D 3.1.1 – STATE OF THE ART AT TECHNICAL AND ORGANIZATIONAL LEVEL

Activity 3.1 – SoA - State of the Art

December, 2020 - Final version

Partner: LP – Municipality of Ancona
Authors: Sanja Vukorep, Stefano Campanari
Email: sanja.vukorep@comune.ancona.it

Project Acronym	E-CHAIN
Project ID Number	10048282
Project Title	Enhanced Connectivity and Harmonization of data for the Adriatic Intermodal Network
Priority Axis	4 - 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
Work Package Number	3
Work Package Title	Mobility Maritime Design
Activity Number	3.1
Activity Title	SoA - State of the art
Partner in Charge	LP - Municipality of Ancona
Partners involved	LP - Municipality of Ancona PP6 – Prosoft d.o.o. PP7 - Jadrolinija
Status	Final
Distribution	Public

VERSION CONTROL

Date	Version	Prepared by	Revised by	Approval	Revision	Comment
June, 2020	Template	Aris Grozić	Nelida Pogačić		draft	
June, 2020	Draft	Stefano Campanari	Sanja Vukorep		draft	
Dec, 2020	Final	Stefano Campanari	Sanja Vukorep	Nelida Pogačić	Final	
June, 2022	Final		Nelida Pogačić		Final	Cover page changed

TABLE OF CONTENTS

ACRONYMS / ABBREVIATIONS

ACRONYM	DEFINITION
SoA	State of the Art
PP	Project partners
PT	Project Team
TC	Technical task coordinator
WP	Work package
IT	Information Technologies

REFERENCE DOCUMENTATION

No	TITLE	REPORT No.	PUBLISHED BY
1	**Application Form – E-CHAIN - Enhanced Connectivity and Harmonization of data for the Adriatic Intermodal Network** 2014 - 2020 Interreg V-A Italy - Croatia CBC Programme Call for proposal 2017 Standard - E-CHAIN Priority Axis: Maritime transport	Application ID: 10048282	Lead Applicant: Municipality of Ancona

1. INTRODUCTION

1.1 PURPOSE OF THE DOCUMENT

This document is relevant to the activity 3.1 SoA - State of the Art of E-CHAIN project - Enhanced Connectivity and Harmonization of data for the Adriatic Intermodal Network.

The purpose of this document is to collect detailed information on local Travel Planning systems and services being used, ITS services available and the possibility of integrating such systems in a E-CHAIN platform to offer updated – real-time – combined travel information to the travellers. The focus will be the collection of information on the current situation within Consortium through a census of transport types locally used and implemented, relative modules or software used (technology state of the art) and the interfacing with external systems (AVM, info mobility, etc). Moreover, this activity will gather all information about standard and programme languages used, the general architecture realized at local level.

A deep analysis will highlight the weakness and strength in each local environment and the outcomes will outline the specific actions needed to enhance and promote the development and integration within E-CHAIN platform.

It is the operational document for the execution of the project being used:

- by the Task Manager (TM) and Project Team (PT) to provide detailed information on current state within consortium.
- by the Activity 3.2 Stakeholders analysis (Transport needs) information needed for D 3.2.1 – Benchmark, transport needs & suppliers' roles.
- by the Activity 3.3 Technical and functional requirements to provide data needed for D 3.3.1 – Use case scenarios selection and preliminary requirements definition for defining starting level of mobility services for scenarios and D 3.3.2 – Technical and non-technical requirements for information on current operational systems capabilities.

2. BACKGROUND INFORMATION

E-CHAIN (Enhanced Connectivity and Harmonization of data for the Adriatic Intermodal Network) main objective is to enhance connectivity and harmonization of data for the Adriatic Intermodal Network, through the realization of a modular integrated software (E-CHAIN platform) for the management of intermodal transport services in port areas for passenger transport. To enhance the current situation, E-CHAIN will focus on providing new services such as an improved Port multimodal info mobility system for the passengers, a ticketing system integrated with other transport modes, an advanced touristic co-marketing tool for the operators. These services will be designed and deployed in the selected pilot sites (Ancona, Split and Venice). A Business model suited to adapt the technology developed in the three applicative contexts will be created and specific needs will be taken into account.

The aim of WP3 is to design platform and services and to prepare the E-CHAIN services for deployment in the pilot sites (Ancona, Split and Venice).

The specific objectives of this WP are to:

- Establish the requirements and specifications for E-CHAIN services and for integration with existing services/systems
- Create a detailed reference architecture that complies with relevant standards and best practices
- Verify adapted services against the requirements and specifications before developing for pilot sites to WP4

The starting point is analysis of the State of the Art within Consortium to identify the IT system implemented, technological innovations existing in the current IT system, the main services / modules available (booking & payment, info mobility, etc.), and flexibility of the existing systems to allow the integration into E-CHAIN platform.

3. CURRENT TRAVEL PLANNING SYSTEM

3.1. ORGANIZATIONAL AND FUNCTIONAL DESCRIPTION

The city of Ancona is a port city located on the northern Adriatic coast of Italy and it is the capital city of the Marche Region. Its port is also one of the main ports on the Adriatic Sea, especially for passenger traffic, fishing and cargo. It has a key function in the Adriatic Ionian Region as terminal of international ferry routs to Croatia as well as to Albania and Greece.

The Municipality of Ancona is involved in many ways on the traffic management and planning also around the port area in order to reduce the environmental, congestion, pollution and other impacts that it may cause. For that purpose, the municipality is defining a new transport management plan that will be extended to the whole municipal area.

The Municipality of Ancona is the major stakeholder of the local public transport company called "Conerobus S.p.A". It is directly involved in the administration of the company that includes the management of a great part of the public urban and suburban transport, within the territory of the Province of Ancona. There are two info and ticket points, managed by the Conerobus, set in the Ancona urban area.

Furthermore, the company Conerobus is operating within the Ancona Port Area too, through a free transport service for passengers provided by Port Authority. The free bus service connects the embarking area with the Ferries check-in and luggage terminal. The information and paper timetables are posted at the relevant bus stops shelters.

3.2. TECHNICAL DESCRIPTION

3.2.1. MAIN SERVICES/MODULES

Conerobus has three main services to sell: **single ticket**, season ticket and package tickets.

For E-CHAIN project we analyse only the first one because the others are focused on resident's needs.

Focusing on Ancona's port area we found 3 different bus lines operating in this area:

Number 10:

Linea 10	P.zza Ugo Bassi - Cantiere			
	Orario Feriale Scuole Aperte			
Piazza Ugo Bassi	05.00	05.20		
Via Bruno - Enel	05.03	05.23		
Stazione FS Centrale	05.05	05.25	13.00	13.20
Via Marconi - Piazzale Italia	05.06	05.26	13.03	13.23
Via Marconi - Parcheggio Archi	05.07	05.27	13.04	13.24
Cantiere Navale	05.10	05.30	13.10	13.30

Linea 10	Cantiere - P.zza Ugo Bassi		
	Orario Feriale Scuole Aperte		
Note		V1	
Cantiere Navale	13.45	14.05	16.55
Via Marconi - Parcheggio Archi	13.50	14.10	17.00
Stazione FS Centrale	13.53	14.13	17.03
	V1) Escluso: SAB		

This line is a TPL (trasporto pubblico locale) line and start from Ugo Bassi Square, passing through the main railway station and the biggest long stay car parking ending at the main Shipyard that is at the end of the commercial docks. This line is not so used by port passengers because it does not reach the maritime station and check in terminal where customers have to come to receive their embarkation documents.

Number 12:

Linea 12	Stazione - Terminal Biglietterie - Stazione		
	Orario Feriale		
Note			
Stazione FS Centrale	06.19	06.40	13.48
Via Marconi - Piazzale Italia	06.21	06.42	13.50
Via Marconi - Parcheggio Archi	06.23	06.44	13.51
Terminal Biglietterie			13.53
Via Mattei - CRN	06.29	06.50	13.55
Stazione FS Centrale	06.34	06.55	14.03

This line is also a TPL one and starts from the main railway station, passing through the biggest long stay parking and reach the maritime station and Check-in terminal. We can affirm that it is the most interesting line for potential port customers. The above reported timetable is containing few rides due to the winter low season and the reduced number of arrivals/departures of ferries.

We report below, as an example, the timetable for the summer season, August 15th, where we find out a huge number or rides to support the port area.

Linea 12	Stazione - Terminal Biglietterie - Stazione																							
	Orario Ferragosto																							
Stazione FS Centrale	08.00	08.20	08.40	09.00	09.20	09.40	10.00	10.20	10.40	11.00	11.20	11.40	12.00	12.20	12.40	13.00	13.20	13.40	14.00	14.20	14.40	15.00	15.20	15.40	16.00
Via Marconi - Piazzale Italia	08.02	08.22	08.42	09.02	09.22	09.42	10.02	10.22	10.42	11.02	11.22	11.42	12.02	12.22	12.42	13.02	13.22	13.42	14.02	14.22	14.42	15.02	15.22	15.42	16.02
Via Marconi - Parcheggio Archi	08.03	08.23	08.43	09.03	09.23	09.43	10.03	10.23	10.43	11.03	11.23	11.43	12.03	12.23	12.43	13.03	13.23	13.43	14.03	14.23	14.43	15.03	15.23	15.43	16.03
Terminal Biglietterie	08.06	08.26	08.46	09.06	09.26	09.46	10.06	10.26	10.46	11.06	11.26	11.46	12.06	12.26	12.46	13.06	13.26	13.46	14.06	14.26	14.46	15.06	15.26	15.46	16.06
Via Mattei - CRN	08.08			09.08			10.08			11.08			12.08			13.08			14.08			15.08			16.08
Stazione FS Centrale	08.11	08.31	08.51	09.11	09.31	09.51	10.11	10.31	10.51	11.11	11.31	11.51	12.11	12.31	12.51	13.11	13.31	13.51	14.11	14.31	14.51	15.11	15.31	15.51	16.11

	Orario Ferragosto										
Stazione FS Centrale	16.20	16.40	17.00	17.20	17.40	18.00	18.20	18.40	19.00	19.20	19.40
Via Marconi - Piazzale Italia	16.22	16.42	17.02	17.22	17.42	18.02	18.22	18.42	19.02	19.22	19.42
Via Marconi - Parcheggio Archi	16.23	16.43	17.03	17.23	17.43	18.03	18.23	18.43	19.03	19.23	19.43
Terminal Biglietterie	16.26	16.46	17.06	17.26	17.46	18.06	18.26	18.46	19.06	19.26	19.46
Via Mattei - CRN			17.08			18.08			19.08		
Stazione FS Centrale	16.31	16.51	17.11	17.31	17.51	18.11	18.31	18.51	19.11	19.31	19.51

These first two lines are TPL therefore the customers have to buy a ticket and pay for a ride.

As above mentioned, the Conerobus provides also a free transport service within the port area. The costs for this service are entirely sustained by the Central Adriatic Ports Authority of Ancona. The service is organised as a circle line between the Maritime station and Check-In Terminal on one side and the embarkation docks on the other. The timetable for this bus line is related to the daily request of the Ancona Port Authority, based on the number of arrivals/departures of the ships.

The timetable is printed and posted at the three main stops (on the bus shelters). There are also two electronic notice boards: the first is positioned in the “Archi” area (between the railway station and the maritime station) and the second at the maritime station itself. These notice boards are directly managed by the port authority and based on the instructions they send to Conerobus offices.

3.2.2. IT INFRASTRUCTURE

For the single tickets (lines 10 and 12) it is possible to buy them electronically through the following booking services:

- MyCicero App

- ATMA website
- SMS through Dropticket software

The first is a native App designed for residents (because you can use it for short stay parking in some spots of the city centre and near/around the city of Ancona) but can be used also by port users.

Their service is presented as below:

https://www.mycicero.it/z/ancona/

- myCicero® is the app that helps you plan your trip by integrating national connections with local public transport services and buying tickets and passes from your smartphone.

Plan your trip

Find out the best travel solution by indicating a departure address and an arrival address. You can also search for *timetables and bus stops near your destination.*

Buy the ticket

Buy the ticket by accessing the Transport - Ticket Office section, or directly from the chosen travel solution. It is possible to purchase the ticket paying by credit card (Visa and Mastercard circuits), with Satispay or by using a rechargeable credit card, Paypal, Satispay or in cash at all Sisal Pay offices.

The purchased ticket can be downloaded within the app in the Transport section and must be validated before boarding.

Travel by bus

Validate the ticket by pressing the 'Activate' button inside the ticket and framing the Qrcode positioned at the entrance to the bus or inside the bus.

Tickets that can be acquired:

Urban area Ancona

- Simple ride € 1,25

- 100 minutes valid ticket € 1,50

- 24 ore hours valid ticket € 4,00

- 7 days valid ticket € 12,00

- The second is a website of the local public transport consortium, ATMA: https://www.mycicero.it/ATMA-AN/TPWebPortal/

As you can see it use the same software of MyCicero then the two systems give the same results.

- The third service is a software that allows customers to buy a ticket by sending an SMS to a special number. This action charges your phone bill with the cost of the ticket. It seems to be the simplest solution for port customers.

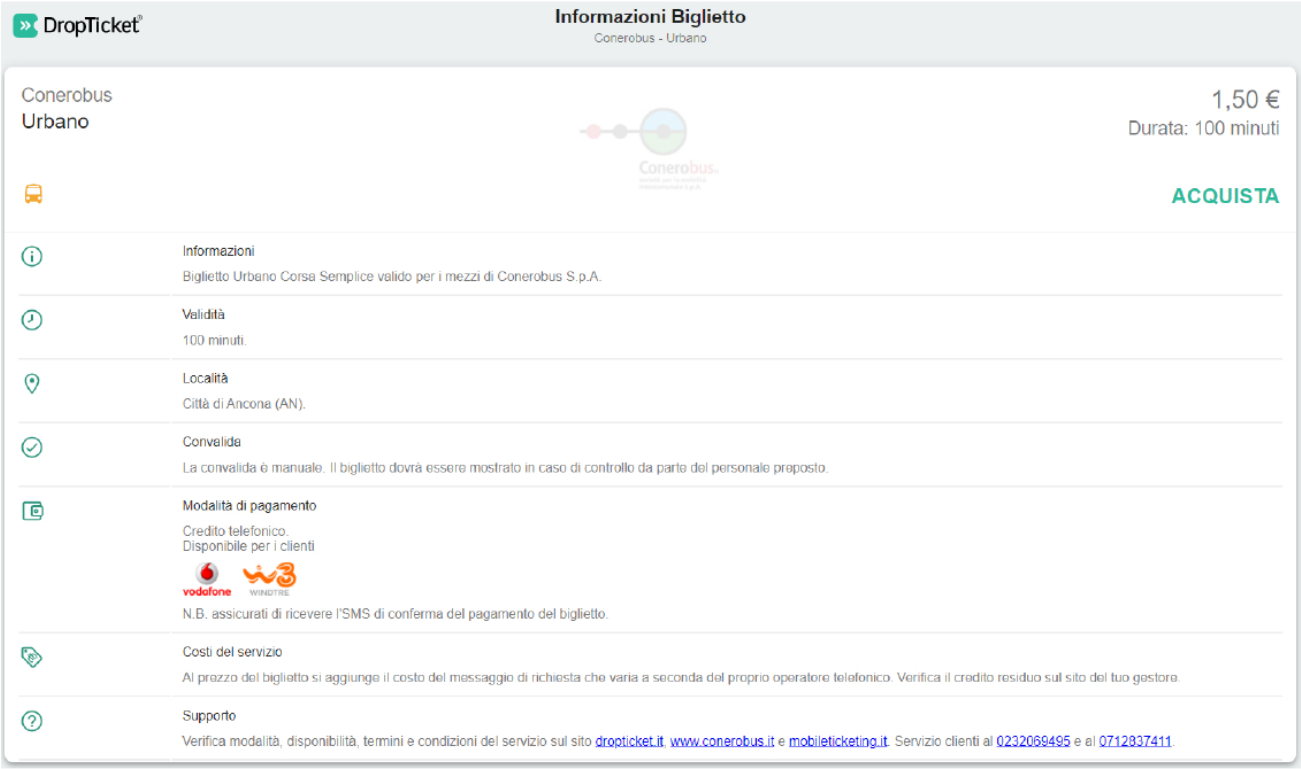
- Their service is presented as below:

But it can be a problem for foreign customers to use it because it is written that this system works with the following mobile providers:

TIM vodafone WIND Più vicini. 3 Tre.it

And we have to go-in-deep what about foreign mobile providers that are connected in roaming with one of these 4 Italian providers.

We checked also their website trying to buy a single ticket and we found as below:

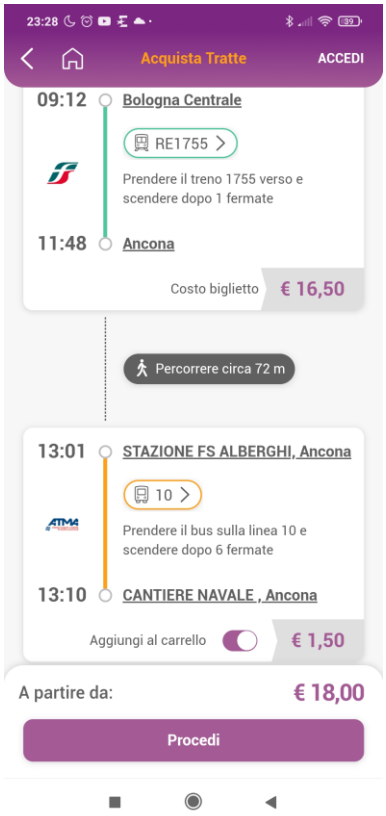


It seems that probably it does not work for foreign people.

3.2.3. INTEGRATIONS WITH OTHER SYSTEMS

There are no integrations between Conerobus single ticket and other transport booking systems instead of the use of the MyCicero's App where we find out the possibility to combine the purchase of train and bus transport.

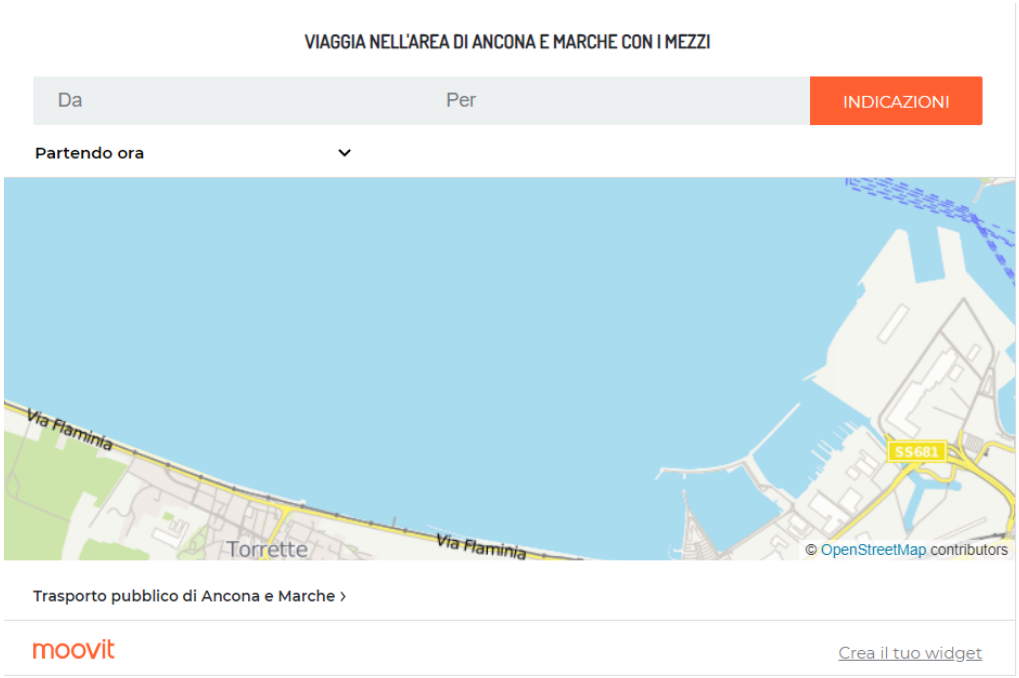
It functions as below:



Then it combines the purchase suggesting the quickest intermodal connection and helping to buy the two tickets within the same chart.

Finally, Conerobus timetable is present on the Moovit website and in Google Transit.

The first service is presented as below:



- Moovit è la **prima app per l'infomobilità al mondo** (utilizzata da oltre 1 milione di italiani), sempre disponibile e in grado di portarti da un punto all'altro della città.

- In Moovit trovi **orari, percorsi, mappe, avvisi personalizzati** e indicazioni passo passo per raggiungere le tue destinazioni.

- Attivando VoiceOver o TalkBack Moovit **consente alle persone non vedenti e ipovedenti di utilizzare tutte le funzioni della app** ascoltando le informazioni necessarie.

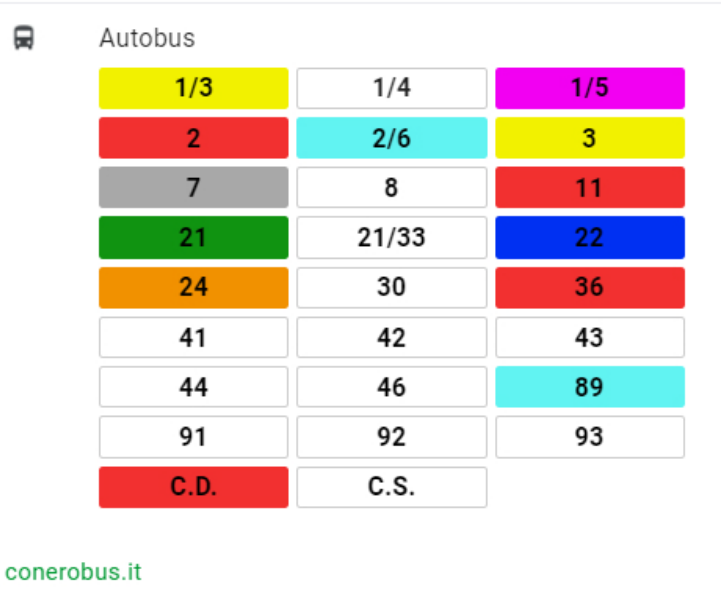
- **Notifica** anticipatamente **la fermata** di discesa.

- Moovit si avvale di una **community attiva** che fornisce utili suggerimenti.

It can be interesting to go-in-deep technically to understand which kind of data extraction can be made within this software.

The second one is the world-famous service of Google that provide transport information in Google Maps the most famous navigation App worldwide.

Checking the Google Transit website, we found as below:



No one of the 3 bus lines involved in the port area are charged on it: during the phase 3.4.1 it must be important to understand why.

4. CURRENT SYSTEM SWOT ANALYSES

Strengths:
Exclusive supplier for port bus transport
It is possible to use the service with a digital ticket
Weaknesses:
People with their own private car probably do not use local transport
The service is not well digitalized then people do not feel secure when wait
Opportunities:
Port customers can park their car somewhere in the port and use local bus transport to explore the city of Ancona (i.e., while waiting to board)
Threats:
Other ports in the Mediterranean Sea can be more digitalized and their customers' experience can be better than the one in Ancona.

D 3.1.1 – STATE OF THE ART AT TECHNICAL AND ORGANIZATIONAL LEVEL

Activity 3.1 – SoA - State of the Art

June, 2021 – Final version

Partner: PP1 – Amatori Interestate Srl
Authors: Corrado Ceccarelli
Email: c.ceccarelli@amatori.com

Project Acronym	E-CHAIN
Project ID Number	10048282
Project Title	Enhanced Connectivity and Harmonization of data for the Adriatic Intermodal Network
Priority Axis	4 - 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
Work Package Number	3
Work Package Title	Mobility Maritime Design
Activity Number	3.1
Activity Title	SoA - State of the art
Partner in Charge	PP1 – Amatori Interestate Srl
Partners involved	PP1 – Amatori Interestate Srl PP6 – Prosoft d.o.o. PP7 - Jadrolinija
Status	Final
Distribution	Public

VERSION CONTROL

Date	Version	Prepared by	Revised by	Approved by	Revision	Comment
June, 2020	Draft	Aris Grozić	Nelida Pogačić		draft	
June, 2021	Final	Corrado Ceccarelli		Nelida Pogačić	final	
June, 2022			Nelida Pogačić		Final	Cover page modified

TABLE OF CONTENTS

ACRONYMS / ABBREVIATIONS

ACRONYM	DEFINITION
SoA	State of the Art
PP	Project partners
PT	Project Team
TC	Technical task coordinator
WP	Work package
IT	Information Technologies

REFERENCE DOCUMENTATION

No	TITLE	REPORT No.	PUBLISHED BY
1	**Application Form – E-CHAIN - Enhanced Connectivity and Harmonization of data for the Adriatic Intermodal Network** 2014 - 2020 Interreg V-A Italy - Croatia CBC Programme Call for proposal 2017 Standard - E-CHAIN	Application ID: 10048282	Lead Applicant: Municipality of Ancona

1. INTRODUCTION

1.1 PURPOSE OF THE DOCUMENT

This document is relevant to the activity 3.1 SoA - State of the Art of E-CHAIN project - Enhanced Connectivity and Harmonization of data for the Adriatic Intermodal Network.

The purpose of this document is to collect detailed information on local Travel Planning systems and services being used, ITS services available and the possibility of integrating such systems in a E-CHAIN platform to offer updated – real-time – combined travel information to the travellers. The focus will be the collection of information on the current situation within Consortium through a census of transport types locally used and implemented, relative modules or software used (technology state of the art) and the interfacing with external systems (AVM, info mobility, etc). Moreover, this activity will gather all information about standard and programme languages used, the general architecture realized at local level.

A deep analysis will highlight the weakness and strength in each local environment and the outcomes will outline the specific actions needed to enhance and promote the development and integration within E-CHAIN platform.

It is the operational document for the execution of the project being used:

- by the Task Manager (TM) and Project Team (PT) to provide detailed information on current state within consortium.
- by the Activity 3.2 Stakeholders analysis (Transport needs) information needed for D 3.2.1 – Benchmark, transport needs & suppliers' roles.
- by the Activity 3.3 Technical and functional requirements to provide data needed for D 3.3.1 – Use case scenarios selection and preliminary requirements definition for defining starting level of mobility services for scenarios and D 3.3.2 – Technical and non-technical requirements for information on current operational systems capabilities.

2. BACKGROUND INFORMATION

E-CHAIN (Enhanced Connectivity and Harmonization of data for the Adriatic Intermodal Network) main objective is to enhance connectivity and harmonization of data for the Adriatic Intermodal Network, through the realization of a modular integrated software (E-CHAIN platform) for the management of intermodal transport services in port areas for passenger transport. To enhance the current situation, E-CHAIN will focus on providing new services such as an improved Port multimodal info mobility system for the passengers, a ticketing system integrated with other transport modes, an advanced touristic co-marketing tool for the operators. These services will be designed and deployed in the selected pilot sites (Ancona, Split and Venice). A Business model suited to adapt the technology developed in the three applicative contexts will be created and specific needs will be taken into account.

The aim of WP3 is to design platform and services and to prepare the E-CHAIN services for deployment in the pilot sites (Ancona, Split and Venice).

The specific objectives of this WP are to:

- Establish the requirements and specifications for E-CHAIN services and for integration with existing services/systems
- Create a detailed reference architecture that complies with relevant standards and best practices
- Verify adapted services against the requirements and specifications before developing for pilot sites to WP4

The starting point is analysis of the State of the Art within Consortium to identify the IT system implemented, technological innovations existing in the current IT system, the main services / modules available (booking&payment, infomobility, etc.), and flexibility of the existing systems to allow the integration into E-CHAIN platform.

3. CURRENT TRAVEL PLANNING SYSTEM

3.1. ORGANIZATIONAL AND FUNCTIONAL DESCRIPTION

Amatori Interestate Srl is a Ship Agency covering any kind of service which can be granted to shipowners and to ships in port or ashore: ship agency and ship husbandry, loading and unloading of cargoes, loading and unloading of RO-RO vessels, booking and ticketing for passengers and vehicles, embarkations and disembarkations, etc.

We are agents for "JADROLINIJIA", liner company of ferry boats between Ancona and Bari and the Croatian ports of Split, Starigrad,Zadar and Dubrovnik. As Port Agent of Jadrolinija we take care of all the needs of the passangers: from the first information about timetables and tariffs till the procedures of check in and embarkation on the vessel.

Our offices are located in the port area: at the Maritime Station and in the main entrance to the port with 6 doors at street level.

We own also other offices and stores located in the port area. Our staff is presently in the number of 30 persons and is particularly experienced in maritime, touristic and in logistic business.

We menage about 10.000 reservations per year (pre-covid) and make check in to about 50.000 passengers departing form Ancona to Split/Zadar with Jadrolinija ferries.

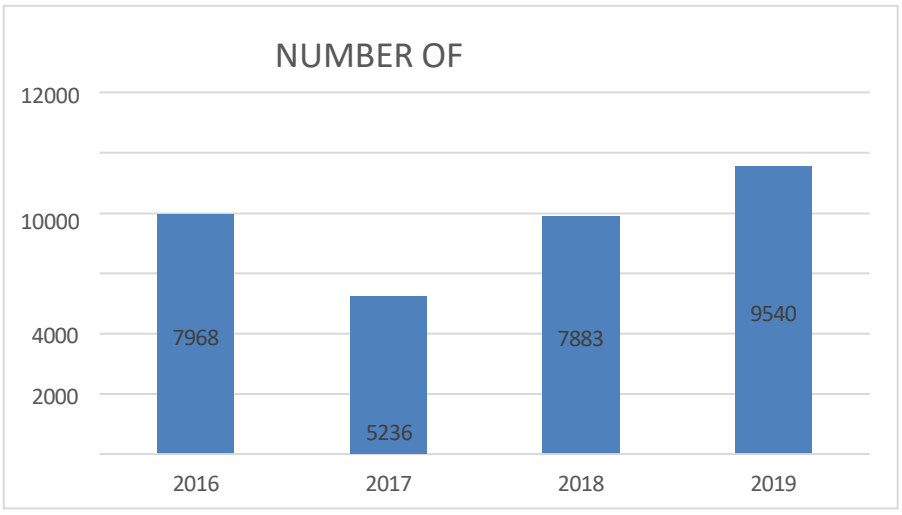


Figure 1

JADROLINIJA - ANCONA-SPALATO ROUTE										
Paasengers embarked in Ancona										
	Bus	Camion	Camper	Moto	Bici	Auto	Trailer	Roulotte	Totale Veicoli	Totale Passeggeri
2018	267	2285	260	1225	188	5889	76	31	10221	40276
2019	247	2001	320	1523	198	7366	94	17	11766	46395
2020	2	1330	57	118	24	1650	34	4	3219	8178

Figure 2

Amatori also operates as a specialized Tour Operator in the Balkans, in particular Croatia, Slovenia, Bosnia and Montenegro. The Amatori staff boasts an in-depth knowledge of these lands and organizes holidays in the name of quality and sustainability. Customers, whether they are agencies or individuals, can always count on the accuracy of the information, the variety of offers and constantly updated communication.

Since 2001 Amatori has been certified by RINA / CISQ with the ISO 9001: 2000 QUALITY CERTIFICATION, confirming constant attention to customer needs and continuous improvement of the quality standards of the services offered.

3.2. TECHNICAL DESCRIPTION

3.2.1. MAIN SERVICES/MODULES

Main services we provide are:

1) Information
2) Reservations
3) Ticketing
4) Check-in at Maritime Station of Ancona Port

All the **information** is provided by mail, telephone, chat and in person by our operators.

Our offices are open from Monday to Friday from 09.00 to 13.00 and from 15.00 to 19.00. The check-in and ticket office is always open at least 4 hours before the departure of the ship. All the operators con provide info in Italian, English or Croatian.

Reservations/Tickets can be made by mail, telephone, website, chat or in person at our ticket offices in the city centre and inside the maritime Station. Passengers can also book our services through one of our 3000 partner travel agencies.

With reference to our cancellation policy, the cancellation of a voyage or its portion should be done prior to departure. A refund for an unused ticket or an unused portion of the voyage will be done by the agency that issued the ticket, provided that the date of cancellation is duly confirmed in writing by an authorised office (travel agency or port agent). For cancelled tickets, passengers shall be refunded the cost of their trip less the following charges:

Prior to Departure	Charge
Up to 22 days	10%
8 - 21 days	20%
1 - 7 days	30%
On the day of departure	100%

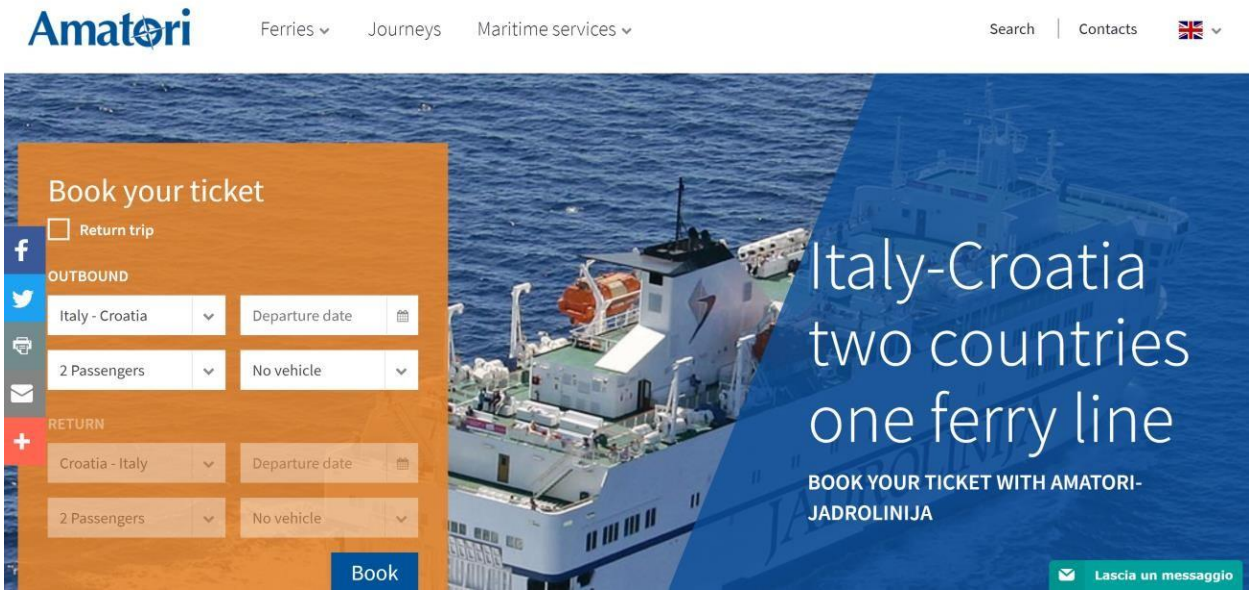
Figure 3

Fares paid for meals are refundable without any charges. Should the passenger quit the voyage in any of the ports on the route, or in case of a non-cancelled reservation or NO SHOW, a 100% charge is applied.

Claims are accepted at the latest 15 days after the end of the trip.

One change of the date of the voyage is allowed free of charge, except for commercial vehicles on the day of departure.

Check in is to be done compulsory at the Maritime Station of the departure port. Online check in is not allowed.



3.2.2. IT INFRASTRUCTURE

Ticketing and Check in are made with Voyager a Client/Server application provided by Jadrolinija Company.

Reservations are made with Voyager + Our own Management Software (Team System Solution)

Passengers con book also through our web site www.amatori.com that use the APIs made available by the Company.

For technical details refer to the document *D 3.1.1 - State of the Art_Amatori_Annex.pdf*.

3.2.3. INTEGRATIONS WITH OTHER SYSTEMS

At the moment our system is integrated just with Jadrolinija system but we can easily provide APIs to other stakeholders or partners.

The analysis shows that we could integrate with:

- Port of Ancona (https://www.porto.ancona.it/it/): Here, infact, it is possible to find some useful information for the passengers about port community system, safety rules, real time news, etc. However, the website is only in Italian language.
- Taxi Ancona service (http://www.taxi-ancona.it/)
- Ancona Parcheggi (http://www.anconaparcheggi.it/): the society that manages parkings in Ancona. However, the website is only in Italian language
- Aeroporto delle Marche Airport (http://www.marcheairport.com/en)

4. CURRENT SYSTEM SWOT ANALISYS

We've used SWOT Analysis to assess our organization's current position. ***SWOT*** stands for Strengths, Weaknesses, Opportunities, and Threats.

STRENGHTS	**WEAKNESSES**
• Stability • Experience and deep knowledge of the market	• Rigidity • Length of development time • Refunds must be made manually by an operator in the office • The user cannot independently make cancellations and changes
OPPORTUNITIES	**THREATS**
• Use of text Apps and geo-ref apps in transports and travel • Digitalization and decarbonization	• High rate of obsolescence in software travel solutions

Figure 5

D 3.1.1 – STATE OF THE ART AT TECHNICAL AND ORGANIZATIONAL LEVEL

Activity 3.1 – SoA - State of the Art

June, 2021 - Version final

Partner: PP2 – Brusutti srl
Authors: Marco Cocciarini, Federica Gervasoni
Email: admin@globeinside.com; federicagervasoni@brusutti.com

Project Acronym	E-CHAIN
Project ID Number	10048282
Project Title	Enhanced Connectivity and Harmonization of data for the Adriatic Intermodal Network
Priority Axis	4 - 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
Work Package Number	3
Work Package Title	Mobility Maritime Design
Activity Number	3.1
Activity Title	SoA - State of the art
Partner in Charge	PP2 - Brusutti
Partners involved	PP2 - Brusutti PP6 – Prosoft d.o.o.
Status	Final
Distribution	Public

VERSION CONTROL

Date	Version	Prepared by	Revised by	Approved by	Revision	Comment
December, 2020	Draft	Federica Gervasoni	Marco Cocciarini		draft	
June, 2021	Final		Nelida Pogačić	Aris Grozić	final	
June, 2022	Final		Nelida Pogačić		final	Cover Page template changed

TABLE OF CONTENTS

ACRONYMS / ABBREVIATIONS

ACRONYM	DEFINITION
SoA	State of the Art
PP	Project partners
PT	Project Team
TC	Technical task coordinator
WP	Work package
IT	Information Technologies

REFERENCE DOCUMENTATION

No	TITLE	REPORT No.	PUBLISHED BY
1	**Application Form – E-CHAIN - Enhanced Connectivity and Harmonization of data for the Adriatic Intermodal Network** 2014 - 2020 Interreg V-A Italy - Croatia CBC Programme Call for proposal 2017 Standard - E-CHAIN Priority Axis: Maritime transport	Application ID: 10048282	Lead Applicant: Municipality of Ancona

1. INTRODUCTION

1.1 PURPOSE OF THE DOCUMENT

This document is relevant to the activity 3.1 SoA - State of the Art of E-CHAIN project - Enhanced Connectivity and Harmonization of data for the Adriatic Intermodal Network.

The purpose of this document is to collect detailed information on local Travel Planning systems and services being used, ITS services available and the possibility of integrating such systems in a E-CHAIN platform to offer updated – real-time – combined travel information to the travellers. The focus will be the collection of information on the current situation within Consortium through a census of transport types locally used and implemented, relative modules or software used (technology state of the art) and the interfacing with external systems (AVM, info mobility, etc). Moreover, this activity will gather all information about standard and programme languages used, the general architecture realized at local level.

A deep analysis will highlight the weakness and strength in each local environment and the outcomes will outline the specific actions needed to enhance and promote the development and integration within E-CHAIN platform.

It is the operational document for the execution of the project being used:

- by the Task Manager (TM) and Project Team (PT) to provide detailed information on current state within consortium.
- by the Activity 3.2 Stakeholders analysis (Transport needs) information needed for D 3.2.1 – Benchmark, transport needs & suppliers' roles.
- by the Activity 3.3 Technical and functional requirements to provide data needed for D 3.3.1 – Use case scenarios selection and preliminary requirements definition for defining starting level of mobility services for scenarios and D 3.3.2 – Technical and non-technical requirements for information on current operational systems capabilities.

2. BACKGROUND INFORMATION

E-CHAIN (Enhanced Connectivity and Harmonization of data for the Adriatic Intermodal Network) main objective is to enhance connectivity and harmonization of data for the Adriatic Intermodal Network, through the realization of a modular integrated software (E-CHAIN platform) for the management of intermodal transport services in port areas for passenger transport. To enhance the current situation, E-CHAIN will focus on providing new services such as an improved Port multimodal info mobility system for the passengers, a ticketing system integrated with other transport modes, an advanced touristic co-marketing tool for the operators. These services will be designed and deployed in the selected pilot sites (Ancona, Split and Venice). A Business model suited to adapt the technology developed in the three applicative contexts will be created and specific needs will be taken into account.

The aim of WP3 is to design platform and services and to prepare the E-CHAIN services for deployment in the pilot sites (Ancona, Split and Venice).

The specific objectives of this WP are to:

- Establish the requirements and specifications for E-CHAIN services and for integration with existing services/systems
- Create a detailed reference architecture that complies with relevant standards and best practices
- Verify adapted services against the requirements and specifications before developing for pilot sites to WP4

The starting point is analysis of the State of the Art within Consortium to identify the IT system implemented, technological innovations existing in the current IT system, the main services / modules available (booking&payment, info-mobility, etc.), and flexibility of the existing systems to allow the integration into E-CHAIN platform.

3. CURRENT TRAVEL PLANNING SYSTEM

3.1. ORGANIZATIONAL AND FUNCTIONAL DESCRIPTION

Brusutti is a bus company based in Tessera (Venezia) and is boasts a roster of consolidated activities about Passenger transport, which is the core business of the company, as public transport on the routes to the Dolomites, the regional ports and airports, as well as Croatia. Today the main services are diversified into Airport Parking, Hiring Coach, the lines to the Dolomites and two ticket point, one of them working as travel agency, in Venice.

Brusutti is looking forward to invest in commercial lines, in consideration of the growth of users of airports or intermodal hubs. One of these lines is already operative and highly popular, connecting Venice city centre to Treviso Airport, in collaboration with Ryanair Airlane Company and our partner ATVO S.p.A., a limited company with mainly public capital.

It is the company's policy to create a diversified offer of tourist services dedicated both to B2B and B2C with data management and services offered as follow:

- Road passenger transport with a fleet of 27 buses and 1337 seats in total;
- 5 Public passenger transport lines on urban and long-distance routes to the Dolomites;
- 3.640.776,00 euro of annual turnover about road passenger transport;
- 1 carpark with 699 seats in total for an annual turnover of 1.052.055,00;
- 2 ticket office in Venice, nearby Cruise Terminal, with information services, ticketing and touristic products for final customers;

3.2. TECHNICAL DESCRIPTION

3.2.1. MAIN SERVICES/MODULES

Brusutti company has two physical point of sale in Venice and a web shop on his own website. All of them work with the same ticketing software that produce an electronic ticket for each customer (1.164 tickets in total sold in the ticket points, and 1.279 ticket sold on the Net).

3.2.2. IT INFRASTRUCTURE

The ticketing software is located into a private section of a cloud server, with an automatic backup every week.
The OS platform used is Linux with Mysql DB platform.
The ticket identification system works checking through a QR code scan device.

3.2.3. INTEGRATIONS WITH OTHER SYSTEMS

The integration with other systems is possible through API.

4. CURRENT SYSTEM SWOT ANALYSES

Strengths:

- Within the Bus Control ticketing software is possible to check the sales of all sales channels (ticket offices, web, device);
- Ticketing operators can make cancellations and changes quickly and easily;
- The sale of tickets can also be allowed last minute on board from a device;

Weaknesses:
- Refunds must be made manually by an operator in the office;
- The user cannot independently make cancellations and changes;
- Devices can run out on long journeys (for example 4 hours to the Dolomites) creating discomfort for users;
- Rigidity and absence of qualified internal staff dedicated to IT implementations

Opportunities:
- Veneziadolomiti.com is a virtuous experience of integration with other carriers so this is technically possible;

Threats:
- It is not possible to integrate with other local intermodal carriers because they do not permit it to others except in specific projects (such as Veneziadolomiti.com);
- The sale of ACTV and ATVO products is always possible but offline using their sales systems individually;
-

D 3.1.1 – STATE OF THE ART AT TECHNICAL AND ORGANIZATIONAL LEVEL

Activity 3.1 – SoA - State of the Art

June, 2021 - Version final

Partner: PP3 – GMT SpA
Authors: Emanuele Giglio, Giovanni Massimiliano Lanzillotta
Email: giglio@gmtspa.it; lanzillotta@gmtspa.it;

Project Acronym	E-CHAIN
Project ID Number	10048282
Project Title	Enhanced Connectivity and Harmonization of data for the Adriatic Intermodal Network
Priority Axis	4 - 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
Work Package Number	3
Work Package Title	Mobility Maritime Design
Activity Number	3.1
Activity Title	SoA - State of the art
Partner in Charge	PP3 - G.M.T. S.P.A.
Partners involved	PP3 - G.M.T. S.P.A. PP6 – Prosoft d.o.o. PP7 - Jadrolinija
Status	Final
Distribution	Public

VERSION CONTROL

Date	Version	Prepared by	Revised by	Approved by	Rev	Comment
December, 2020	Draft	Giovanni Massimiliano Lanzillotta	Emanuele Giglio		draft	
June, 2021	Final	Giovanni Massimiliano Lanzillotta	Emanuele Giglio	Aris Grozić	final	
June, 2022	Final		Nelida Pogačić		final	Cover Page Template changed

TABLE OF CONTENTS

ACRONYMS / ABBREVIATIONS

ACRONYM	DEFINITION
SoA	State of the Art
PP	Project partners
PT	Project Team
TC	Technical task coordinator
WP	Work package
IT	Information Technologies

REFERENCE DOCUMENTATION

No	TITLE	REPORT No.	PUBLISHED BY
1	**Application Form – E-CHAIN - Enhanced Connectivity and Harmonization of data for the Adriatic Intermodal Network** 2014 - 2020 Interreg V-A Italy - Croatia CBC Programme Call for proposal 2017 Standard - E-CHAIN	Application ID: 10048282	Lead Applicant: Municipality of Ancona

1. INTRODUCTION

1.1 PURPOSE OF THE DOCUMENT

This document is relevant to the activity 3.1 SoA - State of the Art of E-CHAIN project - Enhanced Connectivity and Harmonization of data for the Adriatic Intermodal Network.

The purpose of this document is to collect detailed information on local Travel Planning systems and services being used, ITS services available and the possibility of integrating such systems in a E-CHAIN platform to offer updated – real-time – combined travel information to the travellers. The focus will be the collection of information on the current situation within Consortium through a census of transport types locally used and implemented, relative modules or software used (technology state of the art) and the interfacing with external systems (AVM, info mobility, etc). Moreover, this activity will gather all information about standard and programme languages used, the general architecture realized at local level.

A deep analysis will highlight the weakness and strength in each local environment and the outcomes will outline the specific actions needed to enhance and promote the development and integration within E-CHAIN platform.

It is the operational document for the execution of the project being used:

- by the Task Manager (TM) and Project Team (PT) to provide detailed information on current state within consortium.
- by the Activity 3.2 Stakeholders analysis (Transport needs) information needed for D 3.2.1 – Benchmark, transport needs & suppliers' roles.
- by the Activity 3.3 Technical and functional requirements to provide data needed for D 3.3.1 – Use case scenarios selection and preliminary requirements definition for defining starting level of mobility services for scenarios and D 3.3.2 – Technical and non-technical requirements for information on current operational systems capabilities.

2. BACKGROUND INFORMATION

E-CHAIN (Enhanced Connectivity and Harmonization of data for the Adriatic Intermodal Network) main objective is to enhance connectivity and harmonization of data for the Adriatic Intermodal Network, through the realization of a modular integrated software (E-CHAIN platform) for the management of intermodal transport services in port areas for passenger transport. To enhance the current situation, E-CHAIN will focus on providing new services such as an improved Port multimodal info mobility system for the passengers, a ticketing system integrated with other transport modes, an advanced touristic co-marketing tool for the operators. These services will be designed and deployed in the selected pilot sites (Ancona, Split and Venice). A Business model suited to adapt the technology developed in the three applicative contexts will be created and specific needs will be taken into account.

The aim of WP3 is to design platform and services and to prepare the E-CHAIN services for deployment in the pilot sites (Ancona, Split and Venice).

The specific objectives of this WP are to:

- Establish the requirements and specifications for E-CHAIN services and for integration with existing services/systems
- Create a detailed reference architecture that complies with relevant standards and best practices
- Verify adapted services against the requirements and specifications before developing for pilot sites to WP4

The starting point is analysis of the State of the Art within Consortium to identify the IT system implemented, technological innovations existing in the current IT system, the main services / modules available (booking&payment, info-mobility, etc.), and flexibility of the existing systems to allow the integration into E-CHAIN platform.

3. CURRENT TRAVEL PLANNING SYSTEM

3.1. ORGANIZATIONAL AND FUNCTIONAL DESCRIPTION

GMT is an ESCo (Energy Service Company) based in Padova and operates in the sector of energy efficiency and renewable energy installations since 2004. The company is active on the national stage in the application of efficient technologies for the rational use of energy in order to reduce energy consumption and help achieve the objectives of the Kyoto Protocol and the European Climate-Energy Package goal 20/20/20.

G.M.T. SpA seeks to achieve the highest standards of quality, inspiring its business to the principles of sustainable development that involves both the scope of the energy savings and the development of alternative energy in this project, involving all the management, employees and the Customer which for GMT is a partner in the development and implementation of interventions.

From 2016, with the collaboration of the "Politecnico di Milano" and "Università di Padova", the R&D branch of GMT started to develop two new projects:

- "ZapGrid" – in the smart mobility field. A system designed in order to manage the charging infrastructure for electric car. Besides allowing the management and the control of the charging infrastructure, it helps the users charging their electrical devices with a simple and intuitive approach. The system consists of three macro sections, each one characterised by different functionality based on need of the users: the Managers – the Maintenance Managers and - the final user; the first two will be able to manage the individual stations/charge box and to view all the data related to the top-up recharges through the use of a webApp (web computing platform), while the owner of the electrical car will be able to download a free appMobile which makes the individuation of the recharging stations and their use much easier.
- "Nigel" – in the smart energy field. This EMS (Energy Management System) platform allows the integration of data coming from any open-source system, giving the customer the possibility of having full control of the quantities of interest. Access through Cloud

allows the visualization of data in real time and the possibility of receiving alerts in the event of values out of scale. Thanks to machine learning algorithms it is possible to carry out predictive analysis functional to the knowledge of the functioning of the machines and to the planning of maintenance interventions with consequent reduction of costs and inefficiencies.

Both projects brought to GMT very useful skills regarding the role of GMT inside the E-Chain project

3.2. TECHNICAL DESCRIPTION

3.2.1. MAIN SERVICES/MODULES

GMT company has two offices, one in Veneto and the other one in Puglia. The Zapgrid platform manage 160 recharge point for electric vehicle placed in 80 different station all over Italy, with 2.750 that used the system 10.400 times in 2020. The Nigel platform manage to collect data from different type of equipment installed in 110 different locations in Italy from different types of companies (GDO, warehouse, factory…).

3.2.2. IT INFRASTRUCTURE

The software is located into a private section of a cloud server, with an automatic backup every week.
The OS platform used is Linux with PHP and Python platform.
The payments for the recharge trough the ZapGrid platform are managed using the BrainTree system of PayPal, that allowed to use PayPal accounts or credit cards to pay.
The identification system works in a different way, using the gps from the portable device, checking through a QR code scan device or using the ID of the used device.

3.2.3. INTEGRATIONS WITH OTHER SYSTEMS

The integration with other systems is possible through API.

4. CURRENT SYSTEM SWOT ANALYSES

Strengths:

- data collected from a very different type of sources are easily managed to create verified database ready to be analysed
- the payments for the very different type of services are managed by the BrainTree system of PayPal and goes directly from the customers to the owners of the services
- the position of the customers is checked using the GPS system of their mobile devices, so we can offer the best services close to them

Weaknesses:

- Absence of a 24/7 call centre service that can help customers
- Only digital payments (credit cards, PayPal accounts) are allowed

Opportunities:

- Municipality is working hard to digitalize different type of services for passengers departing, crossing-by or arriving at Venice;

Threats:

- It will be difficult to include in the project many different local intermodal carriers in Venice because they are scared to share a platform for the same services with their competitors;

D 3.1.1 – STATE OF THE ART AT TECHNICAL AND ORGANIZATIONAL LEVEL

Activity 3.1 – SoA - State of the Art

June, 2022 - Version final

Partner: PP5 – Jadrolinija d.d.
Authors: Saša Aksentijević, PhD, Aksentijevic Forensics and Consulting, Ltd.
Email: sasa.aksentijevic@ict-forensics-consulting.com

Project Acronym	E-CHAIN
Project ID Number	10048282
Project Title	Enhanced Connectivity and Harmonization of data for the Adriatic Intermodal Network
Priority Axis	4 - 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
Work Package Number	3
Work Package Title	Mobility Maritime Design
Activity Number	3.1
Activity Title	SoA - State of the art
Partner in Charge	PP7 - Jadrolinija
Partners involved	PP7 - Jadrolinija PP6 – Prosoft d.o.o.
Status	Final
Distribution	Public

VERSION CONTROL

Date	Version	Prepared by	Revised by	Approved by	Revision	Comment
March, 2021	Draft	Saša Aksentijević	Vanja Svetina	Vanja Svetina	draft	
June, 2022	Final		Nelida Pogačić		final	Cover page changed

DISCLAIMER

This document reflects the author's views; the Programme authorities are not liable for any use that may be made of the information contained therein.

TABLE OF CONTENTS

ACRONYMS / ABBREVIATIONS

ACRONYM	DEFINITION
SoA	State of the Art
PP	Project partners
PT	Project Team
TC	Technical task coordinator
WP	Work package
IT	Information Technologies

REFERENCE DOCUMENTATION

No	TITLE	REPORT No.	PUBLISHED BY
1	**Application Form – E-CHAIN - Enhanced Connectivity and Harmonization of data for the Adriatic Intermodal Network** 2014 - 2020 Interreg V-A Italy - Croatia CBC Programme Call for proposal 2017 Standard - E-CHAIN	Application ID: 10048282	Lead Applicant: Municipality of Ancona

1. INTRODUCTION

1.1 PURPOSE OF THE DOCUMENT

This document is relevant to the activity 3.1 SoA - State of the Art of E-CHAIN project - Enhanced Connectivity and Harmonization of data for the Adriatic Intermodal Network.

The purpose of this document is to collect detailed information on local Travel Planning systems and services being used, ITS services available and the possibility of integrating such systems in a E-CHAIN platform to offer updated – real-time – combined travel information to the travellers. The focus will be the collection of information on the current situation within Consortium through a census of transport types locally used and implemented, relative modules or software used (technology state of the art) and the interfacing with external systems (AVM, info mobility, etc). Moreover, this activity will gather all information about standard and programme languages used, the general architecture realized at local level.

A deep analysis will highlight the weakness and strength in each local environment and the outcomes will outline the specific actions needed to enhance and promote the development and integration within E-CHAIN platform.

It is the operational document for the execution of the project being used:

- by the Task Manager (TM) and Project Team (PT) to provide detailed information on current state within consortium.
- by the Activity 3.2 Stakeholders analysis (Transport needs) information needed for D 3.2.1 – Benchmark, transport needs & suppliers' roles.
- by the Activity 3.3 Technical and functional requirements to provide data needed for D 3.3.1 – Use case scenarios selection and preliminary requirements definition for defining starting level of mobility services for scenarios and D 3.3.2 – Technical and non-technical requirements for information on current operational systems capabilities.

2. BACKGROUND INFORMATION

E-CHAIN (Enhanced Connectivity and Harmonization of data for the Adriatic Intermodal Network) main objective is to enhance connectivity and harmonization of data for the Adriatic Intermodal Network, through the realization of a modular integrated software (E-CHAIN platform) for the management of intermodal transport services in port areas for passenger transport. To enhance the current situation, E-CHAIN will focus on providing new services such as an improved Port multimodal info mobility system for the passengers, a ticketing system integrated with other transport modes, an advanced touristic co-marketing tool for the operators. These services will be designed and deployed in the selected pilot sites (Ancona, Split and Venice). A Business model suited to adapt the technology developed in the three applicative contexts will be created and specific needs will be taken into account.

The aim of WP3 is to design platform and services and to prepare the E-CHAIN services for deployment in the pilot sites (Ancona, Split and Venice).

The specific objectives of this WP are to:

- Establish the requirements and specifications for E-CHAIN services and for integration with existing services/systems
- Create a detailed reference architecture that complies with relevant standards and best practices
- Verify adapted services against the requirements and specifications before developing for pilot sites to WP4

The starting point is analysis of the State of the Art within Consortium to identify the IT system implemented, technological innovations existing in the current IT system, the main services / modules available (booking&payment, infomobility, etc.), and flexibility of the existing systems to allow the integration into E-CHAIN platform.

3. CURRENT TRAVEL PLANNING SYSTEM

Analysis of the characteristics of the currently used travel planning system consists of the organizational and functional description of the used system and its technical description. Technical description will briefly outline its main services and modules, used IT infrastructure and integrations with other systems. Furthermore, SWOT analysis will be performed of the existing system in order to identify main strengths, weaknesses and threats and opportunities arising from them. Remainder of the document will be presented in outlined fashion.

3.1. ORGANIZATIONAL AND FUNCTIONAL DESCRIPTION

Jadrolinija is Croatia's largest liner shipping company for the maritime transport of passengers and vehicles, with a hundred-year long tradition.[1]

The Company was founded on 20th January 1947 in Rijeka, Croatia as a successor of various mergers of small-sized shipowners having taken place since 1872.

Jadrolinija is one of Croatia's oldest shipping transport companies. Legally, Jadrolinija was established on 20 January 1947 in Rijeka as the company Jadranska linijska plovidba, a successor to Jadranska plovidba d.d., part of Dubrovačka plovidba and the remainder of Zetska plovidba. Prior to the war, Jadranska plovidba also arose through the merger of several small coastal shipping companies after the fall of the Austro-Hungarian Empire, and those previous shipping companies arose from other mergers, and so on, all the way back to 1872.

It was in that year at the initiative of the Senj shipping company that the steamboat Hrvat was ordered from the Stabilimento Tecnico in Rijeka (at that time a torpedo factory, later Torpedo). The ship was launched in the sea on 13 July that same year, and already on 4 September made its trial voyage from Rijeka to Senj. Immediately afterwards, the ship Hrvat established a regular sailing line between Senj and Rijeka, stopping in the ports at Novi, Selce, Crikvenica, Voz, Kraljevica and Bakar.

[1] https://www.jadrolinija.hr/en/about-us/about-jadrolinija/personal-data-on-jadrolinija (accessed: 20th March 2021.)

Even prior to 1872, there were attempts to organise transport and excursion shipping (Lloyd's rail and excursions - Arciduco Lodovico 1837 railway Trieste – Dubrovnik – Kotor, with stops in Rijeka and the railway for Rijeka, excursions in Bakar and Krk in 1845 and 1846).

At the end of the 19th century, several Croatian ship owners merged into a new shipping company, in which the shareholders were S. Kopajtić, A Štrk, M. Polić, the Bakarčić brothers and other ship owners from Kostrena, Draga, Sušak and Istra. On 11 September 1899, they established the Austro-Croatian joint stock company, which they called Ungaro-Croata. This was the first modern shipping company, virtually entirely Croatian owned and which dealt with the transport of goods and passengers along the entire Adriatic and all the seas of the world. Ungaro-Croata was a very successful company, with a positive balance right up until the end of its existence in 1919.

In the period from 1902 to 1908, a number of shipping companies were established: the Croatian Steamship company at Senj, the Krk Steamship company at Šilo, the Austro-Croatian Steamboat company at Punat, and several other small shipping companies. Meanwhile, on the central and southern Adriatic, several steamship companies were established or merged together, the most significant of which was the merger into the company Dalmacija, and the development of the Dubrovnik Steamship Line, Boka Shipping and other small shipping companies.

With the breakdown of the Austro-Hungarian Empire and after years of negotiations, all the ship owners of various companies were divided and from this fleet, new shipping companies were formed in the newly established country. As such, the companies Jadranska plovidba (former Ungaro-Croata), Dalmatija, Austro-Croatian Steamship company, Coastal Steamshipping (Dubrovnik), Croatian Steamship company (Senj) and Oceanija from Trieste were merged into the company Jadranska plovidba d.d. Sušak in 1922.

Jadranska plovidba d.d. had some 70 ships for the transport of passengers and goods on Adriatic lines, and lines for Albania, Greece and Levant.

During World War II, some of the smaller ships were destroyed, and in 1947, the remaining ships were managed by the Direction of marine navigation, seated in Split, until 20 January 1947 when a new shipping company was established in Rijeka –Jadranska linijska plovidba. The new company began its activities with old ships, repaired the damaged and sunken ships, and only in 1952 did it order and receive new ships from Croatian shipyards. The first was delivered by the shipyard in Pula, later from Split, etc.

When it was established, the company had 41 ships under its command, but by the end of its first year had only 29 small coastal fleet ships. The age structure of those ships was very unfavourable. The newest

ships at that time were Bakar, Rab and Šipan, constructed in 1931 and Kotor in 1938. The remaining ships were still from the Austro-Hungarian period, built between 1891 (Trogir) and 1914 (Kupari).

For this reason, the continuity of Jadrolinija can be observed and analysed only in the context of the development of coastal shipping lines, from 1872 to the present day.

In the period from 1952 to 1960, several new ships were ordered, and old ships overhauled. In 1958, Jadrolinija had a total of 65 ships, mostly classic ships, which was partly a consequence of the traditional conception regarding the type of ships and the organised shipping line network.

In the early 1960s, ferry transport was introduced. The first ferry, Bodulka, was put into operation on 1 January 1963, and this opened a new chapter in the history of Jadrolinija, as the old ships were replaced with new, modern means of transport, and international lines were soon established.

Jadrolinija was particularly significant during the Homeland War. In the war years 1991 and 1992, Jadrolinija and its brave crew transported about 50,000 people from the occupied territories in Croatia and Bosnia-Herzegovina.

In connecting the two isolated halves of Croatia separated by war, Jadrolinija lost four ships: m/b Perast, m/t Klimno, m/t Supetar and m/t Kačjak, and 13 seamen gave their lives as a contribution for freedom.

The basic purpose of Jadrolinija is to connect major centres along the Croatian coast as well as numerous islands with the mainland. The carriage of passengers and vehicles is of seasonal character and closely

Figure 1: Head office of Jadrolinija in Rijeka, Croatia

related to the travel and tourism industry. Head office of Jadrolinija is situated in the Adriatic Pallace[2], the most representative building of Rijeka, adding since the time of its construction to the reputation of

the town as a maritime trading centre of cosmopolitan character. It was erected to seat Hungarian first shipping company founded there in 1882 under the name of 'Adria', which started its regular merchant shipping with legal capital of 2,5 million Hungarian forints and seven medium-sized vessels.

There are 3 spacious car – ferries: Marko Polo, Dubrovnik and Zadar operating on the international lines towards Italy (Ancona and Bari) and Montenegro (Bar).

Furthermore, 37 smaller car-ferries, 4 classic passenger ships and 10 catamarans that sail on the regular local car- ferry and ship lines in the Adriatic.

Jadrolinija has rendered booking and ticketing possible for its guests at their own place of residence, as its sales network comprehend all the tourists generating countries: Italy, Germany, Bosnia and Herzegovina, Slovenia, Poland, Great Britain, France, Belgium and Australia. Besides at the agencies, all the relevant information may be obtained via internet address www.jadrolinija.hr as well.[3]

Within the context of E-CHAIN project, it is important that Jadrolinija is partnered with Amatori Interestate Srl, a shipping agency that is a project partner, covering any kind of service which can be granted to shipowners and to ships in port or ashore: ship agency and ship husbandry, loading and unloading of cargoes, loading and unloading of RO-RO vessels, booking and ticketing for passengers and vehicles, embarkations and disembarkations, etc. Considering that Jadrolinija serves as a liner company of ferry boats between Ancona and Bari and the Croatian ports of Split, Starigrad, Zadar and Dubrovnik, Amatori Interstate Srl serves as a port agent of Jadrolinija, taking care of all the needs of the passengers, from the first information about timetables and tariffs until the procedures of check in and embarkation on the vessel.

The partner is managing for Jadrolinija around 10.000 reservations per year (pre-covid) and provides check in services to around 50.000 passengers departing from Ancona to Split/Zadar, using Jadrolinija's ferries.

To achieve data management, Jadrolinija is using an IT system whose description in more details follows in subsequent chapters.

[2] https://www.jadrolinija.hr/en/about-us/about-jadrolinija/history-of-jadrolinija/jadrolinija's-business-premises---the-adria-palace (accessed 20th March 2021.)
[3] https://www.jadrolinija.hr/en/about-us/about-jadrolinija/history-of-jadrolinija (accessed 20th March 2021.)

3.2. TECHNICAL DESCRIPTION

Technical description of the system entails description of main services and modules, underlying IT infrastructure and basic outlines of integration with other systems. Internet ticketing in Jadrolinija has started with a pilot project in 2013., and involved only local catamaran lines, and has since spread to all lines served.

3.2.1. MAIN SERVICES/MODULES

Systems configuration definition may be divided to several categories: technical specification of the hardware, server, network (data centre) equipment and the system software (that includes requirements for the hardware and architecture layout, network layout and suggested data centres layout required to run Jadrolinija's ticketing module, technical specification of the application system supporting described processes and technical specification of the information security, and compliance (includes information security, disaster recovery and business continuity) and suggested treatment of the intellectual property.

Two different venues to obtain tickets for services rendered by Jadrolinija will be described: **Web shop e-ticket,** and **Jadrolinija2Go** card prepaid card. Furthermore, Jadrolinija's mobile application **m-jadrolinija** will be described.

Jadrolinija operates **online Web shop** whose navigation follows usual (expected) steps assuring adequate user experience and high levels of satisfaction. The passengers access journey search form based on ports of departure and arrival and tentative voyage date, as shown in Figure 2. below.

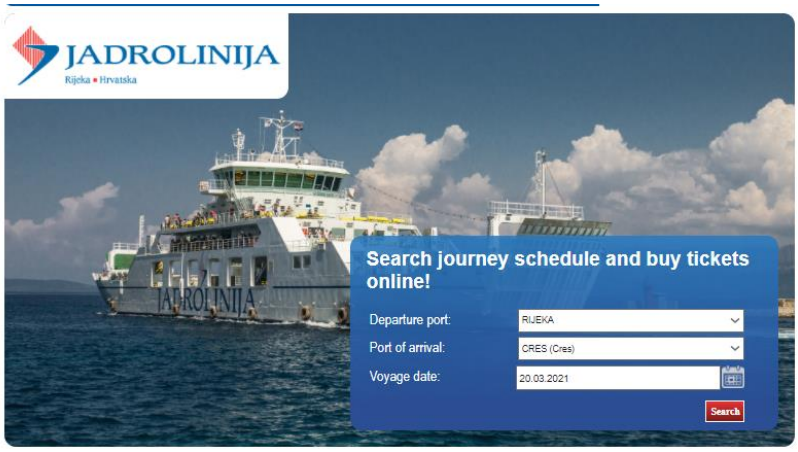


Figure 2: Step one in ticket purchase: searching for journey based on ports and desired voyage date

After this selection, different possibilities for sea voyage with timetable are displayed according to both ports (in this example, Rijeka and Cres), along with line, ship type, name, price last and option to buy each displayed voyage. This is shown in Figure 3 below.

ABOUT US | SAILING SCHEDULE | PRICES | SALES POINTS | OFFER | FAQ

Departing from **RIJEKA**	Arrival at **CRES (Cres)**	Line	Ship type	Ship name		
Sat 3/20/2021 2:30 PM	Sat 3/20/2021 3:50 PM	(9308) M.LOŠINJ-UNIJE-CRES-RIJEKA	CATAMARAN	DUBRAVKA	Price list	» Buy «
Sun 3/21/2021 4:00 PM	Sun 3/21/2021 5:20 PM	(9308) M.LOŠINJ-UNIJE-CRES-RIJEKA	CATAMARAN	DUBRAVKA	Price list	» Buy «
Mon 3/22/2021 2:30 PM	Mon 3/22/2021 3:50 PM	(9308) M.LOŠINJ-UNIJE-CRES-RIJEKA	CATAMARAN	DUBRAVKA	Price list	» Buy «
Tue 3/23/2021 2:30 PM	Tue 3/23/2021 3:50 PM	(9308) M.LOŠINJ-UNIJE-CRES-RIJEKA	CATAMARAN	DUBRAVKA	Price list	» Buy «
Wed 3/24/2021 2:30 PM	Wed 3/24/2021 3:50 PM	(9308) M.LOŠINJ-UNIJE-CRES-RIJEKA	CATAMARAN	DUBRAVKA	Price list	» Buy «
Thu 3/25/2021 2:30 PM	Thu 3/25/2021 3:50 PM	(9308) M.LOŠINJ-UNIJE-CRES-RIJEKA	CATAMARAN	DUBRAVKA	Price list	» Buy «
Fri 3/26/2021 4:00 PM	Fri 3/26/2021 5:20 PM	(9308) M.LOŠINJ-UNIJE-CRES-RIJEKA	CATAMARAN	DUBRAVKA	Price list	» Buy «
Sat 3/27/2021 2:30 PM	Sat 3/27/2021 3:50 PM	(9308) M.LOŠINJ-UNIJE-CRES-RIJEKA	CATAMARAN	DUBRAVKA	Price list	» Buy «
Sun 3/28/2021 4:00 PM	Sun 3/28/2021 5:20 PM	(9308) M.LOŠINJ-UNIJE-CRES-RIJEKA	CATAMARAN	DUBRAVKA	Price list	» Buy «
Mon 3/29/2021 2:30 PM	Mon 3/29/2021 3:50 PM	(9308) M.LOŠINJ-UNIJE-CRES-RIJEKA	CATAMARAN	DUBRAVKA	Price list	» Buy «
Tue 3/30/2021 2:30 PM	Tue 3/30/2021 3:50 PM	(9308) M.LOŠINJ-UNIJE-CRES-RIJEKA	CATAMARAN		Price list	» Buy «
Wed 3/31/2021 2:30 PM	Wed 3/31/2021 3:50 PM	(9308) M.LOŠINJ-UNIJE-CRES-RIJEKA	CATAMARAN		Price list	» Buy «
Thu 4/1/2021 2:30 PM	Thu 4/1/2021 3:50 PM	(9308) M.LOŠINJ-UNIJE-CRES-RIJEKA	CATAMARAN		Price list	» Buy «
Fri 4/2/2021 4:00 PM	Fri 4/2/2021 5:20 PM	(9308) M.LOŠINJ-UNIJE-CRES-RIJEKA	CATAMARAN		Price list	» Buy «
Sat 4/3/2021 2:30 PM	Sat 4/3/2021 3:50 PM	(9308) M.LOŠINJ-UNIJE-CRES-RIJEKA	CATAMARAN		Price list	» Buy «
Mon 4/5/2021 4:00 PM	Mon 4/5/2021 5:20 PM	(9308) M.LOŠINJ-UNIJE-CRES-RIJEKA	CATAMARAN		Price list	» Buy «
Tue 4/6/2021 2:30 PM	Tue 4/6/2021 3:50 PM	(9308) M.LOŠINJ-UNIJE-CRES-RIJEKA	CATAMARAN		Price list	» Buy «
Wed 4/7/2021 2:30 PM	Wed 4/7/2021 3:50 PM	(9308) M.LOŠINJ-UNIJE-CRES-RIJEKA	CATAMARAN		Price list	» Buy «
Thu 4/8/2021 2:30 PM	Thu 4/8/2021 3:50 PM	(9308) M.LOŠINJ-UNIJE-CRES-RIJEKA	CATAMARAN		Price list	» Buy «
Fri 4/9/2021 4:00 PM	Fri 4/9/2021 5:20 PM	(9308) M.LOŠINJ-UNIJE-CRES-RIJEKA	CATAMARAN		Price list	» Buy «

Figure 3: Timetable possibilities for individual voyage selection

Also, there is an immediate possibility to visualize the ports and route using Google maps, as shown in Figure 4.

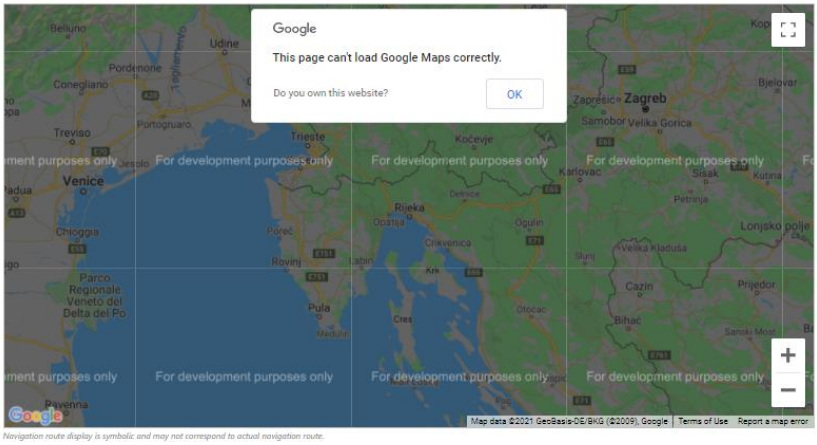


Figure 4: Google Maps voyage display available to passengers

After selection of the desired voyage, the passenger can either enter their previously created username and password, connected with their personal and payment data, or enter their data manually. In this case, if they require a business invoice (if the ticket is purchased on behalf of the legal entity and not physical person), an extended menu will be presented, with possibility to enter data of the legal entity. After this step is successfully completed, the passenger is presented with a payment gateway. Effectively, the passenger is routed from internal Jadrolinija's CRM to external payment gateway operated by Croatian Telekom called T-PayWay, where the passenger may select various means of payment and credit cards. This is shown in the Figure 5 below.

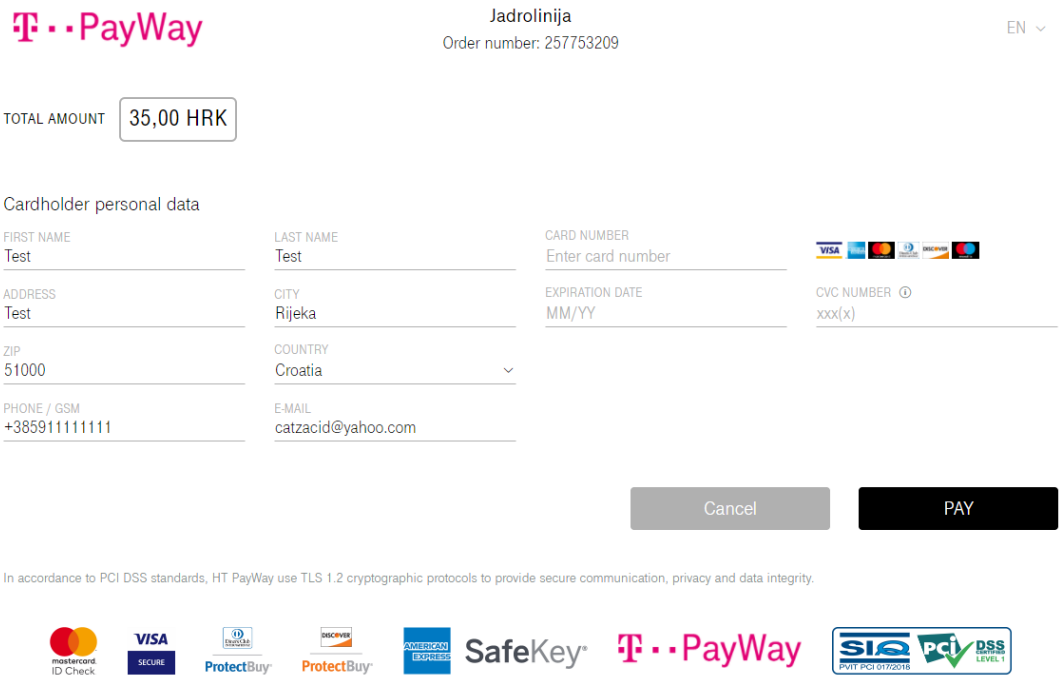


Figure 5: Payment gateway for the ticket

When this step is successfully completed, the passenger is issued with an electronic ticket that may be used to board the ship. The ticket does not have to be printed physically as it involves a QR code that is scanned by the ship's crew member at the embarkation point.

Another ticketing service provided by Jadrolinija is **Jadrolinija2Go card.** It is a contactless card that is used for easier and faster travel, a card with which the user identifies his subscription account, i.e., uses the funds (s)he has paid in advance. User data and funds on the account are read using a chip on the cards,

attaching cards to readers in Jadrolinija's branches and on ships, or using Jadrolinija2GO cards for purchases via websites or mobile applications. The owners of the Island Card are furnished by the Jadrolinija2Go card, which is used with funds with prepaid accounts, after the user has opened his subscription account in Jadrolinija. Visualization of Jadrolinija2go prepaid card is shown in Figure 6.

Figure 6: Visualization of Jadrolinija2go prepaid card

Prepaid account can be opened by all legal and adult natural persons, regardless of residence. The account can also be opened by the owners of the Island Card, without requesting a Jadrolinija2Go card. The island card is a means of identifying the prepaid account that the user has opened and replaces and has all the functions of the Jadrolinija2GO card. Multiple cards can be linked to one prepaid account. All cards linked to the account are authorized to use funds from the same.

The procedure for registering a Jadrolinija2Go card is as follows:

·Using link https://www1.jadrolinija.hr/ProdajaWeb#/login, it is necessary to make the first application. For the first login, enter the prepaid account number in both fields and then change the password of the subscriber's choice

· Then any line and departure date should be selected on the "search timetable and buy ticket" option

· One trip should be selected by clicking "Buy"

· The registration option will appear in the upper right corner of the screen

· After registration, the profile will appear in the right corner

· Clicking on change profile, the user will get the option to add prepaid / postpaid cards

· All cards can be registered or only one that will serve as a "payment card"

· When registering the card, it is necessary to insert a "minus" sign between the numbers 71-02152112-36

· After registration, the user can start shopping and when (s)he gets to the screen that takes the user to payment, the option "prepaid card payment" should be selected, click on the selected card should be executed and the prepaid account will be charged for the specified amount, and the e-ticket will be received by email.

A logical continuation of the development was the **mobile application m-Jadrolinija** for iOS and Android platforms. Published in the App store and Google play, it has all the functionalities that the Jadrolinija website itself has. Thus, the new application enables the search of the navigation area, the situation in maritime traffic and service information, available units for all Jadrolinija lines, and, of course, the purchase of tickets.

Application clearly depicts the situation in maritime traffic where information on changes in sailing schedules is up-to-date integration with HAK[4] for all information that is interesting to the traveller during the trip, such as:

1. road traffic situation
2. inspection of crowds in ports via HAK cameras
3. road works
4. weather forecast
5. fleet overview and information on the current position of the ship
6. purchase of the multiple tickets through a cart with a consolidated charge

The design is adapted to the user experience on the mobile phone with clear and simple graphics as the complicated sales system is solved in as few steps as possible, and to the satisfaction of the end-user (passenger).

[4] https://www.hak.hr (Croatian Auto Club, accessed 20th March 2021.)

3.2.2. IT INFRASTRUCTURE

Jadrolinija and internal users utilize standard Ethernet 10/100/1000 mbps network and WiFi for connectivity in office areas and areas where operative business is conducted. Rules for access, authentication, information security and identity management are managed using Microsoft Windows server Group Policies and Active Directory. Data sharing is achieved using shared network storages and document management system

Systems are regularly upgraded to new versions as the old ones expire and updated, under maintenance contracts. Architecture uses mixed on premise, hybrid cloud and cloud solutions and development and management of IT systems is achieved both by using internal resources and IT subcontracting and external consulting, when possible, as a part of co-financed projects and initiatives.

There is a separate organized and funded IT department employing several full-time employees and head of department directing initiatives, budget, providing project management services and escalations towards Board of directors, when necessary.

Ticketing is achieved using system called Voyager, a client/server application provided by Jadrolinija company. Jadrolinija also extends these services to other companies involved in the travel management, who in turn process reservations done within Voyager and their orn CRM software solutions.

Jadrolinija operates several Web instances used for the ticketing system:

- www2.jadrolinija.hr : ticketing system
- www1.jadrolinija.hr : Prepaid card ticketing system
- m-Jadrolinija application, available from Android Play and AppStore

3.2.3. INTEGRATIONS WITH OTHER SYSTEMS

The inclusion of web ticket sales in the offer after successful pilot project in 2013. has in fact allowed a step forward towards integration with other agents as well. Jadrolinija has achieved bidirectional communication with the sales systems of foreign agents who can sell Jadrolinija tickets online. These are Directferrys, Aferrys and other online ticketing platforms through which tickets can be purchased from any part of the world.

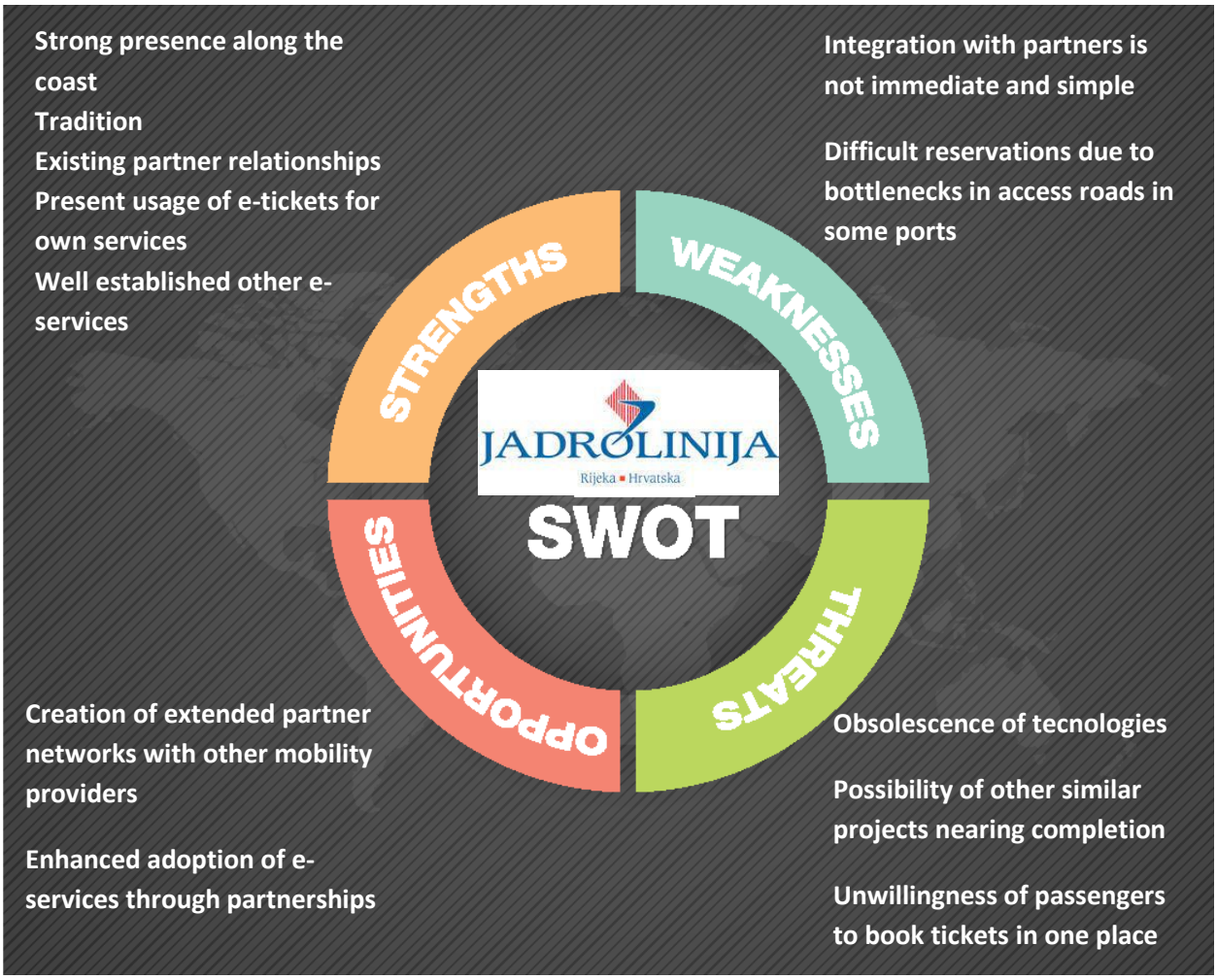
Another used possibility is custom, direct b2b connection to agents and partners using APIs for the internal ticketing system. One such example is integration for ticket sales services with agent Amatori in Ancona, also a project partner in the E-CHAIN project.

On the end user side, statistics provided by Jadrolinija show that mobile phones are mostly used to view the Jadrolinija website, so the share of mobile devices is 51.4 percent, computers 42.7 percent, and tablets 5.86 percent.[5] This means that for further integrations, an emphasis has to be placed on favourable user experience for users with mobile devices, as this share is constantly increasing.

Integration is also achieved for services of the mobile application m-Jadrolinija, with the system of HAK (Croatian Auto Club), serving it situational camera feed on the roads and in ports to Jadrolinija passengers. Furthermore, the system is integrated with Google Maps visualization system, enhancing situational user experience.

[5] https://www.novilist.hr/novosti/gospodarstvo/jadrolinija-uvodi-rezervacije-mjesta-na-trajektu-putem-mobitela-evo-kako-ce-to-funkcionirati/ (accessed 20.03.2021.)

4. CURRENT SYSTEM SWOT ANALYSES



D 3.1.1 – STATE OF THE ART AT TECHNICAL AND ORGANIZATIONAL LEVEL

Activity 3.1 – SoA - State of the Art

January, 2021 - Version final

Partner: PP8 – Grad Split
Authors: Andrea Barić, Mojca Soža
Email: andrea.baric@split.hr, mojca.soza@vitarukrmu.hr

Project Acronym	E-CHAIN
Project ID Number	10048282
Project Title	Enhanced Connectivity and Harmonization of data for the Adriatic Intermodal Network
Priority Axis	4 - 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
Work Package Number	3
Work Package Title	Mobility Maritime Design
Activity Number	3.1
Activity Title	SoA - State of the art
Partner in Charge	PP8 - City of Split
Partners involved	PP8 - City of Split PP6 – Prosoft d.o.o. PP7 - Jadrolinija
Status	Final
Distribution	Public

VERSION CONTROL

Date	Version	Prepared by	Revised by	Approved by	Revision	Comment
June, 2020	Template	Aris Grozić	Nelida Pogačić		draft	
October, 2020	draft	Andrea Barić			draft	
January, 2021	final	Mojca Soža	Andrea Barić	Nelida Pogačić	final	
June, 2022	final		Nelida Pogačić		final	Cover page changed

TABLE OF CONTENTS

ACRONYMS / ABBREVIATIONS

ACRONYM	DEFINITION
SoA	State of the Art
PP	Project partners
PT	Project Team
TC	Technical task coordinator
WP	Work package
IT	Information Technologies

REFERENCE DOCUMENTATION

No	TITLE	REPORT No.	PUBLISHED BY
1	**Application Form – E-CHAIN - Enhanced Connectivity and Harmonization of data for the Adriatic Intermodal Network** 2014 - 2020 Interreg V-A Italy - Croatia CBC Programme Call for proposal 2017 Standard - E-CHAIN Priority Axis: Maritime transport	Application ID: 10048282	Lead Applicant: Municipality of Ancona

1. INTRODUCTION

1.1 PURPOSE OF THE DOCUMENT

This document is relevant to the activity 3.1 SoA - State of the Art of E-CHAIN project - Enhanced Connectivity and Harmonization of data for the Adriatic Intermodal Network.

The purpose of this document is to collect detailed information on local Travel Planning systems and services being used, ITS services available and the possibility of integrating such systems in a E-CHAIN platform to offer updated – real-time – combined travel information to the travellers. The focus will be the collection of information on the current situation within Consortium through a census of transport types locally used and implemented, relative modules or software used (technology state of the art) and the interfacing with external systems (AVM, info mobility, etc). Moreover, this activity will gather all information about standard and programme languages used, the general architecture realized at local level.

A deep analysis will highlight the weakness and strength in each local environment and the outcomes will outline the specific actions needed to enhance and promote the development and integration within E-CHAIN platform.

It is the operational document for the execution of the project being used:

- by the Task Manager (TM) and Project Team (PT) to provide detailed information on current state within consortium.
- by the Activity 3.2 Stakeholders analysis (Transport needs) information needed for D 3.2.1 – Benchmark, transport needs & suppliers' roles.
- by the Activity 3.3 Technical and functional requirements to provide data needed for D 3.3.1 – Use case scenarios selection and preliminary requirements definition for defining starting level of mobility services for scenarios and D 3.3.2 – Technical and non-technical requirements for information on current operational systems capabilities.

2. BACKGROUND INFORMATION

E-CHAIN (Enhanced Connectivity and Harmonization of data for the Adriatic Intermodal Network) main objective is to enhance connectivity and harmonization of data for the Adriatic Intermodal Network, through the realization of a modular integrated software (E-CHAIN platform) for the management of intermodal transport services in port areas for passenger transport. To enhance the current situation, E-CHAIN will focus on providing new services such as an improved Port multimodal info mobility system for the passengers, a ticketing system integrated with other transport modes, an advanced touristic co-marketing tool for the operators. These services will be designed and deployed in the selected pilot sites (Ancona, Split and Venice). A Business model suited to adapt the technology developed in the three applicative contexts will be created and specific needs will be taken into account.

The aim of WP3 is to design platform and services and to prepare the E-CHAIN services for deployment in the pilot sites (Ancona, Split and Venice).

The specific objectives of this WP are to:

- Establish the requirements and specifications for E-CHAIN services and for integration with existing services/systems
- Create a detailed reference architecture that complies with relevant standards and best practices
- Verify adapted services against the requirements and specifications before developing for pilot sites to WP4

The starting point is analysis of the State of the Art within Consortium to identify the IT system implemented, technological innovations existing in the current IT system, the main services / modules available (booking&payment, infomobility, etc.), and flexibility of the existing systems to allow the integration into E-CHAIN platform.

3. CURRENT TRAVEL PLANNING SYSTEM

3.1. ORGANIZATIONAL AND FUNCTIONAL DESCRIPTION

The role of Split as the economic and cultural center of Dalmatia has shaped its transport system. According to the last census, conducted in 2011, Split has 178,192 inhabitants, and is the administrative center of Split-Dalmatia County to whom gravitates the urban agglomeration of Split that has almost 400,000 inhabitants.

The city of Split is connected to the surrounding area by all modes of transport. Road connectivity is provided by the A1 motorway and the D8 and D1 state roads. Railway traffic to and from Split takes place via the north-south corridor, which in the long-term development of railway transport at the level of the European Union would form a segment of the Adriatic-Ionian corridor. The said corridor consists of two sections under the designations M604 and M202. The seaport of Split is the second largest Croatian trading port, the largest passenger port in Croatia and the third largest port in the Mediterranean in terms of the number of passengers. Split Airport is located 20 kilometers by road from the center of Split and provides transport connections with the most important European destinations.

The conducted analysis of the road infrastructure showed that in the area of the City of Split the length of the basic road network length is approximately 376 kilometers, out of which there are:

- State roads - 22.9 km (6%)
- County roads - 30 km (8%)
- Local roads - 37.36 km (11%)
- Unclassified roads - 286 km (73%)

It is important to note that the county and local roads in the observed area are under the jurisdiction of the City of Split (Ministry of the Sea, Transport and Infrastructure, 2012).

Traffic accessibility, in addition to the development of the transport network, significantly depends on the urban structure of the city. Most of the city of Split is located on the peninsula, and the city center is located on the southwest coast of the peninsula. For this reason, the road

network is designed in such a way that the main longitudinal roads are connected into a system of radial rings in the area of the city center. This spatial specificity of the area, and the organization of the transport network from the transport point of view has a positive and negative aspect. The positive thing is that no significant transit routes pass through the center of the city of Split, and therefore there is no reduction in the ecological, social and tourist component of the city. The downside is that the strong traffic attractions in the city center, ferry port, bus and train station are at the end point of the main traffic routes which inevitably generates traffic congestion, especially during the tourist season. Compared to the short travel time within the compact urban structure of the city, the travel time to the surrounding areas of the city is relatively large. The reason for this is that the traffic connection with the surrounding area is exclusively from the east and the linear spatial development of the surrounding areas along the coast.

Area of the City of Split, according to the national data, numbers 76,284 registered personal vehicles, 7,345 trucks and 7,032 motorcycles. Taking into account the data from 2013, an exponential increase in the number of registered motor vehicles by an average of 2.7% per year was found, which indicates a very unfavorable trend in the habits of citizens. Given the above, the degree of motorization in the City of Split is about 428 vehicles / 1000 inhabitants. This is higher than the average of the Republic of Croatia (358 vehicles / 1000 inhabitants), and less than the EU average (495 vehicles / 1000 inhabitants). According to data on modes of transport in the city of Split from 2018, collected as part of the project REMEDIO - Low Carbon Mobility Solutions in the City of Split (Mobilita Evolva ltd, 2018), it was found that as much as 47% of daily travel is done by car (42% as a driver and 5% as a passenger). In the second place is walking which was used as a way of travel in 24% of cases. As reasons for walking, the citizens of Split quoted acceptable distances for walking and avoiding waiting in traffic jams. Public transport is represented in 22% and bicycle in 5% of travel. The remaining 2% of the travel is done by UBER and motorcycle.

Considering that through a conversation with citizens and a mobility survey made in 2018, it was determined that the city of Split is suitable for walking due to the urban structure and the fact that 70% of travel refers to trips up to five kilometers in one direction. Accordingly, in order to further strengthen sustainable modes of transport, it is necessary to improve the conditions of active modes of transport for shorter journeys and the public passenger transport system for

medium and long journeys. In order to have a clearer understanding of traffic trends and needs, an analysis of daily migrations in the wider area was conducted. Daily population migration belongs to the forms of spatial mobility of the population, and it can take place for work, schooling, etc. According to the national data, the City of Split has 12,407 inhabitants who migrate every day, out of which there are 11,039 employees, 998 school pupils and 370 students. Out of the total number of employees in the area of the City of Split, 2,867 of them work in another settlement of the same city (it is assumed that most of them work in the settlement of Split), 7,608 work in another city or municipality within the county (assuming that most of them refer to outgoing migrations from the settlement of Split), and 557 work in another county. Although no research has been conducted on the exact number of daily migrations to Split, it can be assumed that from the area of the urban agglomeration of Split about 35,000 - 40,000 people migrate to the city daily.

~ RAILWAY, BUS, MARITIME AND AIR TRAFFIC AND PORTS IN CITY OF SPLIT

There are two railway stations in the area covered by the City of Split:

- Split railway and bus main Station
- Split Suburbs Station

Split railway and bus main Station are the final station of the M604 railway with dominant passenger transport. It is located next to the City Port (ferry passenger port), bus station and the old city core. Split Suburbs Station is located near the neighborhood Kopilica and the North Port. Along with the Split railway and bus main Station, it is the only station within the administrative boundaries of the City of Split. The Split Suburbs Station is divided into two locations:

- Split Suburbs Station (passenger-freight purposes)
- North Port cargo terminal (under the jurisdiction of Station Solin)

The cargo terminal with eight industrial tracks is located in the area of the North Port and is not under the jurisdiction of the Split Suburbs Station. It contains additional branches leading to operational shores where the majority of multimodal freight traffic between ships and railways takes place. The terminal allows manipulations with general, bulk and special cargo. It is used by many cargo port entities such as the container terminal, cement factory, iron factory, shipyard, Petroleum Industry (INA), Croatian Navy (HRM) and others.

In terms of maritime transport in 2017, a total of 18,546 ships entered the Main City Port of Split, out of which 5.6 percent refers to international traffic. The largest percentage of the traffic refers to the City Port of Split (approximately 88.6%). The analysis of maritime traffic includes the traffic of goods, passengers, vehicles and other maritime traffic in individual ports. Of the ships entering the City Port of Split, approximately 38 percent are smaller than 500 GT, and those larger than 10,000 GT are approximately 3 percent. Of the ships entering other basins, most are less than 500 GT (approximately 52%), while those above 10,000 GT are approximately 4 percent (Port of Split Authority, 2020). Passenger and vehicle traffic takes place through the City Port of Split, which in 2017 accounted for approximately 88.6 percent of the total number of arrivals in ports under the control of the Port of Split. The share of local ferry traffic is 58.9 percent, local high-speed lines traffic 14.7 percent, while 15.8 percent is the traffic of domestic tourist vessels. Of the other ship traffic (inflows) in 2017, there are 258 ships on international lines traffic, 234 ships on cruises, 225 tugboats, work and other ships, and 110 yachts. Passenger traffic in 2017 amounted of approximately 5.26 million passengers (domestic 92.3%), vehicle traffic amounted to 775,396 vehicles (domestic 95.2%), while truck traffic counted 180,554 tractors (domestic 96.4%). All international truck traffic was realized with Italy on the international line Split - Ancona. The structure of traffic through the number of arrivals by type of vessel in the period 2013-2017 shows an average daily traffic of 51 ships per day. Real daily turnover changes in the seasonal or off-seasonal period. During the season, the daily number of ship arrivals is approximately 100, while out of season this value drops to 20 to 30 arrivals per day. The most intensive traffic on a daily basis takes place between 08:00 and 20:00 (Port of Split Authority, 2020). Maritime traffic in the City Port of Split by ferry lines takes the largest volume on the local lines with national shipping company Jadrolinija and the only international line Split - Ancona (Italy) is maintained throughout the whole year by Jadrolinija, while during the tourist season other foreign shipping companies Blue Line and SNAV engage. The majority of passenger traffic (93%) refers to local lines to islands that gravitate to the port of Split. Other passenger traffic refers to local commercial trips, international ferry line Split - Ancona and cruises (local and international). Compared to other most important Dalmatian ports with maritime passenger transport, the Port of Split has twice as many transported passengers in relation to the other city ports of Dubrovnik and Zadar.

National local lines are divided into the following categories:

- Ferry lines (transport of passengers and vehicles by Ro-Ro ferries)

• Ship lines (passenger transport by ships)
• High-speed lines (passenger transport by catamaran)

Lines of local maritime transport are of national character and according the Law of Public Transport are divided into:
• Inter-county lines (in the area between counties)
• County lines (in the area within the county)
• Utility lines (in the area of a particular administrative area of the city)

The international maritime traffic of the City Port of Split consists of the international ferry line Split - Ancona, the international high-speed line Split - Civitanova (seasonal), commercial cruise lines and international seaplane traffic. International ferry line Split - Ancona, counted total 258 arrivals in 2018, out of which 54 percent refers to Jadrolinija, and the rest to the Italian carrier SNAV (which maintains the lines only during the summer season when the total traffic is five to six times bigger than in the off-season).

Split Airport has the basic function of receiving and dispatching passengers and cargo in air traffic. It was opened in 1966 and covers a total area of 100 ha. The new modernly equipped terminal was put into operation in 2019, bringing its total area to 48,000 m2. The maximum passenger capacity of the Airport is 2,500 passengers / hour. The Airport is connected to the city of Split with public transport bus lines and specialized airport lines of the carrier Pleso prijevoz ltd. Due to inadequate infrastructure and lack of stops, there is no efficient access to the Airport by rail. The nearest railway station is the Sadina station, and it is located approximately three kilometers air distance from the Airport. The nearby port in Divulje, as part of the port in Kaštela Bay D, provides the connection between the Airport and the city of Split by sea and air. In the period 2013 - 2017 commercial transport services between Split Airport and the city by seaplane and water taxi were realized. In the line with passenger terminal, there is the infrastructure necessary for the safety and air traffic flow with the accompanying infrastructure, which includes paid parking

facilities, taxi stands, stops for tourist and shuttle buses and parking for rent-a-car services. In terms of traffic volume and the number of passengers transported, Split Airport is the second largest Airport in the Republic of Croatia. Air traffic for passengers is constantly

increasing, with the most intense period during the summer months when additional routes and air traffic capacities are established.

3.2. TECHNICAL DESCRIPTION

3.2.1. MAIN SERVICES/MODULES

For the E-CHAIN project, we analyse the essential stakeholders in the passenger's transport in Split's port area. This is a very particular area in the City of Split since there is, practically on the same location, a port, the central bus station, the central railway station and also the old city centre and the centre of Split's social life. Particularly in the high tourist season, this is a very crowded area, full of passengers, cars, busses, taxi-drivers etc.

The main stakeholders who we have to take into consideration are as follows:

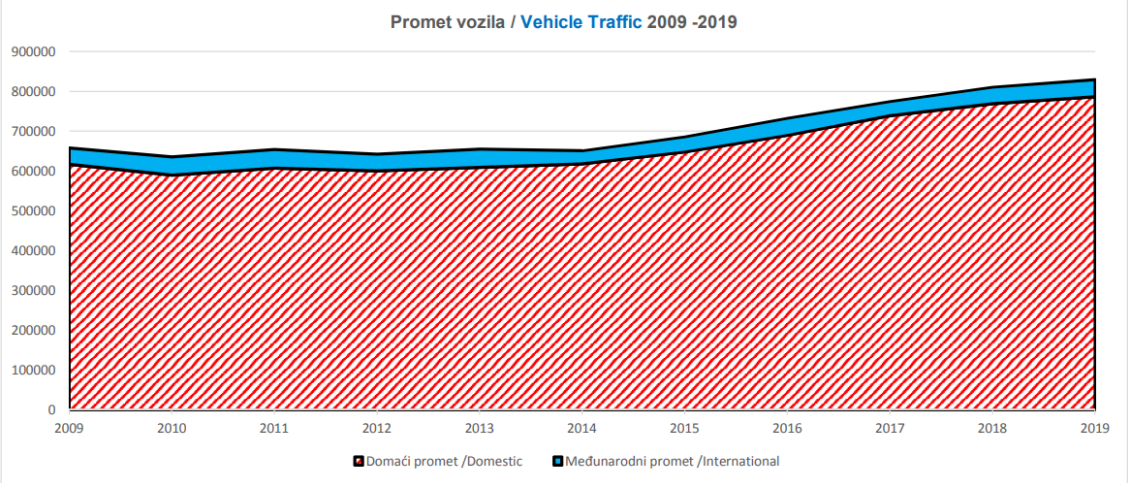
Port of Split

The Port of Split is the leading passenger's and vehicle's port for Dalmatian destinations on the islands and along the coast. From the Split's port are also maintained the daily ferry connections to Italy.

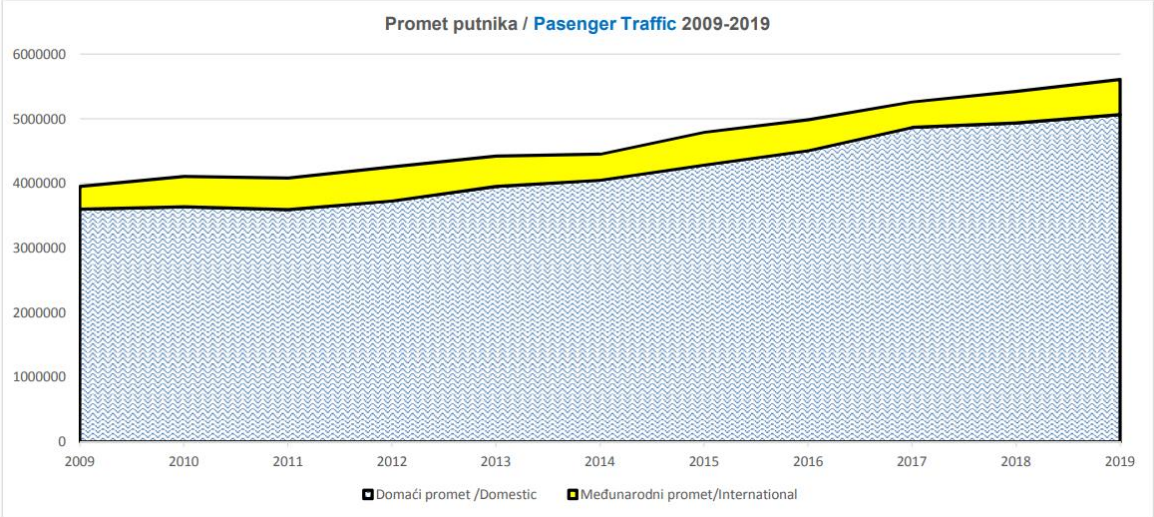
Above all, the Port of Split's importance is to transport the local population, connect the medieval islands to the mainland, and serve a large number of tourists, both in transit and at the final destination. Passenger traffic is dominated by domestic traffic, with around 90 % of all transported passengers, of which over 40 % is generated in the summer. Passenger numbers are on the increase annually, and in 2016 the number of passengers crossed the border of five million passengers and continued to increase. In 2019, five million passengers were already registered for the first nine months. In the last four years, excepting the Covid year 2020, the number of passengers rose on average by 5 % per year and has tripled the number of passengers over the last two decades. The number of vehicles carried is increasing by similar yearly rates.

In the year of 2019, through the Port of Split almost 830,000 vehicles were transported, 5.6 million of passengers and 282 Cruise ships with nearly 360,000 passengers.

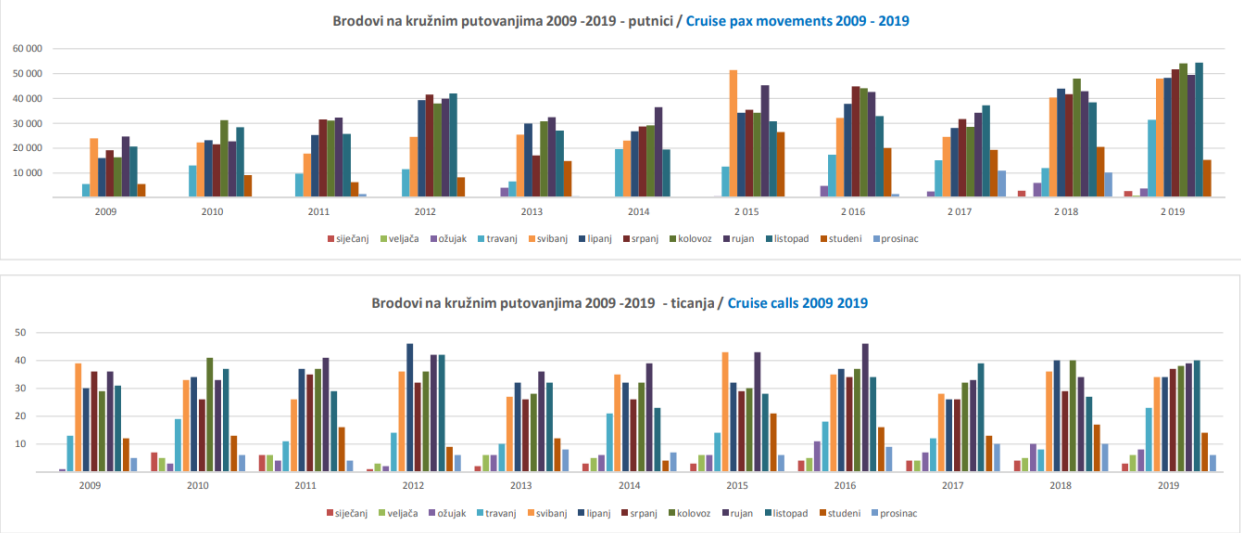
Vehicle Traffic in the Port of Split in the period 2009-2019:



Passenger Traffic in the Port of Split in the period 2009-2019:



Cruise Traffic in the Port of Split in the period 2009-2019:



The majority of the passenger and vehicle traffic in the connections between the mainland and the islands is carried out by the Croatian shipping company Jadrolinija, which also connects Split to the international port of Ancona. Next to Jadrolinija, there are few private-lead operators: Kapetan Luka – Krilo, Bura Line and Krilo Shipping Company (KSC), which maintain the lines between Split, medieval islands and Dubrovnik. The international route Split-Ancona-Split is operated by the Croatian company Jadrolinija and by the Italian companies SNAV and Blue Line.

- **Jadrolinija** operates with ferries, catamarans and classic passenger ships. The complete fleet of the Jadrolinija counts 54 ships; out of this, ten catamarans, 37 smaller car-ferries, four classic passenger ships and three spacious car-ferries operating on international lines.

  The web page of the company is available on Croatian, English, Italian and German language. A very easy-to-use search engine is available, where the traveller can search the journey setting the arrivals and department date and buy tickets on-line. The mobile application is also available. Besides buying the tickets option, the application has lots of other useful information, like information about the sailing schedule, traffic conditions, cameras in the ports, weather information etc.

Jadrolinija has rendered booking and ticketing possible for its guests at their own place of residence, as its sales network comprehends all the tourists' generating countries: Italy, Germany, Bosnia and Herzegovina, Slovenia, Poland, Great Britain, France, Belgium and Australia. Besides at the agencies, all the relevant information may be obtained, and the tickets can be bought via internet and mobile application as well.

- **Kapetan Luka – Krilo** is a private-lead company operating with four fast catamarans in their fleet. They are operating on the lines from Split to islands Hvar, Korčula, Brač, Mljet, and Dubrovnik. The tickets can be bought online. The web page is available on Croatian and English language. They are operating during the whole year.

- **Krilo Shipping Company (KSC)** is a private-lead company connecting Split with the islands Brač (town Milna) and Šolta (town Rogač). The tickets can be bought online. The web page is available on Croatian and English language. They are operating during the whole year. In the current Covid-19 situation, they have temporarily closed down all their lines.

- **Bura Line** is a private-lead company operating the line Split-Slatine on the island of Čiovo (near Trogir). There is no option to buy a ticket online. The web page is available on the Croatian and English version.

Promet Split – local public bus transport

Promet Split is a local bus operator, operating the city, urban and the suburban bus lines. Most of them are beginning and ending on the central bus station and are also very useful for maritime transport passengers. There are direct bus lines to the Airport, Trogir, Solin, Podstrana, Omiš, Kaštela, operating several times per day, with extra lines during the high season.

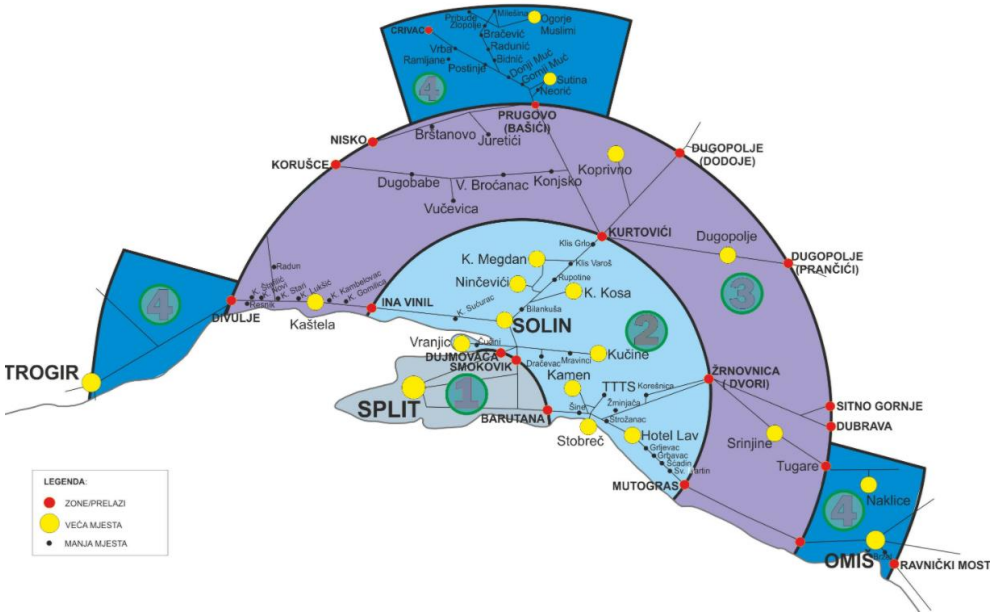
The bus tickets can be bought directly from the driver and in most kiosks in Split. There is no on-line solution to purchase tickets. In the case travelling with the ticket purchased in the kiosk, the passenger must show the ticket to the driver at the entrance into the bus, and the driver cancels the ticket with stamping.

The map of all available bus lines is available on the web site and on the bus stations. The map is not interactive, neither the one on the web site of the company. The web page of the Promet

Split is available on Croatian and English language. The map with the bus lines available on the English web site, is not translated into the English language (phrases like Airport, Central Bus station, Ferry Port, Market place, Tariff zones etc.).

The local public bus system is divided into four tariff zones. The first division (Zone 1) comprises the City of Split. Zone 2 includes the City of Solin, Stobreč, Podstrana and Klis. Zone 3 includes Kaštela and Dugopolje and reaches the shore south to the Dugi Rat. The last Zone 4 includes the City of Trogir and Omiš.

There is no need for a special bus line to operating in the port area.



The connections are good, with additional lines on the busiest lines during the high tourist season.

Various possibilities for tickets are available: one-drive ticket, two drives-ticket, tickets in blocks of five, daily ticket, 72-hours ticket and other. The one-drive ticket which is bought in the kiosk is almost 20% cheaper than the one bought directly at the bus driver.

Central bus station

Split Bus Station is located in the very centre of Split, right next to the port and the railway station. Such location enables fast and easy communication and transfer of passengers.

Two main reasons are why Split's central bus station is an essential stakeholder in the E-CHAIN project. First, it is located practically on the same location as the Port of Split. Second, many maritime passengers are connected to bus lines to/from Split.

Travellers can get information about the available lines on the web page of the Central bus station. A web search engine is available where one can find information about planned arrivals and departures and the operators of a single available line. The search procedure involves assigning two parameters from the offered list: the destination (in the case of departures from the Split bus station), or starting point (in case of arriving at the station), and the date of departure/arrival. No possibility of on-line reservations or buying the tickets exists. There is only a phone number for all other information and for checking vacancies and reservations. The other option is personally on station info point.

Split's central bus station is an extremely crowded area during the high tourist season. Any additional technical solution for better traveller's information and/or ticket purchasing would be welcome.

Central Train Station

Split's Central Train Station has a similar role as the Central bus station has. It represents the direct connection from Split to Šibenik, Zadar and Zagreb. The train connections are operated by the company "HŽ Putnički prijevoz". Central Train Station is being located across the road from the port. Many travellers coming to Split with the train are continuing their travel to the islands or other destinations operated from the Port of Split.

The time schedule is available on their web page, where it is also possible to buy the tickets online. The web page is available on Croatian and English language. Mobile application HŽŽP is another option to buy the tickets online.

Shuttle bus ("Pleso prijevoz" company) – passenger transport services from the Airport Split to the Central Bus station and vice versa

A direct Shuttle bus line is available for passengers to/from the Split's Airport to/from the Split's central bus station. It is half an hour drive with, and the price is 30 Croatian kunas (4 euros) for one direction. A Shuttle bus departs from the Airport half an hour after each landing. The tickets can be bought online. Payment options are credit cards American Express, MasterCard, Maestro and Visa.

The web page of the "Pleso prijevoz" company is available in Croatian and English version. It is very simple to find a "buy a ticket" option. When buying the ticket, only the date must be fixed and not also the hour, which is very comfortable due to possible late landings.

Taxi

Most taxi drivers in the City of Split are united in the Association of taxi carriers Split. There are two biggest companies ("Žuti taxi" and "Radio taxi") and several smaller, mostly self-employed taxi drivers. Together, in the Association of taxi carriers Split, there are around 240 business entities (companies / self-employed taxi drivers) with about 300 to 350 taxi-vehicles (out of this, Žuti taxi about 50 and Radio taxi about 60 taxi-vehicles). The biggest company has a web page (Croatian, English) and a mobile application, while the second-biggest company has a Facebook profile. By the others, most communication with the clients is being made by an e-mail, phone calls and SMS messages. The payment possibilities are cash and credit/debit cards by taxi drivers. They provide different services, like transport to/from the Airport Split, transports in the city, city-tours and varying excursions outside the city. There are several taxi-points in the city centre, among others also in the port.

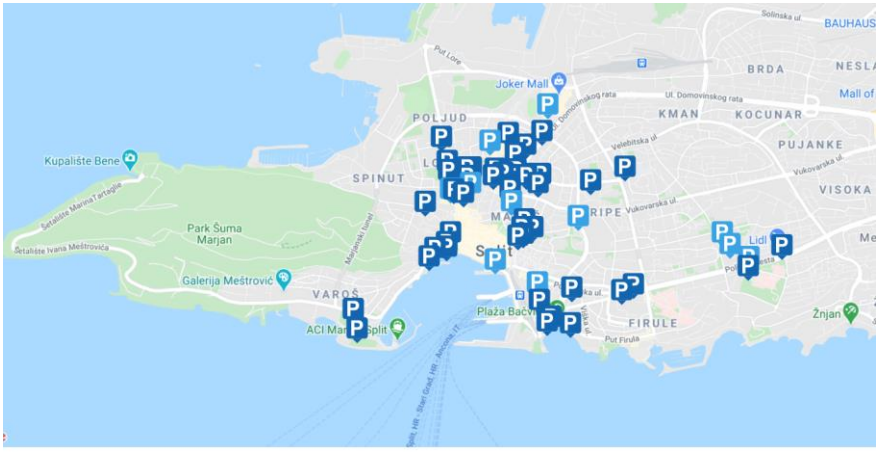
Outside the Association of taxi carriers Split, other carriers are also present in Split, which are not organized into some other association and are also outside the regulation of the City of Split (for the example, Cammeo taxi etc.). These drivers also don't have an obligation to pass the exam on the sights and the city's history and other essential thematics, which can lower the service's quality to the customer.

Split Parking

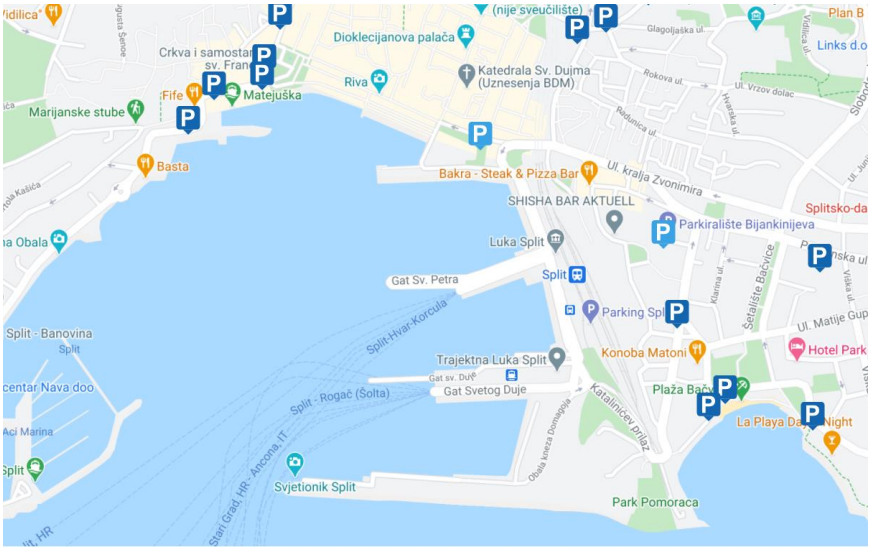
Split Parking is a significant stakeholder when analysing stakeholders connected to the Split's Port. As analysed above, 830,000 vehicles were transported through the Port of Split in 2019. Especially during the high season, there is an enormous need for free parking spaces near the port.

"Split Parking" company operates the public parking spaces in the City of Split, which includes open parking places and parking garages.

The City centre:

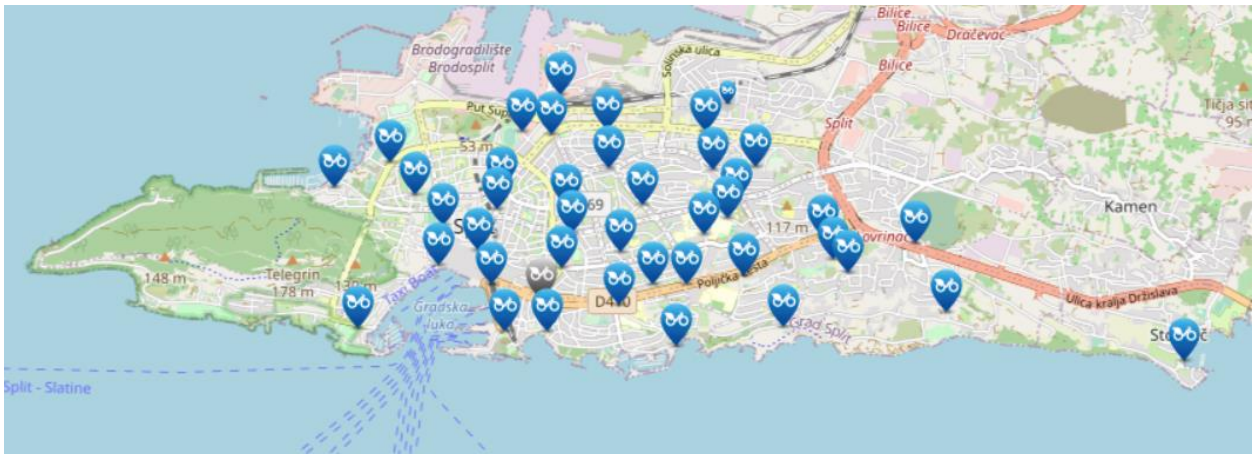


The Port area:



Information about free parking places on each location, including the navigation to the selected location, is available on the mobile application “Smart Splitparking”. A prepaid option is possible and also the single parking-service paying with the SMS option using the mobile phone.

The “Split Parking” company is also operating the public bicycle system, which is being financed from the City of Split and EU funds through the EU project REMEDIO:



On the web page, there is also available a complete list of locations, where the bicycles are available 24/7. There is also information about the prices and users’ information. The bicycles are available using the mobile application “nextbike”.

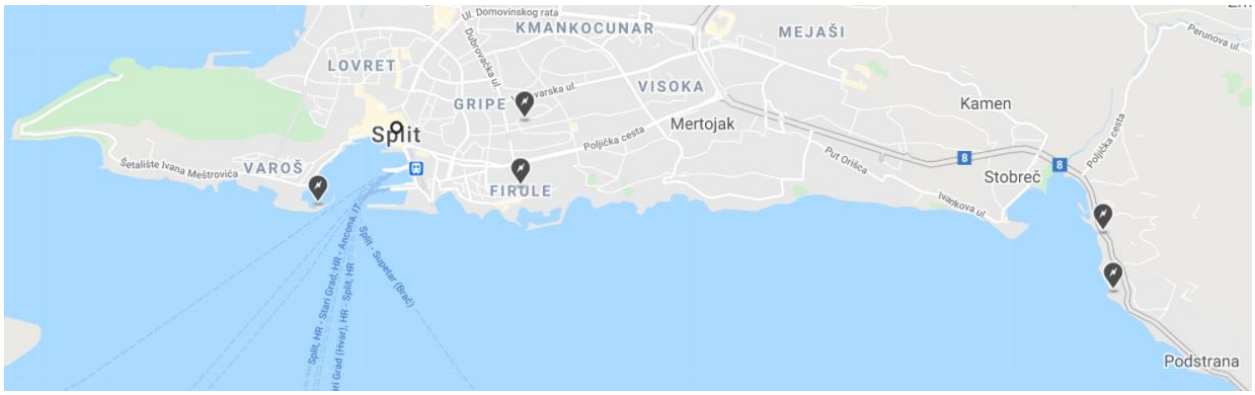
The Split Parking web page is available only in the Croatian language while the mobile applications are also available in the English language.

Chargers for electric cars

A network of the existing chargers for electric cars can be an important issue for maritime passengers. Electric cars users can find the available chargers on the “Elen” web page in the ownership of HEP company, on the Tesla web page about the available superchargers in the ownership of the Tesla company, and on the webpage puni.hr (also a mobile application is available).

There is no “Elen” charger in the Split’s wider port area, by the available information on their web page. The “Elen” web page is available only in the Croatian language, and it is also not very user-friendly.

The Tesla web page is much more user-friendly; the user can easily find information about the available superchargers on the selected location. Information includes navigation, contact phone numbers, information about the availability (public or private), and using instructions (call ahead etc.). There are three Tesla superchargers available near the Port of Split and two more in a broader area:



These is an example for two chargers, about the information available on the Tesla web page:

ACI marina Split

Uvala Baluni 8
21000 Split
Croatia
Opcije rute

http://www.aci-marinas.com/en/ →

Phone +385 21 398 548

Roadside Assistance 017 776 417

Charging
2 Tesla Connectors, up to 22kW.
Available for customers. Self park.

Marvie Hotel & Health

Periciceva 1
21000 Split
Croatia
Opcije rute

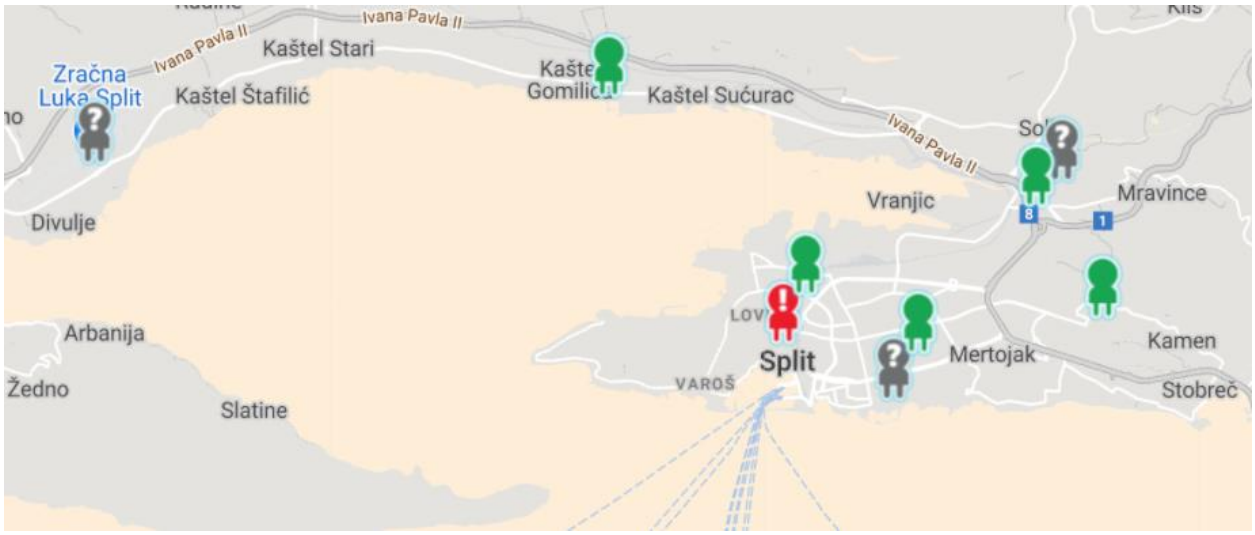
http://marviehotel.com/ →

Phone +385 212 798 00

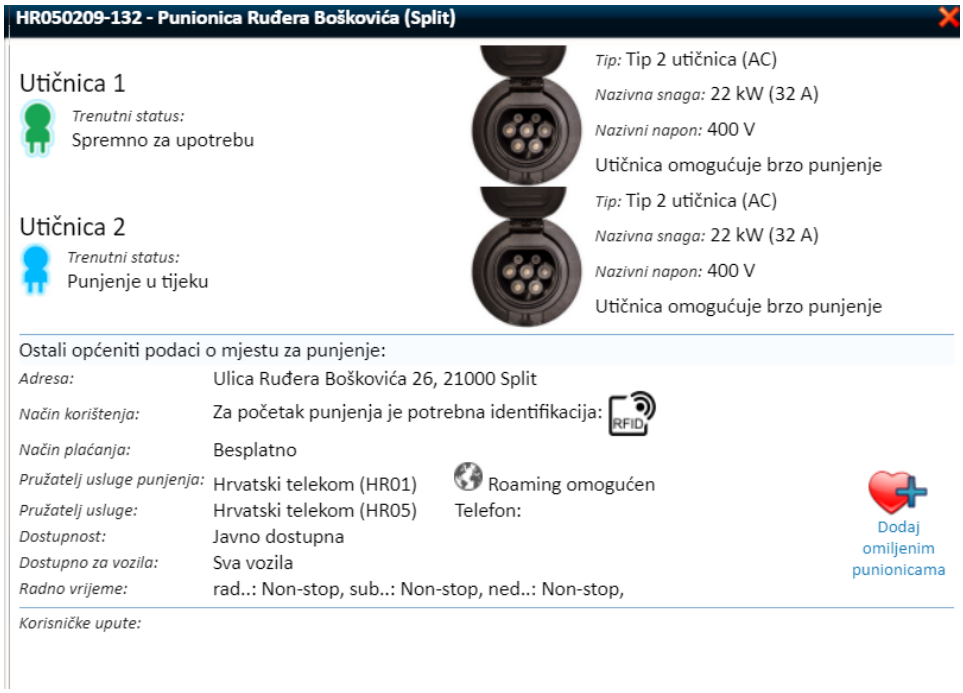
Roadside Assistance 017 776 417

Charging
1 Tesla Connector, up to 22kW.
Available to the public. Please call ahead.
Seasonal availability. Please call ahead.

The third available application is a “puni.hr” application. Here we can find available chargers which are built by the company “Hrvatski Telekom”:



The web page is operating only on the Croatian language and consists the following information (an example for one charging location):



These are the information for the same charger, available on the mobile application (in English only):

There is no application available which would give information about all available chargers on one integrated place.

Split Airport

Split Airport is located at 20 km distance from Split centre / Port of Split. Transport connections are well, but, since the port's specific location (detailed described above), road conjunctions are often during the summer high season.

In 2019, Split Airport had more than 3.3 million passengers (3.1 million in 2018 and 2.8 million in 2017).

A direct Shuttle Bus Line to/from Split is available 30 minutes after each landing (the tickets can be bought online). A Shuttle Bus station is situated in front of the Airport building. Public transport is the other option. Close to Split Airport there is a bus stop of lines No. 37 (Split-Trogir-Split) for the passengers travelling to Trogir/Čiovo, and No. 38 (Split Airport – Kaštel Stari – Split; Split – Kaštel Stari – Split Airport) for the passengers travelling to the Split centre or the Port of Split / Central Train Station / Central Bus station. Next option is a taxi which is available during

Split Airport operating hours. All these information are also available on the Split Airport web page.

The web page is available on the Croatian and English language, offering the usual information about the flights: arrivals, departures and delays. There are also links to the all flight operators web pages. The valuable information about the web check-in options for each flight operator is also available on the Split Airport web page.

3.2.2. IT INFRASTRUCTURE

We have pointed out the main available IT Infrastructure issues for each stakeholder, between the text, in the previous chapter. If we sum it up, these are the crucial information:

Stakeholder	Web page / Languages	Mobile Application	Online Reservation / Ticketing	Other information
Port of Split	CRO / EN	No	n/a	/
Jadrolinija	CRO / EN / DE / IT	Yes	Yes	
Kapetan Luka – Krilo	CRO / EN	No	Yes	
Krilo Shipping Company (KSC)	CRO / EN	No	Yes	
Bura Line	CRO / EN	No	No	
Promet Split	CRO / EN	No	No	The maps are not interactive. The maps are not available in the English language.
Central Bus Station	CRO / EN	No	No	Only information about the lines and the departure/arrival times are available online. Tickets can

				be bought online by the individual bus carrier (not all).
Central Train Station	CRO / EN	Yes	Yes	
Shuttle Bus Airport-Split-Airport	CRO / EN	No	Yes	
Taxi	CRO / EN (only the biggest company)	Yes (only the biggest company)	Yes (web, Facebook profile application, e-mail)	The biggest two companies have some relatively simple IT infrastructure; smaller self-employed taxi providers communicate mostly by e-mail / phone.
Split Parking	Web: CRO Mobile app: CRO / EN	Yes	Yes	Operates also the public bicycle system.
Electric Chargers	CRO (Elen) CRO / EN (Tesla, puni.hr)	Yes – puni.hr and Tesla. No - Elen	No	
Split Airport	CRO / EN	No	n/a	The usual information about each flight (arriving, departing, delays), information about web check-in for each flight operator and links to their web pages are available online.

3.2.3. INTEGRATIONS WITH OTHER SYSTEMS

The analysis shows that there are practically no (or very few) integrations between the systems available. Digitalization of services and/or information available to the final user in on a very low level. Besides, the systems are not integrated with each other.

These are the sum-ups for each analysed stakeholder/system:

Port of Split: no integrations.

Jadrolinija:

- information (very basic) about the traffic is available in the mobile application. For the maritime traffic, Jadrolinija prepares its own information which is also available on the web page. For the road traffic, the HAK's information from their web page is available in the application;
- weather information in Croatian's ports and the ports of Ancona, Bar and Bari are available.

Kapetan Luka – Krilo: no integrations.

Krilo Shipping Company: no integrations.

Bura Line: no integrations.

Promet Split: no integrations.

Central Bus Station: only links to specific web pages are available – Tourist office of the City of Split, Airport Split, Port of Split, Jadrolinija, HAK etc.

Shuttle Bus Airport Split-Split-Airport Split: links to web pages of the Split's Central Bus Station, Jadrolinija and the Tourist office of the City of Split are available.

Taxi: no integrations.

Split Parking: an online application and web page of the public bicycle system are integrated into the Split Parking web page (who is operating with the public bicycle system). Information about the tourist busses is also available in the mobile application.

Electric Chargers: no integration.

Split Airport: only information about travel options to Split are available on the web page, and the link to the Suttle bus web page.

Only for the workers, students and pensioners, the integrated tickets for the "Promet Split" (bus Zones 1, 2 and 3) and "HŽ Putnički prijevoz" (local train line) bus-train services are available. Only the monthly-based cards are available.

4. CURRENT SYSTEM SWOT ANALYSES

Strengths:

- All passenger's transport operators are centralized at one location, and it is, therefore, easier to combine different transport options.
- A long tradition of a port with an excellent knowledge capacity and rich experiences.
- Jadrolinija, the leading operator in the Port of Split, has already made an important step to digitalize services to come closer to the user's needs. The same situation with the Split Parking for both the parking and the public bicycle system.

Weaknesses:

- Ferry port, central bus and central train station are located at the endpoint of the main traffic routes, which is at the same time the location very near to the old city centre, which inevitably generates traffic congestion, especially during the tourist season.
- Only a small number of parking spaces is available at the location of the port and its vicinity, which often results in an even worse situation on the location of the port.
- E-mobility services are not sufficiently available.
- The available services are not being digitalized (enough). Not enough information is available to today's user who is looking for quick information available at any time.

- Significant untapped potential for the advancement of the service quality.

Opportunities:

- Digitalization and decarbonization are two main areas that will be a high-level priority in the EU programmes for 2021-2027. Lots of opportunities will be available to finance those actions, including e-mobility, together with the digitalization, which will be one of the main topics.
- A big potential of integrating the individual operator's services, which will bring an extremely high added value to a final user.
- With the digitalization of services and offering the user a better mobility experience, a significant contribution to the air quality in the port area can succeed due to lower CO2 emissions from the transport.

Threats:

- Other ports in the Mediterranean Sea could be faster and more successful with better programmes, digitalizing them faster and bringing a better solution to the user sooner.