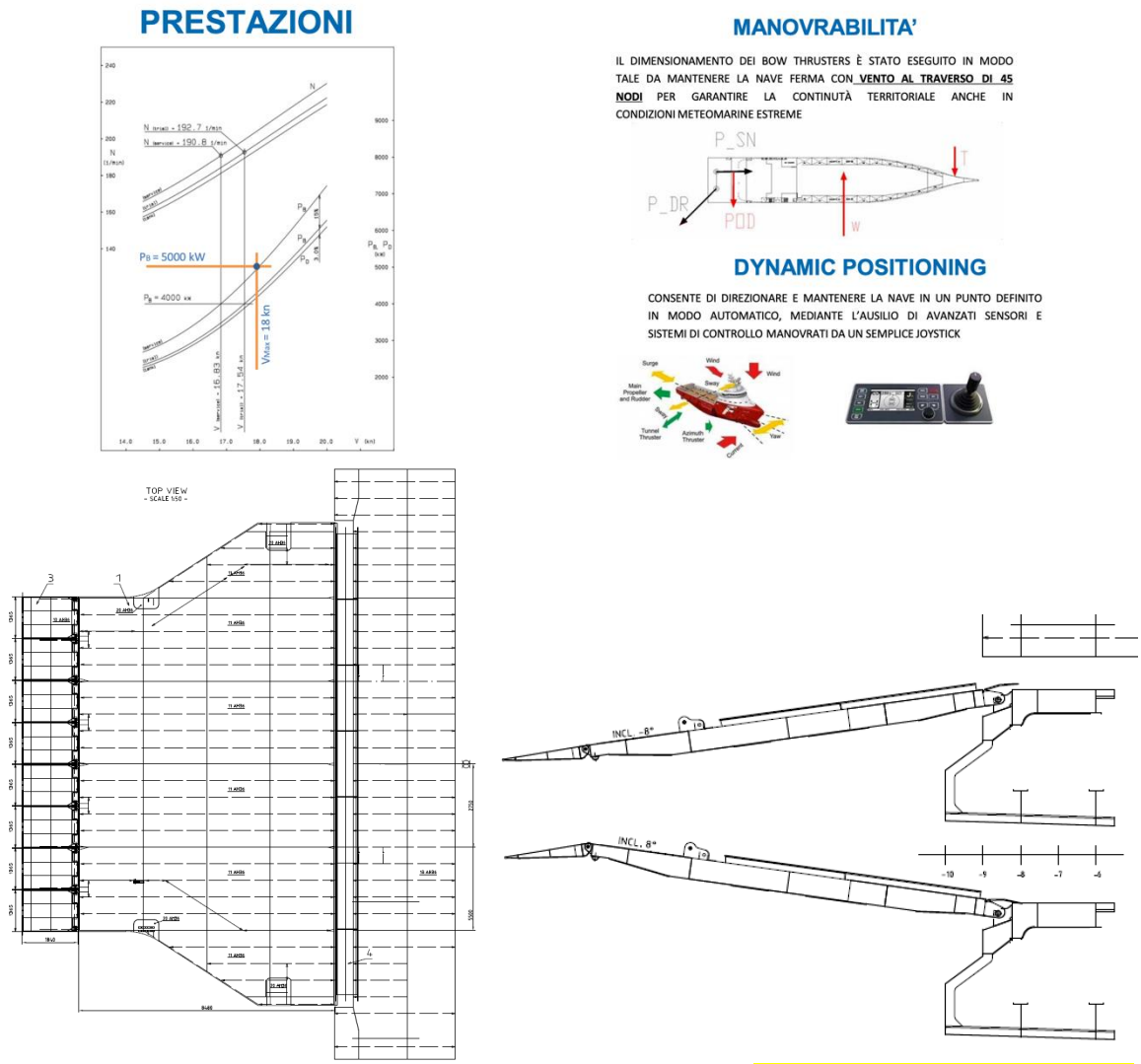


Figure 63: Nave "Nerea" Charonte & Tourist, performance, maneuverability, dimensional characteristics of the hatch

With an installed power of about 5000 kW, the ship is capable of reaching the maximum speed of 18 knots. The installed propulsion system (2x3000 kW + 2x1200 kW dual-fuel diesel + LNG groups) enables the implementation of dynamic positioning systems to manoeuvre accurately and safely even in critical weather conditions.

4.3.2.2 – Features of the link service

The service parameters of the sea link under consideration are determined below. The following table briefly illustrates the operational parameters considered.

	Distance [NM]	Average cruise speed [Nodes]	Trip duration [Hours]	Minimum time spent in port [Hours]	Total [Hours]
Single trip	126	16,5	7,6	4	**11,6**
Round trip	252	16,5	15,3	8	**23,3**

Table 15: Characteristics of the A/R connection

4.3.2.3 – Service sizing

First, the extended 12-month (January-December) annual connection service was considered. The table, below, shows monthly demand, frequency of connection, transport supply, average ship occupancy coefficient and distance travelled.

Month	Demand [passengers/month]	Link frequency [round trip / month]	Offer [passengers/month]	Vessel average occupancy coefficient	Journey [nautic miles/month]
January	211	1	400	53%	252
February	317	1	400	79%	252
March	381	1	400	95%	252
April	1.121	3	1.200	93%	757
May	740	2	800	93%	504
June	1.945	5	2.000	97%	1.260
July	3.066	8	3.200	96%	2.016
August	7.421	19	7.600	98%	4.789
September	1.480	4	1.600	93%	1.008
October	698	2	800	87%	504
November	529	2	800	66%	504
Dicember	592	2	800	74%	504
Total	**18.500**	**50**	**20.000**		**12.604**

Table 16: Annual service sizing

Table 16 shows that the total number of A/R trips in a year is 50 for a total travel distance of about 12,600 nautical miles. Figure 64 shows the monthly trends in supply and demand.

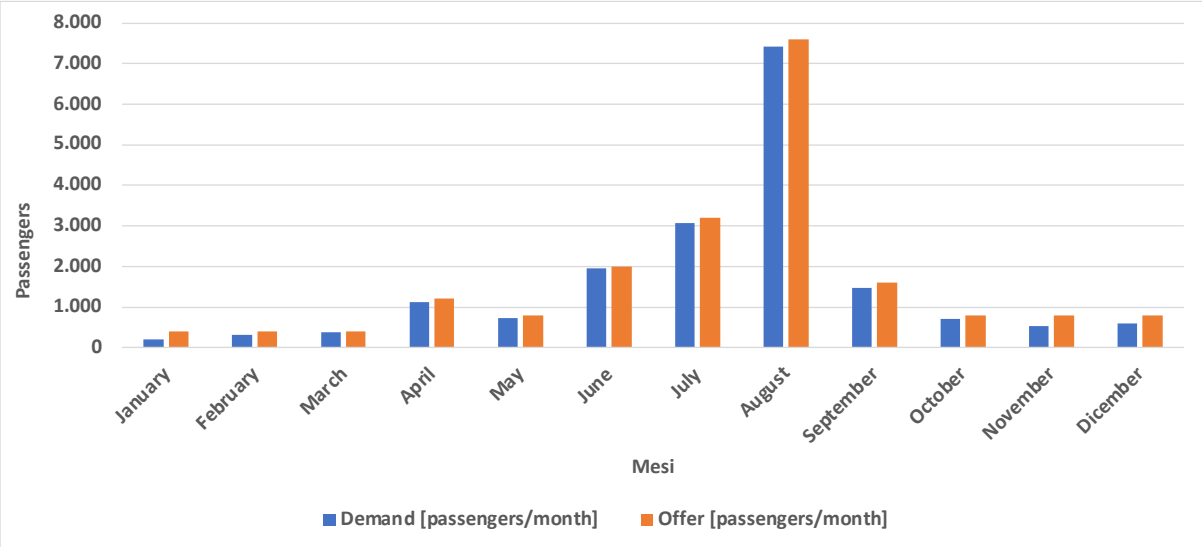


Figure 64: Annual service

In addition, this service configuration allows the potential A/R transport of about 5,700 cars or 1,150 trucks.

Second, similarly to the above, the six-monthly service was sized for the summer period (April - September).

Month	Demand [passengers/month]	Link frequency [round trip / month]	Offer [passengers/month]	Vessel average occupancy coefficient	Journey [nautic miles/month]
April	1.121	3	1.200	93%	757
May	740	2	800	93%	504
June	1.945	5	2.000	97%	1.260
July	3.066	8	3.200	96%	2.016
August	7.421	19	7.600	98%	4.789
September	1.480	4	1.600	93%	1.008
TOTAL	**15.773**	**41**	**16.400**		**10.335**

Table 17: Semiannual service sizing

The table shows that the total number of A/R trips in the six months is 41 for a total mileage of about 10,300 nautical miles (corresponding to about 80% of those of the annual service, respectively).

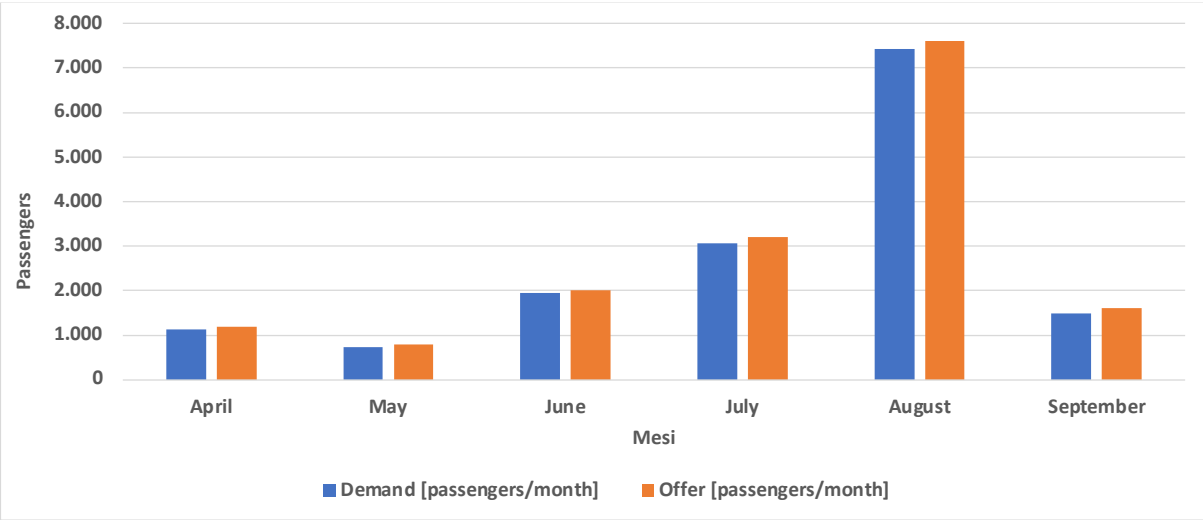


Figure 65: Semiannual service sizing

In addition, this service configuration (semi-annual) allows for the potential A/R transport of 4,674 cars or 943 trucks.

For the Pescara - Split connection, the table below shows the comparison of distances and connection times by sea and land (road with car and rail). It demonstrates that the ship mode results in savings of about 37% and 63% respectively in comparison with road and rail transport.

	Sea		Land			
			Highway		Railway	
Link	Distance [km]	Time [h]	Distance [km]	Time [h]	Distance [km]	Time [h]
Pescara - Split	233	7,6	1137	12	1143	21

Table 18: Comparison between distances and connection times by sea and land transportation

4.3.2.3 – Estimated service costs

The cost of service was estimated based on data provided by the shipowner Caronte & Tourist, according to the two operating scenarios, identified in the previous paragraph, such as:

- Annual service (January - December)
- Semi-annual service (April - September)

The second scenario (half-yearly service) can be considered only in the hypothesis of using the shipping carrier on other connections in the remaining six months. In other words, this hypothesis implies on the one hand, the half-yearly (spring-summer period) use of the ship on the Pescara - Split link, and on the other hand, the use of the same ship carrier on another link in the remaining period of the year.

Service costs were calculated assuming the chartering of the vessel carrier and considering the following two macro-categories:

- **Fixed costs:** crew, insurance, routine maintenance, and rental including depreciation, extraordinary maintenance, ancillary charges (support of the technical office, administrative office, safety office, overhead such as livery and logo preparation, legal fees, certification body costs, brokerage costs, financial charges and business profit)
- **Variable costs:** fuel and port ancillary charges (berthing/unberthing operations, miscellaneous operating costs, terminal movements, and pilotage)

The calculations were made assuming a purchase cost of the ship of 40 million Euros and a depreciation period of 20 years.

Regarding fixed costs, the reference values used were provided by the owner. The crew cost was calculated according to the following table (considering an average surcharge of 10% to cover any variations).

Title	Quantity	Days	Total monthly cost
Commander	1	30	7.352,58 €
First officer	1	30	6.305,86 €
Second officer	1	30	4.585,11 €
Boatswain	1	30	4.061,38 €
Sailor	4	30	14.457,03 €
Hub	1	30	2.861,58 €
Dir. M.	1	30	6.539,38 €
First officer	1	30	5.963,12 €
Second officer	1	30	4.297,61 €
Electrician	1	30	3.677,63 €
Op. Deck	1	30	3.677,63 €
Op. Mot.	2	30	7.706,19 €
Youngling	2	30	5.793,38 €
Cook	1	30	3.677,63 €
Waiter	1	30	3.201,80 €
Room boy	2	30	5.716,98 €
Steward's assistant	1	30	2.646,13 €
Apprentice	1	30	2.858,49 €
	24	**540**	**95.379,50 €**

Table 19: Crew cost. Source: Caronte & Tourist

The rental cost includes the items shown in the table below.

Rental costs	[€/year]
Depreciation	2.000.000
Extraordinary maintenance	150.000
Ancillary charges	470.500
Total rental costs (A)	2.620.500
Business profit (20 % total rental costs) (B)	524.100
Total (A+B)	**3.144.600**

Table 20: Rental costs

Variable costs were calculated according to the performance characteristics of the vessel (provided by the shipowner) and the type of operational service assumed about the two scenarios (annual and semi-annual). Specifically, the assumptions adopted concern an LNG fuel cost of €1.75/kg and an ancillary cost of €3,000 per port (€6,000 total A/R).

It is worth noting that a LNG cost, referring to the last months of 2022, was adopted in the calculations, which is very high against the ship's useful life set at 20 years. Therefore, the variable costs obtained in the

calculation are considerably affected by the adopted LNG cost. In this case, the fuel cost item accounts for about 21% and 30% of the total costs for the annual and half-year scenarios, respectively.

Assessing the gas price scenarios over a longer time horizon and considering the forthcoming development of Italian small-scale logistics, on SNAM's indications it is believed that fuel costs may fall to 0.8-0.9 €/Kg for a Truck-to-Ship bunkering service in Abruzzo. In that case, without prejudice to the other cost items, that related to fuel would represent about 11% and 17% of total costs for the annual and six-month scenarios, respectively.

The fuel cost calculation could be quite similar if the use of Bio-LNG were considered.

Table 21, for the two scenarios considered, shows the estimated cost of service broken down into the two macro-categories (fixed and variable); the table also shows the average cost of an A/R trip and the average cost of a ticket per passenger (also including car and/or truck transport) calculated under the assumption of a balanced budget.

		Annual service cost [€/year]	Semiannual service cost [€/semester]
Fixed costs	Crew	1.144.554	572.277
	Insurance	183.700	91.850
	Routine maintenance	770.000	385.000
	Rental	2.620.500	1.310.250
	Total (A)	**4.718.754**	**2.359.377**
Variable Costs	Fuel moving ship	1.376.903	1.129.060
	Fuel ship in port	0	0
	Ancillary costs to ports	300.000	246.000
	Total (B)	**1.676.903**	**1.375.060**
TOTAL (A+B)		**6.395.657**	**3.734.437**
	Roun trip cost [€/roundtrip]	**127.913**	**91.084**
	Average ticket cost round trip [€ ticket]	**346**	**237**

Table 21: Estimated service costs for the two operating scenarios

The results show that the six-month operating scenario implies service costs of about €3.7 million (corresponding to 58% of those of the annual service). It also shows that the average cost of a round-trip ticket per passenger is €237 (corresponding to 68% of that of the annual service). This cost also includes the transportation of cars and/or trucks.

4.3.3 – Modes of LNG refuelling

The methods of refuelling the LNG ship, which is deemed most technically suitable and economically viable, are described below, on the recommendation of SNAM S.p.a. as a stakeholder in the MIMOSA project.

The replenishment (and eventual storage) methods identified are as follows:

- Truck-to-ship bunkering: this is done using cryogenic tankers (usually with one tank of about 40 m^3 per tanker) that refuel the vessel pulled up on the dock. The procedure can take place in a sequence or parallel (multi-truck-to-ship) using a skid in the latter case.

Figure 66: Bunkering in truck-to-ship mode (Source: Snam s.p.a.)

- Bunkering through port-to-shore refuelling point (Port-to-Ship): these are small facilities, not connected to the gas grid, for the delivery of LNG for the shipping market, with small storage tanks (about 80-400 cu m), which are supplied by cryogenic tankers. The LNG/Bio-GNL is transported by a cryogenic tanker truck and discharged at about -160°C into the tank at the refuelling point, where it can be stored for a long period. The tank is connected to a submersible pump coupled to the dispenser for refuelling naval units.

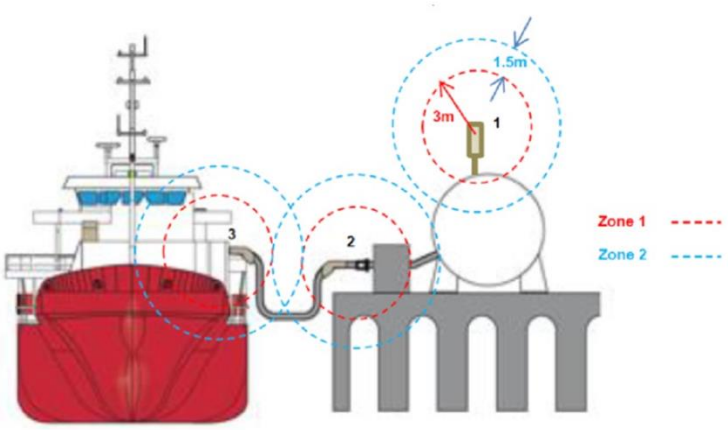


Figure 67: Bunkering via port refuelling point (Source: Snam s.p.a.)

4.3.4.1 – Economic Convenience

From an economic point of view, the "Port-to-ship" solution appears to be more expensive given the investment required for the refuelling point and the related operational costs. However, assuming to obtain

the funding provided by the Supplementary Fund to the NRP for these infrastructures (Interm. D.Interm. 388/2021), for a shipowner the difference in LNG/BioNG price between the two solutions is partially reduced. In addition, if the refuelling point served multiple vessels and also road vehicles (Heavy Duty Trucks or TPLs), the increased volumes of LNG/BioGNL handled would reduce the unit cost.

4.3.4.2 – Time-frequency of replenishment

Considering the estimated LNG consumption for a run equal to what is defined in the relevant paragraph, it can be considered to refuel the ferry at the end of each run at the port of Pescara, via Truck-to-Ship bunkering service (tanker approx. 40 mc). Considering a bunkering pump with a flow rate of 50 mc/h, the unloading time of a single tanker truck is less than an hour, far less than the time the ferry is stationed in port. Alternatively, it is possible to refuel less frequently by making use of Multi-Truck-to-Ship bunkering or in Port-to-Ship mode if a port refuelling point were to be built. Even in this scenario, the total time for unloading tankers is less than the ferry docking time in port. In any case, the frequency should be defined based on operational practicality and any constraints faced by the shipowner.

4.3.4.3 – Current and trend cost of LNG

Estimates made by SNAM S.p.a. to date show that there is no difference in price at the pump between LNG and BioGNL for road transportation. The LNG/BioGNL supply price at the port of Pescara varies depending on the infrastructure of origin. Considering serving at the SNAM micro-liquefaction plant under construction in Pignataro Maggiore (CE), which turns out to be to date the only authorised LNG infrastructure in southern Italy, the table below shows the LNG/BioGNL supply price under different scenarios. It is worth noting that this estimate was made before the well-known war events taking place in the European continent.

Mode	Hypothesis	Volumi	€/MWh	€/mc
Truck-to-Ship	Tanker truck loaded at Snam microliquefactor in Pignataro Maggiore (CE) - assumption also valid for later scenarios	ca. 6 kTPA	ca. 38,5[2]	ca. 265
Port-to-Ship	Dedicated refueling point for the Mimosa project's naval only	ca. 6 kTPA	ca. 41,5[2,3,4]	ca. 287
	Fueling point dedicated only to Mimosa project vessel; considered 30% capex funding, as provided by D.Interm. 388/2021	ca. 6 kTPA	ca. 40,9[2,3,4]	ca. 283
	Refueling point also open to road vehicles (hp. 1.5 kTPA LNG/BioGNL for HDT and/or TPL);	ca. 7,5 kTPA	ca. 40,4[2,3,4]	ca. 280

	considered 30% capex funding, as provided by D.Interm. 388/2021			

Table 22: Estimated LNG supply price

The following are gas price forecasts (TTF) from SNAM S.p.a. analysis.

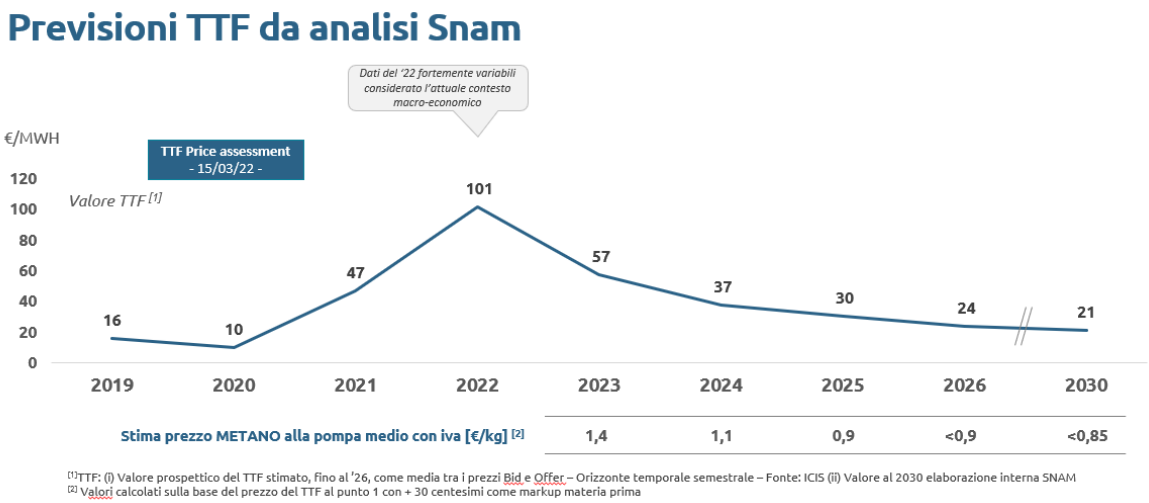


Figure 68: Gas price forecasts (TTF) prior to the current European post-pandemic and war situation. Source: Snam s.p.a.

The data shown in Figure 68 predate the current European post-pandemic and war situation. Therefore, it is expected that current gas costs, although higher than those shown in the figure, can be expected to decrease significantly, together with the lower volatility of gas costs in the near future.

4.3.4 – Estimation of emissions

For the estimation of emissions, this study on the one hand analyses the use of LNG for maritime transportation, and on the other hand identifies Bio-GNL as a suitable fuel to capture emission reduction targets also based on what is reported in Section 4.1. A comparison is therefore made as follows.:

- Maritime transport: LNG ship, MDO ship
- Equivalent passenger land transport: passenger car

For sea transport, the same ship "Nerea" is considered with two alternative fuel options: one on LNG and the other on MDO. The following were used for the calculation:

- Unit consumption provided by Caronte & Tourist stakeholder: 63.2 kg/NM for MDO vessel; 62.4 kg/NM for LNG vessel;
- Cruising speed of the ship: 16.5 knots;

- Connection time (A/R ride): 15 hours;
- Total stationary time in the two ports (A/R run): 8 hours.

The table below shows the comparison of consumption and emissions referring to the use of the same ship ("Nerea") powered by LNG or MDO in the two operating scenarios (annual and semi-annual) described in the previous paragraph.

		Unit	LNG Ship	MDO Ship	LNG vs MDO savings
Maritime link service	Round trip distance	[nautic miles / round trip]	252	252	
Consumptions	In movement	[ton / round trip]	16	16	
	In port	[ton / round trip]	0	3	
	Total	[ton / round trip]	16	18	
	Total semiannual scenario	[ton / semester]	645	756	
	Total annual scenario	[ton / year]	786	921	
Emissions	Total	[ton CO2 / roundtrip]	45	60	**15**
	Total semiannual scenario	[ton CO2 / semester]	1.836	2.448	**612**
	Total annual scenario	[ton CO2 / year]	2.239	2.986	**746**

Table 23: Estimated consumption and emissions LNG ship and MDO ship

The estimation results show that, under the same operating conditions, the use of the LNG vessel, compared with the MDO vessel, results in the following direct emission savings on the route under consideration:

- annual operating scenario: about 746 tons of CO_2;
- semi-annual operating scenario: about 612 tons of CO_2.

Table 24 contains a comparison of direct emissions due to the use of a "Nerea"-type ship powered by LNG or MDO and those due to the use of passenger cars, under the assumption of meeting the same estimated passenger demand under the two operating scenarios (six-month and annual). In the case of passenger cars, the following assumptions are adopted: i) average filling coefficient: 2.3, ii) average direct emissions of 145 gCO2 / km.

Type of transportation		Maritime		Road
		MDO SHIP	LNG SHIP	Car
Round trip	Distance [km]	467	467	2274
	Linking time [hours]	15	15	24
	Equivalent ship load	1	1	174
	Equivalent distance ship [km]	467	467	395478
Emissions	Specific emission [g CO2/km]			145
	Emissions [ton CO2]	60	45	57
	Annual scenario [tonn Co2/year]	2985	2240	2867
	Semiannual scenario [tonn Co2/year]	2448	1837	2351
Savings compared to LNG ship	Annual scenario [tonn Co2/year]	745	0	627
	Semiannual scenario [tonn Co2/year]	611	0	514

Table 24: Emissions LNG ship and MDO ship

The results of the comparison show that the LNG ship connection, compared with the road connection (cars), results in the following emission savings:

- Annual operating scenario: about 627 tons of CO_2;
- Semi-annual operating scenario: about 514 tons of CO_2.

4.4 – Intermodal territorial connection service

The intermodal connection between naval and land transport is of absolute importance with a view to interconnecting the port infrastructure with the surrounding area, both locally (urban) and territorially.

Regarding local transport connections (last mile), noting the centrality of the port of Pescara with respect to the relevant urban layout, it is desired that passenger transport be carried out by the existing urban LPT service using possibly electric or environmentally friendly buses. In support of the urban LPT service, an additional short-distance service dedicated to the purpose can be envisaged. All in accordance with the implementation and goals of an intermodal system that is not only effective but also environmentally sustainable. With a view to the multimodal implementation of the service, the infrastructure nodes to relate to the port are the Pescara Centrale railway station, the bus station located near the railway station, and the Abruzzo International Airport.

Regarding, on the other hand, the service connecting the port of Pescara with its territorial catchment area, the following is a summary of a prefeasibility study, carried out in collaboration with Polo INOLTRA as

a stakeholder in the MIMOSA project. This service is based on the use of an LNG-fuelled bus that can be refuelled using the same system provided for maritime transport.

In the study, the use of a 50-seat Granturismo (GT) coach was taken as a reference, considering a five-year amortisation schedule, within a dual service configuration distinguished by route types:

- Short haul: this type of service provides a connection between the port of Pescara and the Pescara Central Bus station and railway station (and vice versa).
- Long haul: this service assumes commercial interregional connections from the port of Pescara to major destinations in central and southern Italy. Specifically, in reference to 3.2.3.3 and 4.3.2.1, the destinations of the long-distance service are Rome, Naples, Florence, and Foggia.

Please refer to Annex 2 to this study for further details of the working hypotheses and results.

4.5 - Conclusions

In this chapter, the optimal characteristics of a new maritime passenger transport link between the ports of Pescara and Split using an LNG-fueled Ro-Pax ship were studied.

In the first instance, a number of LNG-powered ships operating in the Mediterranean or under construction were identified. Their main functional and dimensional characteristics were analysed. These were then compared with the performance characteristics of the Abruzzi and Croatian ports under study and their operational compatibility was verified.

Next, the demand analysis of tourist flows regarding the new sea link between the ports of Pescara and Split was carried out. The results show a potential demand of about 18,500 and 22,600 passengers/year in 2022 and 2030, respectively. It should be noted that the results of the demand analysis suffer from obvious margins of uncertainty related to the estimates and assumptions made because the data found are uneven and discontinuous over time. Consequently, the service sizing and potential cost analysis are also affected by this uncertainty.

Therefore, the transport offer was designed by identifying the ship "Nerea", Caronte & Tourist group, for its advanced technical-performance characteristics, based on two operational scenarios: one annual (January - December), the other half-yearly (April - September).

The scenario concerning the half-yearly service can only be considered under the assumption of using the vessel on other routes in the remaining six months. In other words, this hypothesis implies on the one hand, the semi-annual (spring - summer period) use of the ship on the Pescara - Split link, and on the other hand, the use of the same ship carrier on another link in the remaining period of the year.

For the two operational scenarios considered, the following were estimated: transport demand and supply, operating frequencies and related service costs. The results show that the six-month operating scenario implies service costs of about 3.7 million euros (corresponding to 58 percent of those of the annual service). It also shows that the average cost of a round-trip ticket per passenger is € 237 (corresponding to 68% of that of the annual service). This cost also includes car and/or truck transportation.

It is worth noting that an LNG cost, referring to the last months of 2022, was adopted in the calculations, which is very high in contrast to the ship's useful life set at 20 years. Therefore, the variable costs obtained

in the calculation are considerably affected by the adopted LNG cost. In this case, the fuel cost item accounts for about 21% and 30% of the total costs for the annual and half-year scenarios, respectively.

Assessing the gas price scenarios over a longer time horizon and considering the forthcoming development of Italian small-scale logistics, on SNAM's indications it is believed that fuel costs may fall to 0.8-0.9 €/Kg for a Truck-to-Ship bunkering service in Abruzzo. In that case, without prejudice to the other cost items, that related to fuel would represent about 11% and 17% of total costs for the annual and six-month scenarios, respectively.

The fuel cost calculation could be quite similar if the use of Bio-LNG were considered.

The possible ways of refuelling the ship with LNG and the emission savings compared to using the same MDO-fueled ship were also analysed for the two operational scenarios:

- annual: around 750 tons of CO_2;
- semi-annual: around 610 tons of CO_2.

Under the assumption of serving the estimated passenger demand between the two ports through the exclusive use of passenger cars, the corresponding emissions were also estimated. For the two operating scenarios, the results show that the use of the LNG ship compared to the use of passenger cars results in emission reductions of:

- annual: around 627 tons of CO_2;
- semi-annual: around 514 tons of CO_2.

Where Bio-GNL is used, by evaluating emissions over the entire lifecycle of the Well to Tank (WtT) fuel, total Well to Wake (WtW) emissions can be greatly reduced to potentially zero depending on the type, origin, and blend of biomass.

In addition, considerations and analyses were developed regarding the intermodal connection between the port of Pescara and the local (last mile) and territorial catchment area.

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Annex 1: History of the maritime link between Pescara and Split

Dr. Bruno Santori

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Introduction

A provincial town in Italy in the mid-1960s. The socio-economic ferment of that historical phase in our country has been the subject of numerous studies and various re-readings. One point that all these analyses have in common is undoubtedly the fact that the country was experiencing the peak of the so-called economic boom after emerging, not long after, from a devastating conflict, but at the same time the first critical signs were beginning to emerge with respect to a social and cultural model that centred, the dictates of the Catholic Church and the political hegemony of the Democratic Christian party on the traditional family. A provincial town in a region that was still very much in the balance: in its inland areas, between the south still burdened by great backwardness, affected by internal emigration and emigration towards foreign countries, and a more lively coastal area, in full construction and commercial expansion and beginning to look beyond the narrow regional borders. The fact of overlooking the Adriatic Sea had always been a key to internal use, mainly in the function of fishing and the nascent mass bathing industry. The port of Pescara, part of a regional port system made up of small but extremely active structures serving the economy of the respective provinces, was suddenly transformed into an open gate to another world, another political, social and cultural dimension as distant as Rome in spatial terms but perceived as even more distant because history had decided so. The pick that opens this gate is a small ship, only 50 metres long, built just before the World War II and passing through various ownerships and various coats of paint. Thanks to far-sighted local economic forces, to a favourable propensity for openness and discovery on the part of certain sectors and expressions of the city and, and last but not least, thanks to the particular political role played by Yugoslavia in the relations between the Eastern and Western blocs, this modern *Nina* became the instrument through which for years thousands of people in disguise of seaside tourists would explore territories, societies and cultures wrongly considered distant because they were difficult to be physically reached. And this only to have to change their minds and lay the foundations for a series of social, economic and cultural relations whose stability was not called into question even by the lacerating events of the war in the 1990s.

The scope of this initiative, reviewed in the light of Croatia's forthcoming accession to the European Union, cannot but be considered innovative, courageous and far-sighted, given that it was launched in 1966, when the spread of economic prosperity in the more developed coastal areas of the region was in some ways offset by the growing desertification of the inland areas; tourism was not yet the mass phenomenon of our times to all intents and purposes but was mostly the prerogative of the well-off middle classes.

A maritime link can be considered a transport infrastructure in itself. An element that has strongly characterised social changes over the last two centuries has been the evolution of transport, thanks to which the lifestyles of populations from different areas have become uniform, city horizons have widened, knowledge of languages, information and technologies have been made possible, making contact between more or less evolved countries possible. This was also true for the small provincial town which, in the mid-1960s, suddenly discovered that in addition to being able to move things and people northwards, southwards and westwards, there was also an open gate to the east.

The purpose of this work is to provide a picture of the economic and social context in which this initiative took off, both on one side and on the other, and to demonstrate that the actions that led to the establishment of such a link, in light of the situation described above, implied the characteristics of farsightedness and pioneering anticipation of social, economic and political phenomena that have been unfolding today. All these elements, in fact, were not fully understood at the time, and unfortunately their full value was only appreciated when the connection between the two shores was interrupted by external factors, such as the outbreak of the conflict between Croatia and Serbia in 1991 or the shut-down of the port of Pescara in 2011.

The term "Iron Curtain", made famous by Winston Churchill in his speech in 1946, actually referred to the borderline between the two blocs, and this line also crossed longitudinally the Adriatic Sea. However, the gradual disengagement of Tito's Yugoslavia from the Soviet bloc (non-alignment) had made the southern segment of the curtain much more permeable to influences and relations with non-neighbouring or neighbouring countries; the coasts of Dalmatia, already a favourite destination for Slovenes, officials of the Serbian nomenclature, Germans and Austrians, were now open to Italian visitors who, returning to their homeland and disembarking from the ferry, left behind an unmistakable trail of lavender perfume. Rather than a militarily garrisoned curtain, one had the impression that they had crossed an immense field of plants of that perfumed essence typical of the Dalmatian coast.

Chapter 1: Italy in the 1960s

The geo-demographic variations occurred in our country between the 1950s and the 1960s reveal a picture of strongly polarised territorial development, that is, dominated by a few main attractors, the large industrial cities of the North of Italy, the large metropolitan areas and the fields of force that they generated within the regional territory of reference and along the main axes of communication, initially and predominantly railways and then increasingly characterised by private road mobility. The depopulation of inland and rural areas is indicative of a gradual abandonment of agriculture as an economic sector that is an indicator of economic and social marginality, in favour of areas with a high concentration of services, employment opportunities in industry and construction, real estate income and infrastructure.

Physical communications and telecommunications are in rapid expansion. Before 1960 the only motorway connections of certain importance date back to the pre-war period and connect Milan with Turin and Pisa with Florence. In 1975 all the great cities of the North are connected; the Motorway of the Sun, a work symbol of the years of the economic boom, uninterruptedly winds from Milan to Reggio Calabria, the first crossing of the Apennines between Naples and Bari was now complete and would soon follow the welding of the two motorway stretches that unite to the West Rome with Aquila and Avezzano and to the East Pescara with Scafa. The railway network, although considerably extended, is not modernised in the same way, highlighting - at that time like at present - serious limitations mainly in the transport of goods and in the peri-urban connections used by commuters.

In the absence of a specific transport policy in the maritime field, Italian ports were lagging behind in terms of technology and infrastructure. Starting in 1965 the Italian merchant fleet went through a phase of expansion which lasted until the end of the following decade. The large passenger ships began to host tourists discovering what lay beyond the national borders. Especially in the Adriatic, the cruising phenomenon began to take on the outlines that most characterise that market today.

In such a framework important socio-cultural phenomena began to assert themselves in the country. Private initiative, facilitated by a favourable economic context, was increasingly asserting itself as a model of development and at the same time, as an instrument of social mobility, especially in urban centres. At the same time, a reorganisation of the family model was taking place, with a contextual redefinition of the role of women, who were becoming more open and willing to work. From the point of view of the affirmation of

mass culture, the overbearing expansion of the television medium contributes to endowing Italy with a common lexicon, plays a supplanting role with respect to the public education system, still too absent in the rural areas and in the South, and favours the consolidation of social and cultural models that allow the affirmation of schemes of social emancipation linked to mass consumption - to "having" more than to "being".

Another main actor of this historical phase, perhaps for the first time in the country's history, was the world of youth, "who in those years began to define themselves as a world of its own, distinguishing themselves from previous generations and contributing to the blurring of traditional class distinctions. They also assert themselves by officiating a joyful funeral mass to an archaic Italy and by immersing themselves in the new opportunities offered by the consumer society ".

On the political front, the country experimented with the experience of the so-called "centre-left wing", that is the opening of a governmental dialogue with the historical forces of the Italian left-wing, with the exception of the PCI (Italian Communist Party). The first significant step in that direction had already been taken in 1960, with the abstention of the PSI (Italian Socialist Party) on the vote of confidence in the single-party Democratic Christian government headed by Amintore Fanfani. Subsequently, thanks to the skilful direction of Aldo Moro, the established alliance was officially sanctioned at the DC congress held in January 1962 and that paved the way for a new Fanfani government, made up of DC, PRI (Italian Radical Party) and PSDI (Italian Social Democratic party), but above all with the external support of the PSI on the basis of an agreed programme. After an initial phase characterised by the first attempts at reforms in the social and economic spheres, the DC suspended the related implementation at the regional level, fearing the strengthening the left-wing party at the level of local power. The elections of 1963, however, rewarded the Liberals, who had opposed such openings, and the Communists. This determined a further slowdown in the reformist thrust, even though in the meantime the organic entry of the Socialists into the Moro government had taken shape. In spite of alternate phases, characterised by splits, mergers, fluctuating electoral results, the experience of the centre-left wing was destined to last until 1968, contributing to perpetuating the political isolation with respect to the PCI.

The repercussions of these arrangements in foreign policy are easily guessed, or rather, are perhaps the consequence. Italy is a country still strongly anchored to the alignments determined at the outcome of the World War II. The alignment to the western axis, hegemonized by the USA, and the condition of borderland

with the bloc of socialist and communist countries makes our country a "special observed" by the United States, subjecting itself to a sphere of influence from which it would succeed in freeing itself, at least partially, only two decades later. The period from the end of the 1950s to the beginning of the 1970s was the scene of numerous events that only rarely saw our country involved in the world scene. Suffice it to think of the US-USSR crisis of 1962, the wars in South-East Asia, the attempts to free some Eastern European states from the Soviet yoke, the myriad of conflicts in Africa, and the difficult exit from colonialism, just to mention a few examples. In these years, Italy's role is therefore limited to a series of bilateral activities, precisely on the basis of its strategic position, as a borderland, not only with the Eastern bloc but also as a country that overlooks the Mediterranean and that with the passing of the years becomes a more and more strategic axis not only in the political field but also in terms of shifting the balance of the world economy after the opening of the Suez Canal. Italy's low profile in foreign policy cannot be explained only by the limited means at its disposal. It is the consequence of the difficult coordination between the three - Atlantic, European and Mediterranean - "circles" in which, for historical and political reasons, the country's foreign policy had been carried out. This set-up left Italy with very narrow margins of action, perhaps finding a full dimension only in the growing Europeanist drive which, from being an aggregating element of a purely economic matrix, began to take on a more political dimension with increasing effectiveness in recent years.

These were the last years when relative political stability prevented most Italians from distracting themselves from their daily attempt at self-affirmation through what had been called the 3 M generations (job, wife, car) and, more generally, from the impulse to make the most out of the sudden widespread affluence. The children of this generation will be the main actors of the change destined to take place shortly thereafter. 1968 and the beginning of the outbreak of terrorism were to be the rude awakening for a country that had grown in a tumultuous and disorderly manner, in which the instruments of government of public affairs and the ethical and social antibodies had not grown concomitantly.

1.1 - Abruzzo and Pescara

Abruzzo had experienced the definitive explosion of the migratory phenomenon in the period 1958-60. Many people continued to choose the Americas as a temporary or definitive destination for their new life project, but migrations towards some European countries began to prevail. These new migratory flows differed from the transoceanic ones for their purely temporary character and for the fact that they were

carried out by the youngest and most enterprising members of the family, destined sooner or later to return to their homeland. Equally important was internal emigration, in which the main poles of attraction were the industrial triangle, Milan and above all Rome, often to carry out the most humble and tiring tasks. Therefore, not only was there a marked demographic decrease, but also a far from comforting picture from an economic point of view, so much so that Guglielmo Tagliacarne described the region as a "poor region".

Lagging behind like the rest of the country, it was only in the early 1960s that Abruzzo "managed to get into high gear, distancing itself from the rest of the Mezzogiorno in the effort to catch up with the country's atavistic delays in overall development". For the first time, in fact, the income produced by the industrial sector exceeded that produced by agriculture. Abruzzo, in short, was only just beginning to take full part in the growth process that was affecting the country as a whole in those years. It was the industrial sector that drove this trend, together with the growth of tourism. Not only was Abruzzo beginning to distance itself from the South, but also the distances with the Centre and the North of Italy were gradually decreasing.

From a political point of view, the DC, or rather the different souls of the DC in Abruzzo were shaken by internal disagreements, while on the opposite front the hegemony was held by the PCI and the trade union CGIL (Italian General Confederation of Labour). However, it was the Christian Democrats who occupied the vital ganglia of the region, so much so that the historian Raffaele Colapietra used the terms "system", "machine" or even "party tout-court ". In the shadow of the great white whale, the figures of Lorenzo Natali and Remo Gaspari stood out, the latter in particular "established a corporate providentialism with no cultural connotations, ...whose formidable parable, according to some, would have led Abruzzo out of the Mezzogiorno... ". Between 1962 and the end of the decade, the region was in fact the scene of considerable public investment in the motorway sector, the high point of which was the Gran Sasso tunnel, which enabled Teramo to realise its dream of a direct link with Rome. And then hospitals, roads, dams, tollbooths, in a context in which the construction of local consensus, the government of public affairs and party interests came to merge into a single decision-making seat. It is quite evident that the infrastructural policy was an essential element in the formation of territorial hierarchies; a harsh clash which lasted through the post-war period and which not infrequently resulted in riots and violence between one municipality and another, between one province and another, for a railway station, for a port, for a barracks, for a school. In these years, when the dynamics of growth were soaring, a decisive role was played by state funding, and in this context the particularistic drives took on even more strength.

The chronicles of the time give us the impression that in Abruzzo wars were fought repeatedly: wars for highways, wars for universities, wars for the capital. The outcome of this widespread conflict, the legacy of old territorial contrasts, meant that everyone got everything. L'Aquila had its university, Pescara, Chieti and Teramo had theirs (Teramo was to break away in the 90s). L'Aquila remained the capital city but had to share offices, council offices and even a quota of Regional Council meetings with Pescara. In retrospect, one wonders whether these choices were positive in terms of territorial rebalancing or whether, on the contrary, not having opted to invest in a city-region that would act as a reference pole (Pescara) was, in the long run, a negative fact.

In the post-war period, a tumultuous and sometimes unregulated growth makes Pescara the first city of Abruzzo in a few years. The local chronicles emphatically report the symbolic event of the birth of the one hundred thousandth resident citizen, on 11 November 1964, even though about twenty years earlier the retreat of the Germans and the allied bombardments had left only destruction and rubble (72% of the city's real estate was destroyed, the bridges that connected the two banks of the city river were mined, as were the port and the airport). In these years the city, a real melting pot in Italian sauce, matured cultural and entrepreneurial impulses that led the administrators of the time to support the need to go beyond the narrow local boundaries and broaden their horizons. In this period the city definitely exalted its commercial vocation: the streets of the centre and the main city avenues were transformed into large open-air commercial galleries; the most elegant shops, especially those of clothing and footwear, acted as an irresistible attraction for buyers arriving from the rest of Abruzzo and neighbouring regions; the flow of money set in motion by civil servants, in constant increase thanks to the new offices of local and state bodies, and by those employed in the building sector, literally exploded at the turn of the 50's and 70's of the 1900's, had triggered a real virtuous circle that allowed the city's commerce to become the most representative economic sector within the provincial economy.

1.2 - Origin of the link

In the mid-1960s Pescara began to record a significant increase in the number of tourists, thanks to a flourishing bathing industry and a rapid increase in the number of hotels in the city and neighbouring towns (Montesilvano and Francavilla al Mare). The port was rebuilt after the war with the main purpose of serving as a supply channel for the chemical and industrial hub of the Pescara Valley, and it took on a primary role in

regional traffic, despite the precariousness of a structure located at the mouth of a river and plagued by major structural limitations. The emerging rivalry with the port of Ortona, on which stood out the protective wing of Gaspari, led to see frustrated the ambitions of Pescara to equip itself with a port capable of making the leap in quality expected by operators and administrators, in a context in which the multifunctionality of the ports was seen as a mutual threat and not yet reasoned in a regional and systemic vision of functional specialisation of ports. In this context, the idea of opening the port of Pescara to passenger traffic testifies to the entrepreneurial and cultural liveliness present at the time.

The first to explore the frontier shores, obviously excluding incursions by fishing boats, were yachtsmen. Pleasure boating was a phenomenon that was constantly on the rise and in Pescara it was particularly inspired by a certain seafaring culture. Among them, the young journalist Romano Di Bernardo decided to sail from Pescara to Split in a small pleasure boat and, back in Italy, he documented this little venture in the manner of a novice explorer. Di Bernardo's initiative had a strong resonance in the city, so much so that it was the starting point for a series of political and cultural initiatives aimed at establishing a maritime link with the other shore. In reality there had also been other initiatives of an institutional nature in previous years.

In the scarcity of documentary sources testifying to their consistency, we can resort to the consultation of official documents and the press of the time. In fact, we read in the text of Resolution No. 221 of September 1966, that the President of the Chamber of Commerce of the time, Giustino De Cecco, represents "the opportunity to organise.....a trip of the Chamber's staff to Split". Why did the Chamber of Commerce consider it to be necessary to take its employees on a trip to Yugoslavia? In a rather explicit manner, the motivational part of the resolution clearly states that the trip is organised specifically to give "a tangible sign of support to the initiative of a maritime line that, as is well known, the Chamber of Commerce supported in the past years through direct contacts with the responsible Yugoslavian bodies, through the action of special economic commissions of both countries that signed an agreement of mutual collaboration in Split." The text of the resolution therefore testifies to a previous diplomatic activity made up of institutional contacts and exchanges of visits between the Chamber of Commerce of Pescara and, presumably, the municipal and chamber of commerce administrators of Split. Even reading the newspapers, in the particular lexicon of 47 years ago, provides some useful indications. In an article on the local newspaper "Il Messaggero", there is an account of a press conference held by the President of the Provincial Tourism Board of Pescara, Prof. Nando

Filograsso. About two weeks before the start of the connection with Split, the President of EPT10 stated that "a maritime line will start operating on 23 June between Pescara and Split. The Società Linee Maritime dell'Adriatico11 of Ancona, accepting the vows formulated by the EPT of Pescara on the occasion of the visit made in our city by Yugoslavian tour operators, promoted by the Centre for Cultural, Economic and Tourist Studies and thanks to the active interest of the Minister of the Merchant Navy, Mr Lorenzo Natali, will start the three-weekly maritime service between Pescara and Split and vice versa on 23 June".

The preparatory exchanges had therefore been intense and productive, even though it is clear that, without the inevitable political aegis, as we have seen with regard to the infrastructural development of the region, every initiative, however valid, was destined to fail to see the light of day. The maritime connections with Yugoslavia, already active from Ancona and Bari, were subsidised by the Government by virtue of their strategic and diplomatic function (maritime services of pre-eminent national interest) and in particular it was the Ministry of the Merchant Navy that determined the funds for the connections and managed the concession.

As a result, the role of the then Minister, Lorenzo Natali from Abruzzo, was decisive. The pervasiveness of politics in national and, even more, regional public life has already been highlighted in the previous paragraphs, but it is the page of a national daily newspaper, in its local edition of June 23, 1966, i.e. the day of the start of the long-awaited link Pescara - Split, which provides an interesting example; in fact, the article reports on the inaugural ceremony of the service in the presence of Natali. "On the occasion of the inauguration of the new ferry line Pescara-Split, the Minister for the Merchant Navy made an official visit to the city of Pescara....". The rest of the article is dedicated to the list of 54 (!) among the highest civil, military, political and religious authorities of the province, accompanied by "other numerous personalities" (The chronicles do not clarify whether the ever-present musical band was also present). On that occasion, the Mayor of Pescara, Zugaro De Matteis, quoting the Minister himself on the occasion of a previous visit, recalled Natali's lofty definition of the city: "City open to the wide sea, to free exchanges and courageous confrontations .

The circumstance was also useful for relaunching the need for Pescara to equip itself with a port structure capable of supporting its commercial and tourist vocation. 47 years later, not only has the issue not been resolved but, if possible, it has become even more dramatic. Built in 1911, after decades of debate between various design hypotheses, the port of Pescara was nothing more than two guardian piers located

at the mouth of the river of the same name and equipped upstream with mooring docks and service yards. In spite of its reduced dimensions and an operation subject to sea conditions, due to a mouth only 40 metres wide, the city harbour nevertheless rivalled the other regional harbours, as already noted above. However, it was the structural limits of the port that forced shipowners to resort to a ship, the Motorship "Egadi", which, although small, had enough space to carry up to 300 passengers, 40 of whom in cabins, and about 30 cars.

These structural constraints also explain why for all the years to come and despite the flattering results in economic terms, the connection was limited only to the summer months, during which rough sea days are statistically less frequent and the demand from passengers was higher. The connection, which started on an experimental basis, was successfully confirmed for the following years, so much so that the shipping company, the already mentioned "Linee Marittime dell'Adriatico", commissioned a new ferry whose characteristics took into account the limited depths and the absence of perpendicular docks in the port of Pescara. So in 1971, after a magnificent launching in the presence of the President of Italian Republic Giovanni Leone, the brand new ferry "Tiziano" joined her sister ships "Jacopo Tintoretto" and "Andrea Mantegna", already in service in Adriatic Sea, connecting Pescara and Split from May to October. This ship opened a new era for the local economy, since it was equipped to carry also trucks to serve the growing traffic with the opposite shore and became part of the collective imagination and memories of several generations of people from Pescara. But we must not forget the small "Egadi" ferry and the almost pioneering spirit with which the protagonists of that phase of the town's history dedicated themselves to this initiative. The social and cultural, as well as economic, value of this link will therefore be measured only with the passing of the years; however, the innovative impact that the ferry line had on the city remains, an impact that perhaps not everyone was able to grasp immediately, but that fostered since then and for years to come, trade, cultural comparisons, relationships, friendships, mutual understanding.

Chapter 2: Yugoslavia in the 60s

The passage which marked the definitive detachment of Yugoslavia from the Soviet sphere of influence, at least from a formal point of view, was the new constitutional charter of 1963 which established two fundamental principles: the economic model of self-management and economic and political decentralisation as an institutional model. The economic reform that followed had as its theoretical objective the drastic modernisation of the country through the revision of prices, the single rate of the dinar, the reduction of the tax burden, but above all the opening of borders to foreign trade and capital. This scheme also responded to some extent to internal pressures, especially from Slovenia and Croatia, which, the former being close to Austria and Italy, and the latter to the strong economic impulse deriving from tourism, demanded less dependence on Belgrade, accompanied by a greater capacity for self-determination in the economic field. In the case of Croatia the question took on particular relevance because of the enormous flow of foreign currency that flowed thanks to tourism. The German mark, the Austrian schilling and the French franc represented the safe haven, the gold bar into which the shaky local currency, impoverished year after year by double-digit inflation, could be converted as quickly as possible. Unfortunately, the results of the reform were not what was hoped for. Prices rose, and inflation and foreign debt increased again, as did unemployment. As a consequence, the flow of emigrants to other countries also resumed.

Obviously, these centrifugal forces were opposed by Belgrade, where there was a tendency to return to the old pre-1963 Constitution, just to avoid losing specific weight in relation to Ljubljana and Zagreb. These instances, only apparently of an economic nature, were instead characterised by political-ideological contents, with two opposing fronts; the centralist one, inspired by Great Serbia and Marxist-Leninist orthodoxy, led by Aleksandar Rankovic, and the one inspired by western social democracies and economic liberalism, led by Slovenian Edvard Kardelj. The conflict was obviously resolved by Tito, who took advantage of the occasion to marginalise Rankovic and, with him, the Marxist-Leninist current in the Serbian party. Such a solution gave breath to a series of claims and "federalist" movements like the Croatian one, whose autonomist claims started from the economic themes to invest the theme of Belgrade's control over the economic assets of the single republics. The candidate himself had the opportunity to personally verify the level of intolerance of the Croatians of Dalmatia towards the bureaucrats descended from Belgrade to manage the most important hotels, tourist and maritime agencies, public enterprises and so on. Also in this

case the economic themes became political, to the point of laying the foundations for an open contestation of the communist system on the wave of what was happening, for example, in Prague.

2.1 - Split

The city of Split has a very different history from that of Pescara, although the ancient port of Ostia Aterni, carved out by going up the mouth of the river Pescara by about a kilometre, appears to have been connected for centuries with Salona, at the gates of modern Split. The function of this port was to ensure the continuity of trade between Rome and the Balkans, via the Via Tiburtina. The majestic palace of Diocletian, in welcoming visitors arriving by sea, offers a very effective idea of the present and past importance of this very important centre. However, apart from the activities related to the sea and the public administrative offices, Split also had a solid industrial base at that time. In particular, the cement industry, fed by the availability of raw materials, chemistry and shipbuilding were important items for the local economy. The first place, however, was occupied by tourism, which was based on the mammoth tourist structures built during the socialist era and the widespread availability of pensions and private rooms for rent. Branko Parađina was responsible for the Protocol of the city of Split from 1967 to 1979. In his book "Splitu u pohode" he describes his years dedicated to organising visits of famous people to the Dalmatian city. "I had the feeling - writes Parađina- that Split was the centre of the world - the place where some very important events took place and where the most historical decisions were made. Regardless of Split's actual place in the world, I think that Split was a truly hospitable city from its very beginnings and that it has maintained this tradition to the present. No matter who the guests were, Split was always counted among their most meaningful experiences ....Although Split is not a capital city, it has been visited by numerous heads of state. They themselves often wanted to visit the city because of its rich cultural and historical heritage and ancient sites."

The list of personalities mentioned in the text is really important if we consider the fact that Split was not, during the Yugoslav period, a capital city and a particularly large centre. In spite of this, to mention just a few personalities, in addition to the various presences of Tito, Queen Elizabeth II, Haile Selassie, the royals of Greece, Indira Gandhi, the Queen Mother of Belgium, Orson Welles, Winston Churchill, Ivo Andric, Leonid Brezhnev, Nikita Kruschev, John Leo, Alfred Hitchcock, John Paul II, etc. have all passed through Split. These notes effectively demonstrate the cultural liveliness and international scope that Split was able to assume already after the war. This dimension astonished and surprised Italian visitors and tourists, who were perhaps

unaware of the fact that the presence of our country during the years of fascism had left a heavy and negative legacy that the Italians would pay for in the following years.

Chapter 3 - Direct Witnesses

It has not been easy to find people who not only lived through those years, but were also involved in some way in the initiative which is the subject of this work. Many of them, to tell the truth, are no longer with us, but fortunately some of the key figures are not only in good health but have made it possible, through their testimonies, to complete the picture of the context in which the initiative of the first maritime link between Pescara and Split matured.

3.1 - Urana Mudronja - Pescara seen from Split. LNG Ships

Urana Mudronja was still a teenager when, in 1966, the connection between Pescara and Split was established.

"In Split in the 1960s we lived very well. I must say that we did not lack anything, we never had the feeling that we were living in an uncomfortable economic situation or at a disadvantage compared to the countries to the west. Before the war Split had less than 50 thousand inhabitants, then at the turn of the 60s and 70s it grew a lot. There had been massive immigration by the military. In fact, 75% of the employees of the army were Serbs and they had the possibility of choosing where to live, and they all chose Split because there is a fantastic climate, similar to that of Rome. In fact we used to name the new districts of the city after the areas where the army officers came from. Then with the war some stayed, many fled, those who had something to fear, but then they came back.

We all went to school, we could attend high schools, during our free time there was no lack of entertainment, social activities or sports. Every evening from 7.45 to 8.30 we all met in the square and every space was occupied by young people from all over Split. The only problem was deciding where to go for dinner, where to spend the money, we also went to Primosten, to Dubrovnik. The square was ideally divided into zones; there was the corner near the library where the citizens gathered, who in turn occupied a different "tile" depending on the age group. On the other side were gathered those who came from the countryside, and so on. The tourists who came to the square wondered, seeing all those people together,

what was happening: a demonstration? A strike? A party? Today the city is too big, it has grown so much, young people have many more meeting places.

We were going to dinner at the famous Park hotel, one of the historic hotels, in downtown Split. There were up to 10 sharp tables with 10 waiters in livery preparing beef tartare. At that time there was even a tradition of organising big balls on the occasion of maturity; these balls were highly anticipated among us young people, they were organised in sumptuous surroundings. The girls wore long dresses, the boys all in suits, when not in tuxedos. I remember very well the ball organised on the occasion of my last year of high school. It took place at the Marjan Hotel, the largest hotel on the Split waterfront, completed in the mid-60s and named after the beautiful hill overlooking the city. It felt like Hollywood from the luxury and atmosphere. Guys lined up along the staircase that led from the hotel lobby to the rooftop terrace with pool overlooking the city's waterfront. The girls, dressed in evening gowns, had the task of escorting the professors from the entrance and down the steps. I was the first to enter the hotel with a professor on my arm. The party was sumptuous, the dinner was luxurious and there was an atmosphere that was magical for us kids. So what could we look for in another country?

Attached to the hotel there was a casino, which was one of the main attractions of the city. I must say that Italians were among the most avid players, and there were many who disembarked from the ferries arriving from Italy and went straight to the Marjan. The hotel was very elegant, even if at the time its architecture seemed out of tune with the historical and ancient promenade of Split.

My family has never had financial problems, although my parents were not rich. My father worked for a sports federation, and supplemented his salary by coaching the handball team and refereeing league matches. My mother was a seamstress at home. My father was a communist and together with his 6 brothers had been partisans. The marriage of my parents was the first marriage with only civil rite, in 46. We were three children, and all three went to university. I chose to enroll in the Faculty of Tourism, which was only in Dubrovnik, but I decided in agreement with my father, not to attend. I basically went there only to take exams. Then to complete my education, I decided to prepare my Italian exam in Perugia, where I attended the University for Foreigners in 71. In Split there were mainly technical faculties. I must say that the first time I set foot outside Yugoslavia was in 1967, on the occasion of a school trip to Italy with the high school I was attending, the trip included a stop in Rome, Florence and Venice. We embarked in Split and landed in Pescara. It was, as I said, the first time that I left my country. I didn't know Pescara and I honestly wouldn't have known

what to expect, since we were only passing through anyway. The group was accompanied by the English teacher, and since I was the best in the class in that subject, I didn't think it was true to run into two American tourists, with whom I could show off my knowledge of the language. I have a beautiful memory of that first experience and, seen through today's eyes, definitely prophetic, since I worked in tourism for years, before embarking seasonally on the ferry service between Pescara and Split and, finally, moving permanently to Pescara, where I still live. To be honest, the first consequence of this first contact with Italy and Pescara was that I got into the habit of buying shoes in Italy, and in Pescara in particular. Already from that first time, I returned to Yugoslavia with 10 new pairs of shoes. The ship was always full for this reason, there were many of my fellow citizens who took advantage of it, also because, especially in the '70s, there was the possibility of leaving in the evening from Split, arriving in the morning in Pescara and spending the whole day going around, embarking again in the evening in Pescara and arriving the next morning in Split to go directly back to work. I came at least 2 times a year to Pescara, the shops of shoes and clothing were renowned, some even made available minibuses that came to pick us up at the port when the ferry arrived and brought us back in the evening in time to embark.

The quality of the products we could find in Pescara was nowhere near as good as what we found on the shelves in our stores. I also bought shoes for my friends, I had a list with their names associated with the shoe size, so every now and then I gave them gifts. Once my colleagues in the office made a bet on the number of shoes I owned, one of them came up and asked me; I had over 30 pairs at the time.
Many of my compatriots used to go shopping in Trieste, where everyone spoke Croatian, even if getting there was rather inconvenient for us. But when the line to Pescara started many people preferred to come here, not only because it was less complicated to get there, it was enough to get on the ship, but also because Pescara was considered more "in".

After finishing university, I started working in tourism, first in a small company, then at Dalmacijaturist, a public tour operator, which had up to 500 employees throughout the former Yugoslavia, with a branch in almost every tourist resort in Dalmatia, and there are many. From the economic point of view I can say that at that time I had a very good salary, in relation to the average salary in my country. We had no problems, every 5th of the month the salary arrived regularly. The company also provided us with a house, so that at the end of the month I had enough money left to spend on myself.

Every year I handled domestic traffic of about 25 thousand tourists, mostly Germans, but also French, British and American, as well as Italians. The boom in tourism began in the 1960s, Split airport was opened in 1966, and in the 1970s an average of 120 charter tourists arrived every weekend. What did the first people from Pescara find when they arrived in Split? They found a town where life was good, the population was quite happy, no one locked their doors, there was a widespread feeling of great security. Split was a very elegant city, and this attracted a lot of people. From my and Split's point of view, Pescara was just a place to go shopping. In our eyes there was nothing else interesting, on the other hand Split has a great historical tradition, it is a city that was already born as a city, not the result of different historical stratifications with a village as a starting point. We didn't feel any kind of fascination, any power of attraction from the West, at least we Spalatini were okay.

When we came to Pescara and went around full of bags, the restaurants had no qualms about taking advantage of us, as is the bad habit of many tourist countries. Then, returning to Yugoslavia, we had to put up with the little abuses of customs, whose officials forced us to open every suitcase. Once I accompanied to Pescara some people who had to renovate a restaurant in Split, these people were put there to run the restaurant by the Communist party. We went into a children's clothing store and the person I was accompanying, hearing the price of a child's onesie, said: - but aren't you ashamed to ask such a price? - I didn't know how to translate this sentence, but I told him that maybe he didn't realise that we weren't in Yugoslavia and that the onesie I was wearing had cost, at the time, 135,000 lire. You're crazy! - he said- they should arrest you!"

3.2 - Edoardo Tiboni

Director of the RAI office for Abruzzo in 1966, Edoardo Tiboni is a journalist, a historian and a scholar, to whose credit we cite, one for all, the International Festival of cinema and writing dedicated to Ennio Flaiano.

"On the fact that the start of the connection between Pescara and Split was made possible by the intervention of the then Minister of the Merchant Marine, I don't think there are any doubts. Natali at the time was trying to oppose or at least limit the power of Remo Gaspari, and his strategy consisted of trying to create alliances with the most representative politicians in the capital cities. In Chieti there was the Mayor Buracchio, while in Pescara the backing had been created with the former Mayor Antonio Mancini. As Director of the RAI office, I was personally involved in all the initiatives in the area, not least because in those years, if we exclude the local pages of the Messaggero, there were no local press organs. So the RAI was the only sounding board for local events and politics. In the years prior to 1966 there had been various initiatives in favor of the activation of this link, but in reality my greatest involvement came after the start-up of the line. I remember having participated, in particular, in an economic mission to Split. One of the things that impressed me most was the endless series of meetings and official visits. We visited municipalities, public offices, chambers of commerce, social wine cellars, oil mills, chemical factories, shipyards. On all these occasions the climate was very austere, and we all had the impression of having come into contact with an economy that was also austere. That impression was accentuated by the fact that instead we were living very intense years from the point of view of economic initiatives. Of course, with hindsight we could say that many of the promises of those years went unfulfilled, especially in Pescara. But those were years just full of expectations, I dare say "hopeful". The years to come were harbingers more of disappointment than satisfaction, unable as we were to claim for the city that role, that primacy, that regional protagonism that it seemed natural to recognise. Also in subject of transports we have always suffered the greater enterprise of Ancona, both in maritime field and, above all, in railway field. Unfortunately Pescara was the victim of its own inertia."

3.3 - Romano Di Bernardo

What could have driven a young journalist to assemble a boat that was little more than a raft with two small outboard motors and cross the Adriatic Sea in September 1963 to arrive in Split?

"In those years, during which I wrote for the local page of the Messaggero, I became the interpreter of a movement of opinion that intended to regain in Pescara the historical routes through which the "trabaccoli", which were the typical sailing boats for the transport of goods spread throughout the Adriatic, arrived from Dalmatia in our canal port to unload various goods. I was also curious to know the places of origin of those routes. As far as I knew, no civilian boat had ever undertaken this type of crossing. So, together with my friend Giancarlo Bonardo, I decided to set up a sort of raft, equipped with two outboard motors by Piaggio. The crossing lasted 36 hours, and when I arrived in Split I felt very lost. I began to go around the offices of the border police and the local Harbour Master's Office, where I had a lot of trouble explaining that my intention of making the crossing was to stimulate the resumption of those relations that were once so flourishing.

To tell the truth, my arguments did not seem to interest my interlocutors very much, and also during the following visits, which were certainly more organised and of a much more institutional nature, I always had the impression that our Croatian friends were very interested in facts, and much less in words, a field in which we Italians were universally known as absolute protagonists.

However, I did not lose heart, and I carefully documented both the preparatory phase of the crossing and the entire period of my stay in Split. Once back in Italy, I used this material to stimulate all the interlocutors, institutional and otherwise, to relaunch the idea from which I had started, that is, that some ships should return and retrace the ancient routes between Dalmatia and Abruzzo. At the beginning I didn't find much support for my project. "What are you going to do there - they told me - the communists are there!"

Among the few people who supported me in this initiative was Luigi Santori, the owner of the local Maritime Agency. The first step was the establishment of a special committee, which included the former President of the Chamber of Commerce Camplone and the then Director of the Union of Industrialists of Pescara, Carlo Santoro. This was not enough to defeat the scepticism and mistrust of the local institutional environments, clearly the result of ignorance and prejudice, which led to equating everything on the other

side of the Adriatic with the Soviet Union. We also found a lot of resistance from the Yugoslavian side, especially because they wanted to impose the use of their passenger fleet, but the port of Pescara, then as now, did not allow ships of a certain size to enter. The other Adriatic ports, in fact, had already been operating for years between the two shores and the market was obviously divided between Italian companies and the Yugoslavian Jadrolinija, all subsidised by their respective governments. The only weight we could spend was the one produced by the Marina Mercantile Minister, who was Abruzzese, and who convinced Mr Lolli Ghetti's company, Linee Marittime dell'Adriatico, to remove a small ferry from the line to the Egadi islands, and to put it in service on an experimental basis between Pescara and Split. I took part to the first voyage, the ship was not so big, we spent almost all the time around a big table, but my travel companions were a bit worried because the dimensions of the ship didn't inspire in them great confidence. During the crossing they often asked me to go up to the bridge to check that everything was running smoothly and that there were no gales on the horizon. When we arrived in Split, although there was a delegation from the city of Pescara on board, there was no one to receive us. There was also a certain diffidence on their part, because they didn't see what kind of advantages Split could gain from establishing more solid relations with Pescara, something that had already happened with Ancona. Only after a few years, and only after the authorities of Pescara assured that they would cover all hospitality expenses, were the first official visits from Yugoslavia made. These delegations were mostly organised by the Chamber of Commerce, as at the time it would have been very difficult to justify that a political entity such as the municipality would visit a counterpart body of another non-socialist country, this type of political relations could not be established.

I was accused of having who knows what kind of interests, of pursuing personal gain and that increased the initial distrust. Also after the start-up of the connection skepticism continued to prevail. Then the numbers proved us right. The small ship Egadi continued to ensure the connection for another 4 years, until she was replaced by the "Tiziano", a ship built specifically for the port of Pescara. In fact, in the meantime, everyone had realised the great success of the connection and its great economic value for both cities. We brought tourists and businessmen, many people arrived from Yugoslavia to buy goods and services, to study and work, and then tourists from other European countries, and the Yugoslav citizens themselves, the more affluent ones, to spend a few days' holiday in Italy.

Today I look with great melancholy and sadness at our city, more and more closed and isolated, just in the year in which Croatia will enter the European Union, a real dream for us who at the time launched

ourselves into this adventure. It is a pity that Pescara has not been able to protect this heritage that has been built over the years thanks to the stubbornness, self-denial and enthusiasm of a few people."

Conclusions

Pescara and Split, two cities in the mirror, photographed, albeit briefly, in the same historical period in an attempt to establish a dialogue between two worlds and two cultures that are only apparently irreconcilable. From the historical-political picture and above all from the direct testimony of the main personalities of that time, we can venture some final considerations.

From the Italian point of view, the start of the connection between Pescara and Split in 1966 seemed to be one of the many cards that the politicians of the time decided to play as a sign of attention towards the requests of a specific territory, in the context of the continuous operation of creating consensus and dividing power on the part of the various currents of the Christian Democratic Party. In essence, without political intervention, the local community would hardly have succeeded and expressed sufficient drive to ensure that the activation of the link was the result of the actual weight and validity of the requests from the city and its economic and cultural forces.

Another clear element is that the theme of the connection with the other side was a matter concerning Pescara only; the rest of the region never intervened in any way and above all, the whole of Abruzzo did not grasp the value and potential present and future. To tell the truth, this circumstance also emerges in a rather evident way, even in the Adriatic city the initiative was accompanied by a certain scepticism about the effective value of the operation. The first voyages to Split were viewed with mistrust, and the evaluations on the actual capacity of the connection from the tourist and economic point of view were full of doubts and perplexities. Perhaps that small ship, so precarious in appearance, was a bit of an emblem of the climate of uncertainty in which the Pescara's initiative took shape. Time and facts would have proved the Promoter Committee right, in fact, over the years, the economic, commercial, tourist and cultural relations originated around this connection would have contributed to form a public opinion, according to which the line between Pescara and Split was an essential element of the city and regional life. The fact that, as often happens, one appreciates the value of some things only when they are no longer there, leads to a bitter consideration regarding the progressive isolation on the eastern front that Abruzzo and Pescara are maturing, paradoxically, precisely in the year in which the customs barriers with Croatia will definitively fall.

From Split's point of view particular interest in the activation of the connection with Pescara never raised. Split had a network of relations and relationships with other cities, it was the scene of important international events and was connected by sea with other important localities, not only in the Adriatic. In addition, Split's historical and cultural heritage, tradition and centrality in the traffic that had historically been based in Split gave boosted its already important role compared to that played by its Adriatic neighbours. Why should it have felt the need to link up with Pescara? This attitude of indifference, justified by the economic and political context, is also testified to by those who experienced those years first-hand. What interested them the most - and even today the attitude does not seem to have changed - were the concrete facts, and not the pompous rituals of Italian politics.

In the following years, the picture changed, albeit slowly. Relations had become increasingly solid. More and more Italians and people from Abruzzo spent their holidays in Yugoslavia first, and then in Croatia. Craft and manufacturing companies began to receive orders from Croatian hotels, companies and builders. The development of tourism-oriented construction in the eastern shore of the Adriatic was in many cases signed by Italian companies for the supply of furniture, sanitary ware, upholstery, fabrics, etc. There are numerous cases of Croatian citizens who have settled in Italy and in Pescara for business or emotional reasons, have studied at our universities or have set up their own businesses here. Fresh fish from Croatian seas was imported into Pescara for many years, at least until Abruzzo was excluded from the location of the peripheral offices of the Ministry of Health responsible for verifying the import of goods of animal origin from third countries. Finally, starting in the first half of the 1980s, the explosion of the religious phenomenon linked to the alleged appearances of the Virgin Mary in Medjugorje meant that record numbers were recorded on the line between Italy and Croatia, despite the seasonal nature of the connection. Even Split, therefore, would have had the opportunity to appreciate the real value and importance of the connection with Pescara in the following years.

The two communities, and the Pescara community in particular, should pay ideal tribute to the spirit of initiative and the far-sighted will of those who struggled to have Pescara and central Italy directly connected with the Balkans by sea. Their initial intuition turned out to be successful and legitimised by the facts. Unfortunately, the dissipation of this important heritage, built up over 46 years, has recently been consumed by the inadequate ability of today's political classes to protect the interests and values that the territory can express. If this can be considered one of the ultimate ends of doing politics, a more reflective reading of what

happened in the years described here could even lead to the surprising re-evaluation of "that" way of doing politics. It is up to each of us to evaluate whether this is a good or a bad thing.

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Abruzzo Region - CITraMS

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Annex 2: Simulation for commercial passenger transport services using GT vehicles fuelled by LNG

Dr. Marco Grifoni

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Simulation for commercial passenger transport services using GT vehicles fuelled by LNG

Following preliminary meetings with the Interreg Italy-Croatia 'Mimosa' project managers, Polo Inoltra conducted a feasibility and cost simulation for road transport services on Granturismo buses, fuelled by LNG, for medium and long-distance routes. In particular, the simulation was conducted considering the use of a 50-seat GT coach, fuelled by LNG, with a five-year amortisation plan. For project EBIT, it is necessary to consider the frequencies of the services that this means will serve.

As far as the analysis is concerned, the use of GT coaches longer than 12m, or even with bi-deckers will be excluded, focusing only on 50-seat GT coaches of 12m. Consequently, it is important to consider that where a medium-long-distance service is configured with a capacity of only 50 passengers, there will be an important incidence of operating costs per passenger, as well as lower competitiveness of the service in economic terms - in addition to the technical limitation of the service mentioned above - compared to large vehicles of higher capacities, e.g. bi-planes of 70 to 80 places, with traditional fuelling.

Both short and long-distance transport services to/from the port of Pescara were examined. The choice of this hub emerged from the design study conducted by the Mimosa team. The transport services will be considered of a commercial type, not LPT, to promote sustainable mobility for passengers bound for ship embarkation at the port of Abruzzo on the new Ro-Ro service and, vice versa, for passengers arriving post-ship embarkation at the port of Pescara on the same service. The project will consider an LNG-fuelled vehicle, the storage, and production of which will be carried out in the port, the GV bus used for the medium-distance order will be based in the port, so that refuelling activities can be completed in its base. In the long haul, vehicles will have to rely on service areas, with the natural impact that LNG supply chain management will have in terms of indirect contract costs. According to preliminary pre-study agreements, neither the costs of installing LNG filling stations along the route of long-distance journeys, nor will the logistical costs of refuelling the stations will not be considered. The estimated work will start with a minimum of two Ro-Ro connections per week, for 50 weeks per year. If frequencies should change, there will be a rescheduling of the depreciation of vehicles and fares.

Short distance

For short-haul services, it was planned to connect the port of arrival/departure in Pescara of the RoRo service with Abruzzo's main intermodal hub, the bus station and the Pescara Centrale railway station. With the indicated short-haul connection, it will be possible to provide a direct link to the main arrival hub for both trains and buses in the region. Bringing passengers to the hub will also make it easier to reach full saturation of the road link to the port, one of the essential requirements for the success of the initiative.

	Da: Pescara porto A: Pescara Centrale
PROJECT ASSUMPTIONS	
Estimated passenger capacity per vehicle	50
Estimated average occupancy per medium %	70%
Default estimate no. of average passengers per vehicle	35
Estimated vehicle cost	5.000.000,00 €
Estimated travel year per Round Trip	300
Estimated years of service	10
Estimated indirect operating costs/year	45.000,00 €
ESTIMATED COST PER ROUND TRIP:	
Driver	15,00 €
Fuel	15,00 €
Tolls	-
Housekeeping	10,00 €
Vehicle maintenance and ancillary charges	5,00 €
Total direct costs	45,00 €
Indirect costs	90,00 €
Amortisation	100,00 €
Totale full costing R/T	235,00 €
COST ESTIMATE PER TRIP S/A:	
Full costing S/A	117,50 €
Full costing S/A for passenger	2,94 €
ESTIMATE OF ACTIVE TARIFF PER CUSTOMER S/A:	
% commercial markup to be applied to full costing	5%
Fare assumptions net of VAT per passenger	3,08 €

Figure 69: Cost estimates on short distances

Considering the use of a vehicle with a capacity of 50 passengers, with an average occupancy rate of 80% as a project assumption, i.e. 40 passengers per trip, an estimated purchase cost of the vehicle of € 500,000, for an estimated 10 years of service (due to the low mileage, assuming that the vehicle is used only for the route under study and not for mixed use on several routes) and an estimated 500 return trips per year (50 working weeks * 5 return shuttles per ship arrival as per the project estimate agreements * 2 ship arrivals per week), we would obtain a direct cost of €45.00 per return trip on the Pescara Porto < > Pescara

Centrale route. Regarding indirect costs, estimating an operational cost of €45,000/year for the route and the amortization schedule indicated above would lead to a total A/R of €235.00. Dividing this figure in half would give the total cost per one-way trip divided by the estimated number of passengers. To obtain the breakeven point, would bring the total cost per one-way trip for the estimated occupancy to €2.94. Applying a 5% markup would result in a per-passenger, net-of-VAT fare of €3.08 for the service, in line with how a short-haul shuttle competing with local LPT services might be.

Long-distance

For long-distance services, consideration was given to commercial inter-regional connections from the port of reference to the main destinations in central and southern Italy. In particular, by mapping the historical flows of the SNAV ship service on the Pescara-Split route, it was decided to carry out a study on the destinations of Rome, Naples, Florence, and Foggia, the main catchment areas for a new ship service departing from Abruzzo and heading to Croatia and vice versa.

	From: Pescara port to: Roma Tiburtina	From : Pescara port To: Napoli -Terminal Bus	From: Pescara port To: Firenze -Terminal Bus	From: Pescara port To: Foggia -Terminal Bus
PROJECT ASSUMPTIONS				
Estimated passenger capacity per vehicle	50	50	50	50
Estimated average occupancy per medium %	70%	70%	70%	70%
Default estimate no. of average passengers per vehicle	35	35	35	35
Estimated vehicle cost	5.000.000,00 €	5.000.000,00 €	5.000.000,00 €	5.000.000,00 €
Estimated travel year per Round Trip	300	300	300	300
Estimated years of service	10	10	10	10
Estimated indirect operating costs/year	45.000,00 €	45.000,00 €	45.000,00 €	45.000,00 €
ESTIMATED COST PER ROUND TRIP:				
Driver	198,00 €	248,00 €	400,00 €	194,00 €
Fuel	238,00 €	298,00 €	480,00 €	233,00 €
Tolls	89,00 €	40,00 €	180,00 €	87,00 €
Housekeeping	40,00 €	50,00 €	80,00 €	39,00 €
Vehicle maintenance and ancillary charges	100,00 €	124,00 €	200,00 €	97,00 €
Total direct costs	665,00 €	760,00 €	1.340,00 €	650,00 €
Indirect costs	150,00 €	150,00 €	150,00 €	150,00 €
Amortisation	166,67 €	166,67 €	166,67 €	166,67 €
Totale full costing R/T	**981,67 €**	**1.076.67€**	**1.656,67 €**	**966,67 €**
COST ESTIMATE PER TRIP S/A:				
Full costing S/A	**490,83 €**	**538,33 €**	**828,33 €**	**483,33 €**
Full costing S/A for passenger	**14,02 €**	**15,38 €**	**23,67 €**	**13,81 €**
ESTIMATE OF ACTIVE TARIFF PER CUSTOMER S/A:				
% commercial markup to be applied to full costing	5%	5%	5%	5%
Fare assumptions net of VAT per passenger	**14,73 €**	**16,15 €**	**24,85 €**	**14,50 €**

Figure 70: Estimated long-distance costs for the port of Pescara

Considering as a project assumption the use of a vehicle with a capacity of 50 passengers, with an average occupancy rate of 70%, i.e. 35 passengers per trip, an estimated purchase cost of the vehicle of

€500,000, for 10 years of estimated service (due to the low mileage, assuming that the vehicle is used only for the route under study and not for mixed use on several routes) and an estimate of 300 return trips per year (50 working weeks * 3 return shuttles per ship arrival as per the project estimate agreements * 2 ship arrivals per week), this would result in a direct cost of €665.00 per round trip on the Pescara Porto < > Rome route, €760.00 per round trip on the Pescara Porto < > Naples route, €1,340.00 per return trip on the Pescara Porto < > Florence route, and €650.00 per return trip on the Pescara Porto < > Foggia route. About indirect costs, estimating an operating cost of €45,000/year per route and the amortisation schedule indicated above, this would lead to a total cost per route of €981.67 for Rome, €1,076.67 for Naples, €1,656.67 for Florence and €966.67 for Foggia. Dividing these figures in half would give the total cost per one-way trip, which divided by the estimated number of passengers, to obtain the breakeven point, would give a total cost per passenger for the estimated occupancy of €14.02 for the Rome service, €15.38 for the Naples service, €23.67 for the Florence service and €13.81 for the Foggia service. Applying a mark-up of 5%, the lowest mark-up realistically conceivable, would result in a fare per passenger net of VAT of €14.73 for the Rome service, €16.15 for the Naples service, €24.85 for the Florence service and €14.50 for the Foggia service.

Comparing the indicated fares to current market levels, it appears to be a discrepancy between the prices under study and those currently applied by the main commercial operators on the Pescara< >Rome and Pescara< >Naples routes. These differences can be justified by the circumstance that these routes, although commercial, are promoted by operators visibly at below-cost levels, often not considering vehicle depreciation, aiming at maximum vehicle saturation (also possible for a different target group of customers, perhaps students and businessmen travelling without bulky luggage), with higher mileage and cheaper vehicle purchases. To make the service more commercially competitive, we recommend using the LNG vehicle also on other routes, not necessarily connected to the sea route to Croatia, so that at least 500 trips/year per vehicle can be counted on, to better spread the running costs and the depreciation schedule of the vehicle.

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