APPRAISAL REPORT

FOR DUBROVNIK AIRPORT PILOT ACTION

Project acronym	ADRIGREEN
Project Title	Green and Intermodal solutions for Adriatic airports and ports
Axis	Maritime transport
Specific Objective	4.1- Improve the quality, safety and environmental sustainability of marine and coastal transport services and nodes by promoting multimodality in the Programme area.
Project website	https://www.italy-croatia.eu/web/adrigreen
Start of the project	01/01/2019
Duration	36 months
Related activity:	4.1 –Testing phase
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CONTENT

I. EXECUTIVE SUMMARY

The main objective of ADRIGREEN project is to improve the integration of Croatian and Italian ports and airports with other means of transportation in order to enhance the processing of passengers during the summer seasons, improving environmental performances of the Adriatic maritime and aviation systems.

According to the application form of ADRIGREEN project, the implementation of Central Adriatic Ports Authority pilot action will be realised in the port of Ancona, covering the following macro area:

- ✓ Implementation of integrated timetabling and information for passengers that must continue their travel by other means of transport.

According to the needs analysis performed, the pilot action will address ferries' passengers, acting on two different levels:

- ✓ Improved connection between the ticket office "Ancona Ferries Terminal" and the ferry quays, as well as port connection with the local public transport system and railway station;
- ✓ Installation of a multimedia outdoor totem to provide passengers on-time information on the ferries and trains transiting, respectively, in Ancona port and Ancona railway station.

According to the environmental analysis realised within the technical framework provided by Marche Polytechnic University, technical partner within Adrigreen project, the pilot action implementation has reduced the environmental impact of ports activities, optimising passengers' flows and creating benefits also for the local community.

II. BACKGROUND OF THE PROJECT

One of the main problems that characterize the Adriatic coastal area is the imbalance in the development of infrastructure and means of transport, caused by a low level of investments and innovation. Italy and Croatia are rich in maritime cities, which have to deal with a very high number of passengers, especially during the summer season. Even though the road transport is still predominant, the number of people that are reaching Adriatic cities by ferry and by plane is significantly increasing year by year. However, most of Adriatic ports and airports are suffering from lack of integration with other means of transport that affect the concept of seamless intermodal transport in the Region.

ADRIGREEN- Green and intermodal solutions for Adriatic ports and airports, financed by the INTERREG V-A Italy Croatia CBC Programme 2014-2020, intends to improve the integration of Adriatic ports and airports with other means of transport by testing intermodal operational and technological solutions.

ADRIGREEN project consists of the following technical work packages:

- ✓ WP 3 – Identification of innovative solutions and Action plan definition
- ✓ WP 4 – Testing and evaluating innovative intermodal and low-carbon solutions
- ✓ WP 5 – Networking and training on Green and intermodal solutions

WP 3 – identification of innovative solutions and Action plan definition

Several activities were performed:

A) Replicability research and analysis replicable operational and technological solutions

The partnership made a general overview of existing solutions for lowering airports/ports environmental impact and improving intermodal connection of ports/airports with other means of transport. International investigation research aimed to identify and analyse the best solutions already implemented worldwide that can be easily implemented in Adriatic region.

b) Environmental assessment

Each project partner performed the Environmental Impact Assessment (EIA) based on ad-hoc guidelines produced by technical expert in the project, Polytechnic University of Marche. In order to assess current situation, evaluation grid for EIA was produced to cover different environmental aspects: environmental impact of local air quality, waste and water management, energy consumption, carbon footprint and noise pollution.

c) Joint action plan definition

Polytechnic University of Marche realised the Joint Action Plan, providing ad hoc suggestions, tailored to the partnership needs in terms of improvement of environmental and intermodal performance. According to the analysis performed, the Central Adriatic Ports Authority focused on the improvement of intermodal connections dedicated to passengers embarking/disembarking to/from the port of Ancona.

WP 4 – Testing and evaluating innovative intermodal and low-carbon solutions

The testing phase is the core phase of the project where identified solutions and best practices are to be put in place and tested within each partner pilot action. The first deliverable of this work package is the Feasibility study for each pilot action, where initial financial and environmental analysis have been performed.

The implementation of Central Adriatic Ports Authority pilot action will be realised in the port of Ancona, covering the following macro area:

- ✓ Implementation of integrated timetabling and information for passengers that must continue their travel by other means of transport.

III. NEEDS ANALYSIS OF CENTRAL ADRIATIC PORTS AUTHORITY

The Central Adriatic Ports Authority is one of the 16 Italian Ports Authority established by the Italian law 84/1994, as updated by the Italian Legislative Decree 169/2016 and subsequent amendments and additions, which identifies the competence of the Central Adriatic Ports

Authority on the ports of Pesaro, Falconara Marittima, Ancona, San Benedetto del Tronto, Pescara e Ortona, located in Marche and Abruzzo regions.

The port of Ancona is the main port of the Central Adriatic Network and core port of the SCAN-MED and Baltic-Adriatic Corridors, a crucial north-south axis for the European economy within the TEN-T network.

In addition to significant freight traffic, the port of Ancona is as a strategic reference point in the Adriatic for all passengers who intend to reach the Balkans and the South-Eastern Mediterranean, in line with the historic vocation of the port as a " Gateway to the East".

Thanks also to its privileged geographical position and competitive transit time to Balkan countries and Greece, the port of Ancona holds nearly 19% on the international ferry passengers flows of the Italian ports. Due to recent road infrastructure improvements, the catchment area of the port of Ancona has increased, as well as its connections to the Italian Western coast.

Indeed, the Doric port is connected during the whole year with Croatia, Albania and Greece, thanks to regular ferry services allowing the transport of goods and passengers.
Some data are provided below:

- Daily departures for Greece (Igoumenitsa-Patras): three companies operating two services (1-2 departures/day)
- Main Italian port on the Italy-Croatia ferry traffic (Split and Zadar in the summer season. Two companies in the summer season operating two services on the Ancona-Split line);
- Regular line to Durres (Albania).

In 2020, passengers' traffic has been affected by the COVID-19 pandemic crisis.

Passengers passing through the port of Ancona in 2020 were 376,989, -68% compared to 2019. Borders were closed for tourist purposes for several weeks and the Jadrolinija connection to Croatia was interrupted from 10th March 2020 to 26th April 2020, while Snav, generally beginning its season in mid-April, started only on 25th June 2020. On the Albanian route, Adria Ferries suspended the connection from 4th April 2020 to 7th May 2020. The connections with Greece were regular, however, only the traffic of goods was allowed for several weeks.

Since 2020 was an unusual year for passengers' traffic, 2019 data are reported below, as a significant benchmark for the needs analysis underpinning the feasibility study of the pilot action of the Central Adriatic Ports Authority within Adrigreen project.

In 2019, 1,189,441passengers transited in the port of Ancona, + 3% on 2018, 1,089,332 of them used ferries.

The number of passengers to/from Greece (772,540) and Croatia (218,499) were stable compared to the previous year, while there was an increase in the number of transits for Albania (98,155 passengers compared to 90,832 in 2018, with an increase of + 8%).

In addition to ferry passengers, there was a 49% increase on 2018 in cruise passengers, a significant figure compared to the national average, equal to 11.2%, recorded for the cruise segment (Source: "Ship2Shore"). In particular, cruise passengers in transit in the port of Ancona were over 84,000, those embarking/disembarking over 15,000 and about 21% of the cruise passengers on the MSC Sinfonia cruise chose Ancona as their port of departure.

The Adriatic shores are an increasingly popular destination for tourists, also due to the significant historical and cultural heritage surrounding their ports.

However, the trend of the tourist flow is not homogeneous during the year, but has peaks during the summer season, creating congestions on city traffic and the infrastructures involved.

Thus, the Central Adriatic Ports Authority decided to focus on new services for passengers transiting to the port of Ancona.

In particular, the Central Adriatic Ports Authority decided to create and test an integrated system containing timetables and information for passengers who must continue their journey with other means of transport.

Further details are provided in the following chapter.

IV. DESCRIPTION OF THE PILOT ACTION IMPLEMENTED

The Central Adriatic Ports Authority will implement several solutions to speed up the passengers flows from/to the port of Ancona. In particular, it complies with the second pilot action field identified by Adrigreen project "implementation of integrated timetabling and information for passengers that must continue their travel by other means of transport".

According to the needs analysis performed, the pilot action will address ferry passengers, acting on two different levels:

<u>Improved connection between the ticket office "Ancona Ferries Terminal" and the ferry quays, as well as port connections with local public transport system and railway station:</u>

The ticket office is located in a different port area from the ferries quays. To ease passengers flow, the Central Adriatic Ports Authority, in close collaboration with the local public transport company, provides to passengers arriving in/departing from the port of Ancona a bus line dedicated to the connection of the "Ancona Ferries check in" with ferries' quays.

Furthermore, Adrigreen pilot action wants to improve the accessibility and the connection between land and sea, providing dedicated signage to smooth passengers' flow and ease the interconnection between the port, the public transport system and the railway station.

Installation of variable message panels

The Central Adriatic Ports Authority intends to install variable message panels in a strategic area, to catch passengers embarking or disembarking in the port of Ancona.

The panel is conceived to give updated on-time information on:

- The number of quays, the dedicated ferry line and the time scheduled for departure/arrival;
- The trains in Ancona railway station.

The panel is equipped with software able to guarantee an efficient and on-time information flow between three different sources of information (ferry related information as well as local public transport and railway ones).

V. ENVIRONMENTAL ANALYSIS

As outlined in par. IV "Needs analysis of Central Adriatic Ports Authority", ferries traffic is a strategic asset for the port of Ancona, both in terms of freight and passengers traffic.

Concerning passengers' traffic, according to Central Adriatic Ports Authority estimation, the majority of them (nearly 98%) reach the port of Ancona by car, as they will embark it to continue their journey on the other side of the Adriatic Sea.

Therefore, ADRIGREEN pilot action will have a positive impact on those who arrive to/depart from the port of Ancona using other means of transport (not embarking/disembarking any vehicle), meaning 19,936 passengers (nearly 2% on total passengers in 2019).

According to Central Adriatic Ports Authority estimation, due to insufficient information on local public transport, half of them use local cars to reach intermodal hubs (railway station, coaches terminal and port areas), meaning 9,968 passengers, according to 2019 passengers values.

Thus, ADRIGREEN pilot action will act on those passengers, increasing the use of local public transport by 10% and 20%, thus reaching between 60% and 70% on the total share.

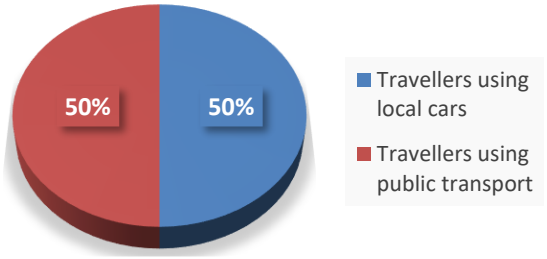
Therefore, the environmental analysis was based on two scenarios, assuming a different share of utilization of two means of transport (i.e., public transport versus local cars), as outlined in Table 1.

***Table 1:** Passengers with no vehicle going from/to intermodal hubs to/from the port area: scenarios before and after the implementation of the pilot action in the port of Ancona.*

Scenarios	Before the pilot action	After the pilot action
Scenario A	50% use local public transport 50% use local cars	60% use public transport 40% use local cars
Scenario B	50% use local public transport. 50% use local cars	70% use public transport 30% use local cars

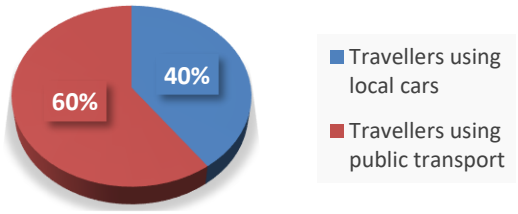
The following graphics represent the pilot action impact on travellers that embark/disembark with no vehicles using public transport or local cars to reach port areas (or other way round), according to the hypothesis outlined within scenario A and scenario B.

Before the pilot action

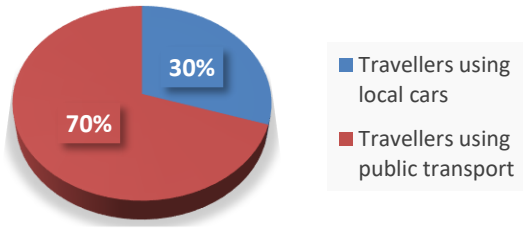


Following the pilot action

SCENARIO A



SCENARIO B



Data and calculations

The following equation shows how to assess the avoided mileage (ΔM, km) by cars because of the expected increase in the use of public transport by the travellers embarking/disembarking at Ancona Port with no vehicle:

$$\Delta M = \left[\frac{TA - TB}{n}\right] \times d$$

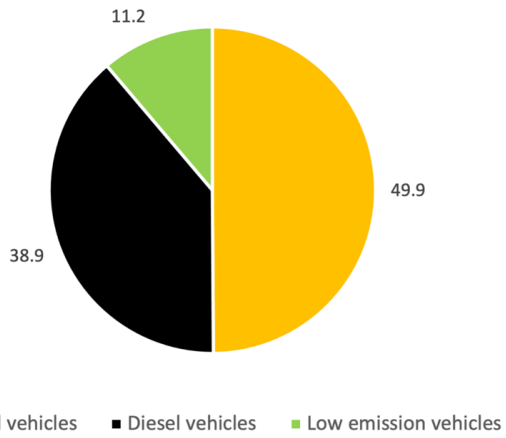
Where TA is the number of travellers going by public transport after pilot action implementation, according to scenarios A and B (third column of Table 2); TB is the number of travellers going by public transport before the pilot action (second column of Table 2); *n* is the average number (i.e., 2) of travellers per local car used to reach intermodal hubs (estimation by Central Adriatic Ports Authority); d is the distance of 3 km, that is the mean path to link the main intermodal hubs (railway station and coaches terminal) to port areas (Ancona Ferries Terminal and quay for embarking/disembarking).

***Table 2**: Avoided mileage by local cars according to the different scenarios, following the implementation of the pilot action.*

Scenarios after the pilot action	Travelers going by public transport before the pilot action (TB)	Travelers going by public transport after the pilot action (TA)	Avoided mileage by cars [km]
A 60% public transport 40% local cars	9,968	11,962	2,990
B 70% use public transport 30% use local cars	9,968	13,955	5,981

The avoided mileage was distributed according to the different types of power supply of the vehicle circulating in Central Italy, levelling local cars distribution to private cars (Figure 2).

***Figure 2** Vehicles circulating in Central Italy by the types of power supply in 2019. UNIVPM elaboration based on data retrived from ISTAT (2021).*



Emissions of airborne pollutants (NOx and PM) and CO2 deriving from fossil fuel vehicles

For fossil fuel vehicles, the emissions of NOx, PM, and CO2 were evaluated following Tier 1 according to Ntziachristos et al. (2019), as follows:

$$E_i = \sum_j EF_j \times FC_j \times \Delta M_l$$

where E_i is the emission value of NOx [g], PM [g], and CO2 [kg]; EF_j is the emission factor specific for the type of fuel and the vehicle category [g/kg fuel] for PM and NOx; [kg CO2/kg fuel] for CO2; FC_j is the fuel consumption related to the j-category of vehicle [g/km]; ΔM is the avoided mileage per year for the l-vehicle [km/year].

***Table 3:** Tier 1 emission factors and typical fuel consumption for different types of passenger cars. Adapted from Ntziachristos et al. (2019).*

	Vehicle category	kg CO2/kg fuel	Mean NOx [g/kg fuel]	Mean PM [g/kg fuel]	Typical fuel consumption [g/km]
Diesel	Passenger car	3.169	12.96	1.1	60
Petrol	Passenger car	3.169	8.73	0.03	70
LPG	Passenger car	3.024	15.2	0	57.5

Table 4 shows the mileage for the l-vehicles that would be avoided thanks to pilot action implementation, according to the two different scenarios.

***Table 4:** Avoided mileage for vehicles with different types of power supply for the A and B scenarios.*

Scenarios	Type of power supply	Vehicle category	Avoided mileage [km]
A	Diesel	Passenger car	1,163
A	Petrol	Passenger car	1,492
A	LPG	Passenger car	335
B	Diesel	Passenger car	2,327
B	Petrol	Passenger car	2,984
B	LPG	Passenger car	670

VI. MAIN OUTCOMES

The implementation of the pilot action is expected to increase the use of local public transport by travellers that embark/disembark in the port of Ancona with no vehicle, decreasing the use of local cars to reach the intermodal hubs.

The avoided mileage of local cars (Table 4), according to the different scenarios, can reduce CO_2 emissions up to nearly 1221 kg per year (Figure 5).

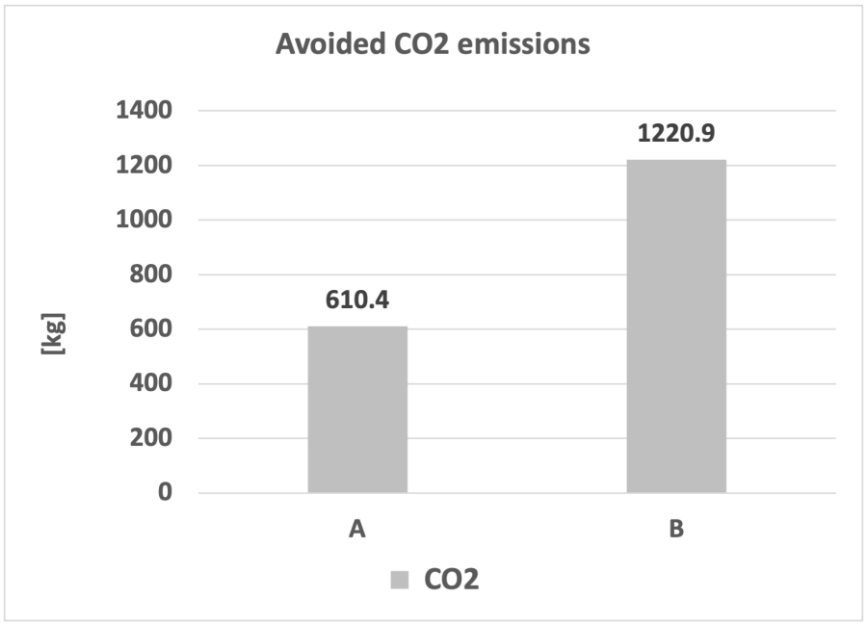


***Figure 5:** Avoided greenhouse gases emissions deriving from increasing the utilization of public transport at expenses of local cars according to the different scenarios.*

Moreover, local emissions of airborne pollutants such as NOx and particulate matter (PM) may be avoided up to about 4.2 kg NOx and 0.2 kg PM per year (Figure 6).

In addition, the pilot action will contribute to the reduction of traffic jams in the rush hours, thus providing further environmental benefits such as the reduction of noise pollution and a further decrease of airborne pollutants and greenhouse gases emissions.

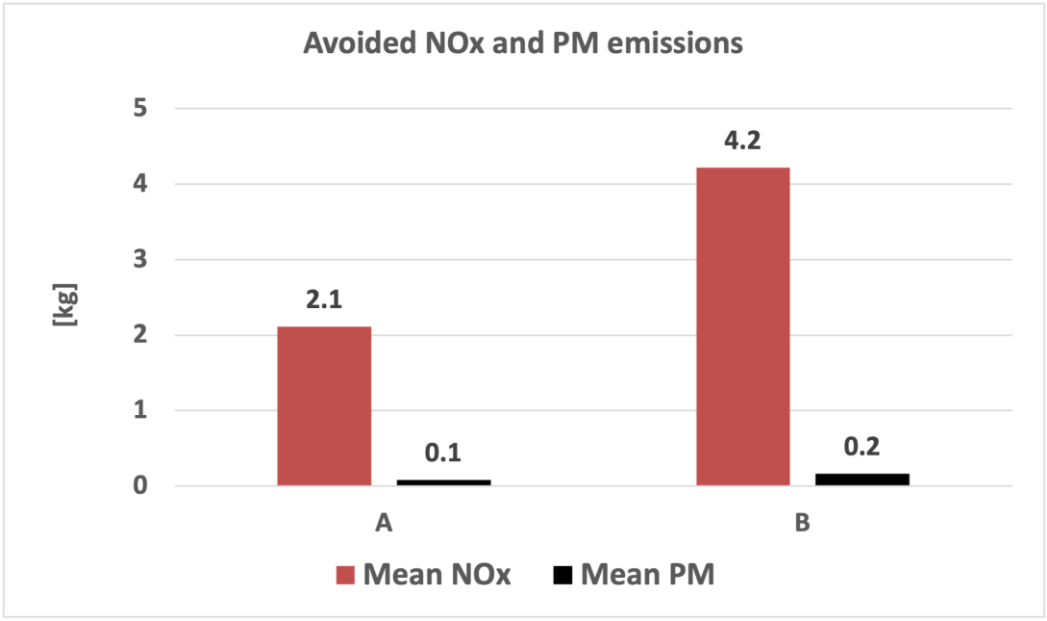


Figure 6: ***Avoided local emissions of airborne pollutants deriving from increasing the utilization of public transport at expenses of passenger cars according to the different scenarios.***

VII. REFERENCES

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