LOCAL STRATEGY – GUIDELINES FOR DUBROVNIK AIRPORT LOW CARBON EMISSION LANDSIDE ACCESIBILITY

D.T3.1.5 - Building the strategy for Dubrovnik airport long term mobility integration into the FUA

Authors:

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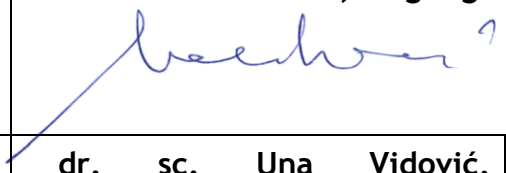
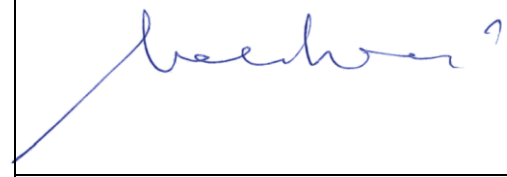
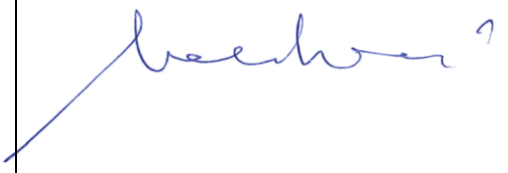
Project leader	**dr. sc. Una Vidović, mag.ing.arch.** 	
KEY EXPERTS	**dr. sc. Una Vidović, mag.ing.arch.** 	Team leader / Traffic planner
	dr. sc. Una Vidović, mag.ing.arch. 	Expert for urban transport, cycling and pedestrian transport
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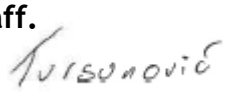
	Alen Tursunović, mag.ing.traff. 	Expert for transport planning
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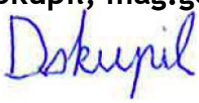
	Dino Dokupil, mag.geogr. 	Expert for urban planning, transport planning, GIS analysis and economic analysis

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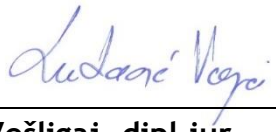
	Vanja Lukačić, mag.ing. aedif. 	Expert for road, bicycle and traffic planning documentation
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CONTENTS

1 INTRODUCTION

Strategies for airports low-carbon landside mobility planning in FUAs should have the target to reduce the CO2 emissions produced by access to the airports in functional urban areas. The threats for the living environment and the provision of ecological services should be recognized in decision procedures in order to make places eco-friendlier. The objective of strategies is to use the experience and knowledge of the partners to build a common transnational format of strategies which will enhance the integrated environmental management of functional urban areas (FUAs) regarding the mobility.

Airports are assets and transnational transport gateways for citizens. The magnitude and growing trend of air traffic (10 percent per year in the EU) requires actions for the landside accessibility of functional urban areas (FUAs) to airports. **LAirA** (**Landside Airport Accessibility**) addresses the multimodal, smart and low carbon mobility integration of airports in the mobility systems of functional urban areas. The project aims to reduce energy use and environmental impacts of transport activities by changing mobility behaviors of airport passengers and employees and by creating novel strategies in low carbon mobility planning for local authorities.

It targets the 56 million passengers and 39 000 employees of the airport systems in Vienna, Budapest, Warsaw, Milano, Stuttgart, Dubrovnik and Poznan. LAirA focuses in particular on building capacities of local and regional authorities and airports, to jointly plan and implement low carbon mobility solutions in a transnational and comprehensive approach which integrates seven key thematic areas: electric mobility, air-rail links, walking and cycling, shared mobility, information technology systems, wayfinding and road public transport. LAirA is a 30-months project (May 2017 – October 2019).

The Dubrovnik Airport Ltd. (Zračna luka Dubrovnik) is one of the partners in the project Landside Airports Accessibility; CE1074 LAirA, financed from the EU funds, as part of the INTERREG Central Europe Programme for transnational cooperation (INTERREG Central Europe).

Each LAirA FUA builds a strategy for low carbon FUA-airport integration (D.T3.1.2 - D.T3.1.8), which defines long term low carbon mobility planning interventions & investments needed consistently with the existing policy framework.

The participation of the Dubrovnik Airport, together with other airports and participants in this project, is based on the desire to contribute to mobility in a way that will ensure reduced CO2 emissions, thereby contributing to the protection of the environment of the City of Dubrovnik and Dubrovnik-Neretva County. The activities to be undertaken will be based on the Transport Development Strategy of the Republic of Croatia (2017–2030), adopted in August 2017.

The approach matches long term actions: delivering knowledge improvement, mobility behavioral change & novel strategies within the project end and strategically shape long term low carbon airports – FUAs integration. The innovation traits are: LairA develops airport FUAs non pre-existent mobility plans which integrate in a multi-disciplinary & comprehensive perspective leverages related to: Electric mobility, Air-Rail links, Walking & cycling, Shared mobility, ITS, Wayfinding, Road Public Transport - Demand Responsive Transport.

Activities:

A) LAirA develops & applies novel & smart ITS tools for travel planning of airports passengers & employees which need to access airports from FUAs, to generate immediate low carbon impacts.

B) It develops non pre-existent transnational training models, courses & strategies for entities of the public sector transferable to non-partner CE FUAs public entities.

C) It assesses the economic viability of the proposed low carbon mobility solutions in terms of transport demand & related revenues with the definition of business cases to allow their long-term sustainability.

Governance: starting from its focus on airports & authorities, it involves in each FUA governance local public & private transport operators & associations active in the FUA and other transport nodes (rail/road/water) on a bottom up approach in mobility planning for airports accessibility. The PPs choice was made according to

two needs: keep the partnership manageable and integrate at transnational level both authorities & airports considering that the LAirA thematic topics do not only include public transport but further topics complementing public transport for which airports are competent bodies.

A Strategy for airports low-carbon landside mobility planning in FUAs is the third part of the LairA project.

WPT1 (Resp. WRS) focuses on understanding the integration between airports and FUAs mobility system as input to improve the capacities of public entities responsible for low carbon mobility planning. It analyzed passengers' and employees' patterns of mobility.

WPT1 feeds low carbon mobility & behavioral change actions of WPT2 & involves all partners.

WPT2 (Resp.ADB) focuses on action planning low carbon mobility services & changing behaviour for low carbon airports accessibility in FUAs. It is related to the second LAirA project specific objective. It targets 7 key thematic areas: Electric mobility, Air-Rail links, Walking & cycling (soft mobility), Shared mobility, ITS, Wayfinding, Road public transport.

WPT3(Resp. DURA) builds & mainstreams strategies for airports low-carbon landside mobility planning in FUAs. It targets the LAirA FUAs & non-partner FUAs with an Enlarged Transfer Programme (ETP). It is related to the third LAirA project specific objective. All partners are involved. Each LAirA FUA builds a strategy for low carbon FUA-airport integration which defines long term low carbon mobility planning interventions &investments needed consistently with the existing policy framework.

1.1 AIMS AND SUBJECT OF THE STRATEGY

LAirA WPT3 will build strategies for low carbon integration of airports in FUAs in a governance process involving airports, authorities, agencies, transport providers, associations & nodes. The strategies will be mainstreamed in official acts of partners according to their statutory missions & in agreement with the FUA stakeholders.

Strategies will be implementation acts of mobility measures within already approved policy frameworks. LAirA will develop a transnational process of roll-out & transfer of its results in CE FUAs also engaging Macro-Regional Strategies. The specific objective is related to a change in terms of novel strategies within the LAirA FUAs and in the development of a blueprint (transnational strategy) transferred to CE FUAs.

The target groups of the strategy are all institutions, organizations and individuals, who are in the position to affect or contribute to the mobility in the airports' FUAs. The strategy is addressed to the local, regional and national stakeholders, the development agencies, authorities, businesses and civil organizations whose actions and attitudes are determinant for the future of the area and durability of the project results.

The time perspective of the strategy is long term partly because the pursuit of sustainable development thus requires and partly because the attainment of the objectives set needs persistent efforts.

1.2 WHY LANDSIDE ACCESS MATTERS

Surface access to Airport Dubrovnik matters because a successful strategy means both passengers and employees can get to and from the airport with an efficient, safe and easy to use low carbon transport system which will stimulate economic growth by providing high quality sustainable transport choices.

Transport underpins everything we do, from getting us to work and school, to taking us on holiday and distributing food and clothes for us to buy. As Dubrovnik Airport and surrounding areas move into a low carbon future, they will show that airports can grow and prosper without more congestion, pollution and CO2. A range of transport options will be provided rather than the one-size-fits-all approach that the versatility of the internal combustion engine has allowed. It's about encouraging smarter travel through a more efficient, intelligent and better organized transport system.

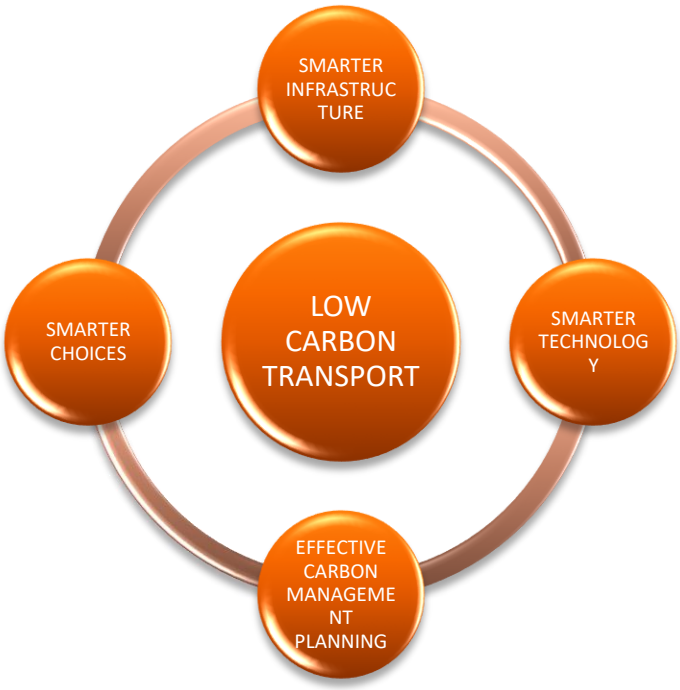
The aim of the project is to reduce the use of energy and environmental impacts of transport activities at airports and their wider environment, by changing the

patterns of behavior of passengers and airline staff mobility and by developing innovative public body strategies for low mobility planning.

The aim of this strategy is to suggest a set of guidelines for the local authorities when planning the low carbon mobility. It is essential to increase the proportion of passengers and staff travelling to the airport using low carbon transport with minimal infrastructure investments.

LAirA also addresses mobility behavior and the subjective attitude of passengers and employees when choosing transport modes and contributes to the (further) development of transport policy strategies.

1.3. WHAT IS LOW CARBON TRANSPORT?



1.4. 7 KEY THEMATIC AREAS

Based on the 7 key thematic areas action plans a set of guidelines will be designed for the Airport Dubrovnik within this strategy: Strategy for planning low carbon modes of transport to and from the airport.

LAirA identifies seven priorities that are relevant for achieving multimodal, intelligent and low-CO2 mobility system:

- Electric mobility
- Air-Rail links
- non-motorised individual transport (foot, bicycle),
- Shared mobility
- intelligent transport systems (ITS),
- orientation at the airport (wayfinding) and
- public transport.

These 7 thematic areas are elaborated within 7 action plans:

1. Joint electric mobility Action Plan
2. Joint Air-Rail links action plan in LAirA airport FUAs
3. Joint soft mobility action plan in LairA airport FUAs
4. Joint Shared mobility action plan in LAirA airport FUAs
5. Joint ITS mobility action plan in LAirA airport FUAs
6. Joint Wayfinding action plan in LAirA airport FUAs
7. Road public transport & Demand Responsive Transport action plan in LAirA airport FUAs

2 BASELINE SITUATION

2.1. LAIRA FUAS MOBILITY PLANS AND POLICIES ANALYSIS

Airport Dubrovnik is located in the Dubrovnik – Neretva county.

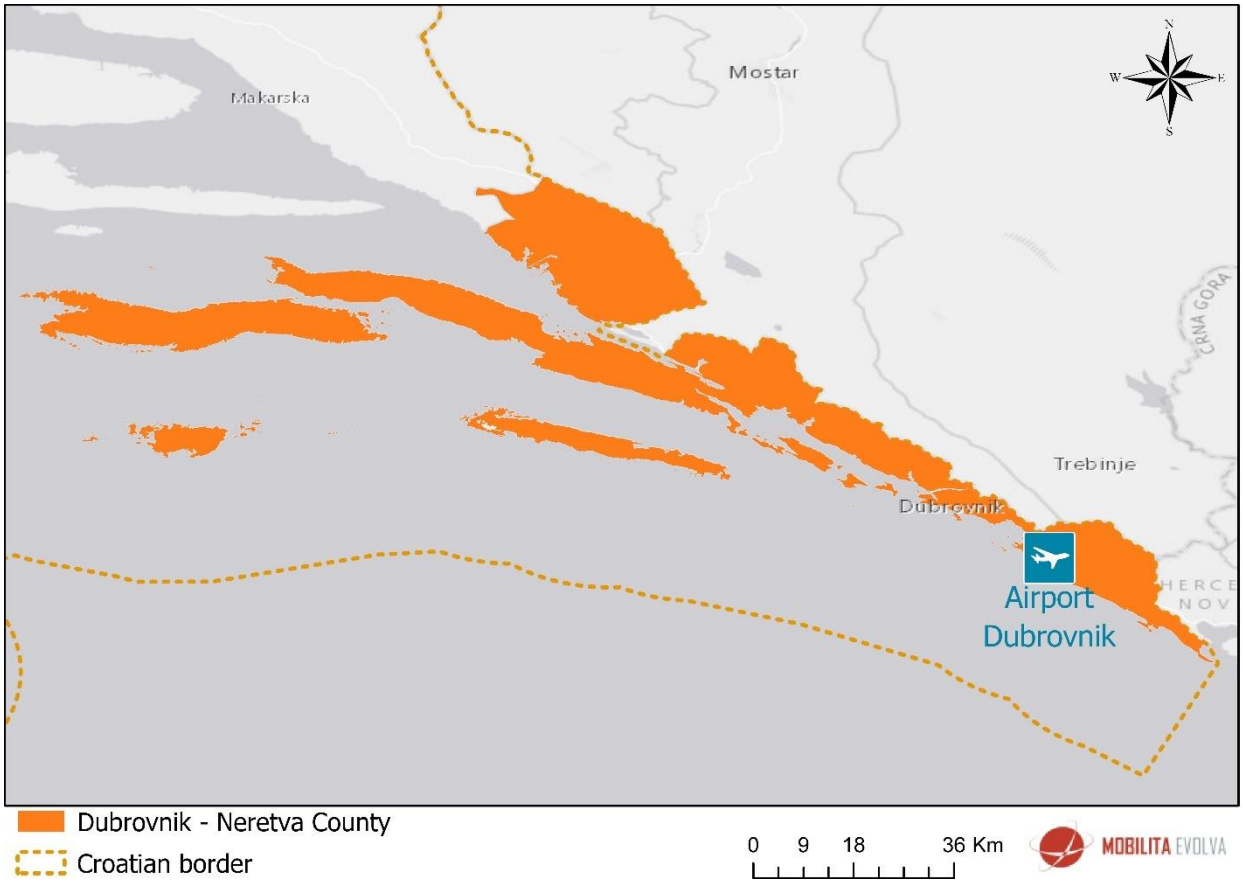


Figure 1 - Geolocation of Airport Dubrovnik

The Dubrovnik-Neretva County is the southernmost Croatian county, peripherally located and the furthest from the country's capital, City of Zagreb. The County borders on land and sea with the Split - Dalmatia County and is an integral part of the NUTS II statistical region Adriatic Croatia.

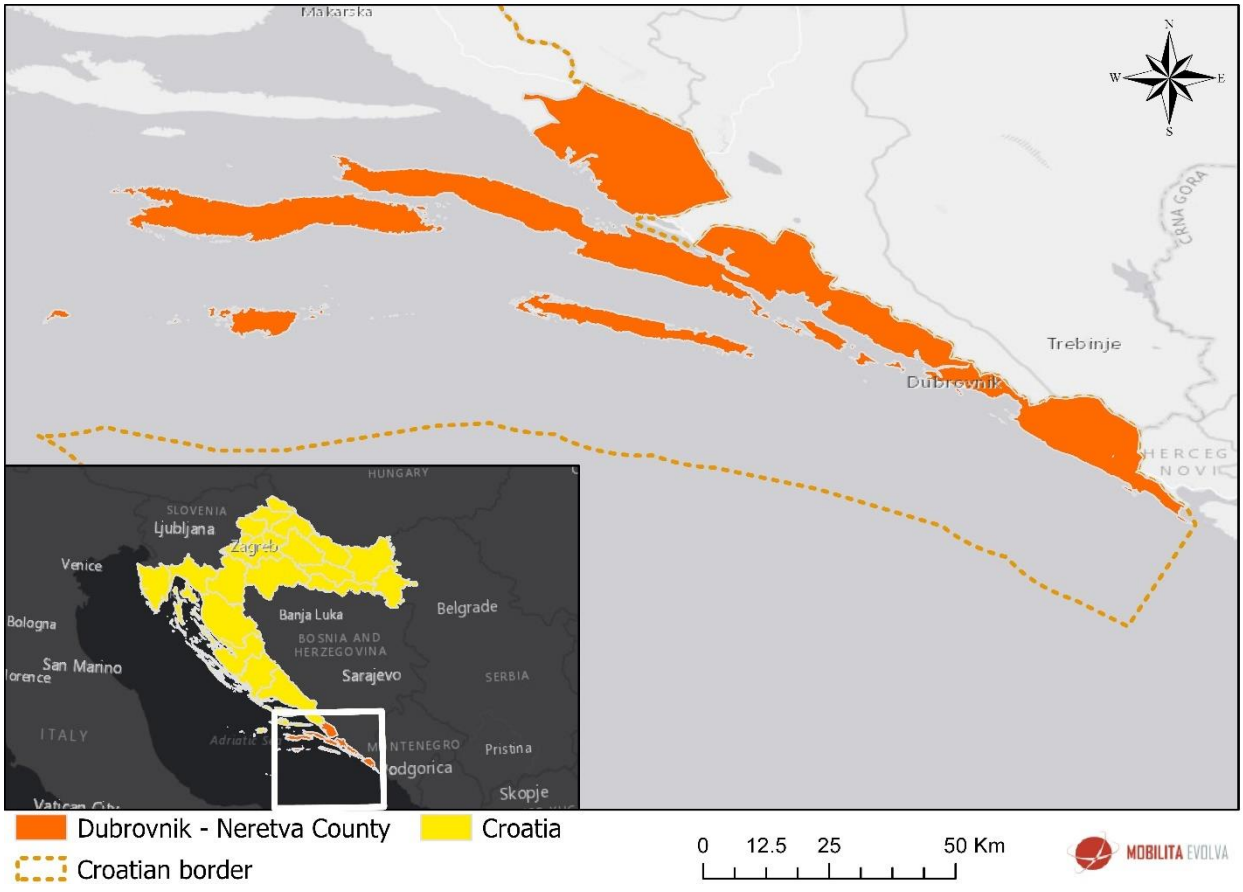


Figure 2 - Geolocation of Dubrovnik - Neretva County

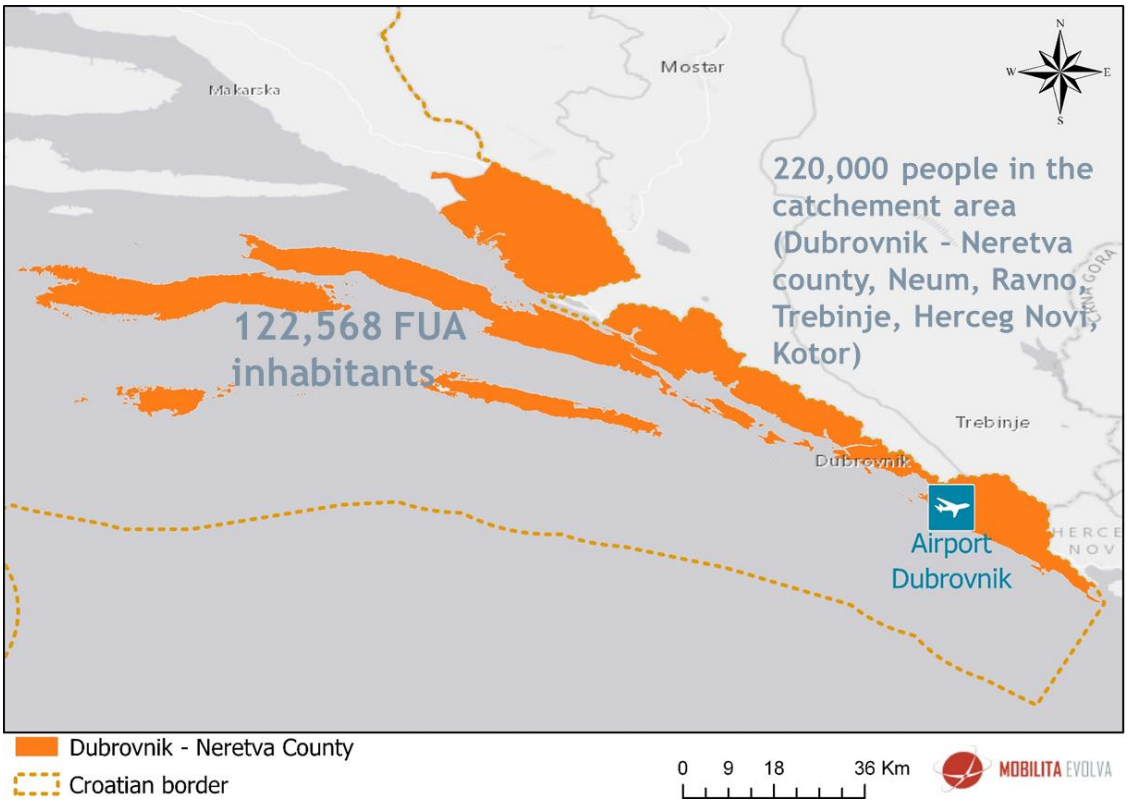


Figure 3 - FUA inhabitants and catchement area

The main characteristic of this region is its transport isolation from the rest of Croatian territory and following that, from the rest of Europe, mostly as a result of physical separation from the rest of the state territory by the Bosnia and Herzegovina access corridor to the Adriatic. The main road routes pass between the coastline and the Bosnia and Herzegovina state borderline. The most significant state road is the D8 state road (Adriatic Highway) with some county and local roads connecting to it, while the A1 motorway runs up to Ploče and the Bosnia and Herzegovina state borderline (Ravča - Ploče L=21.000 m).

The County is on the Adriatic – Ionian route (Motorway A1 Zagreb-Dubrovnik, section Ploče-Dubrovnik) – from the Ploče Interchange to the Osojnik Interchange and further to the Bosnia and Herzegovina State borderline.

A railway line M3, main railway line (in the corridor), section B&H state borderline - Metković - Ploče runs around 24 km into the Croatian land.

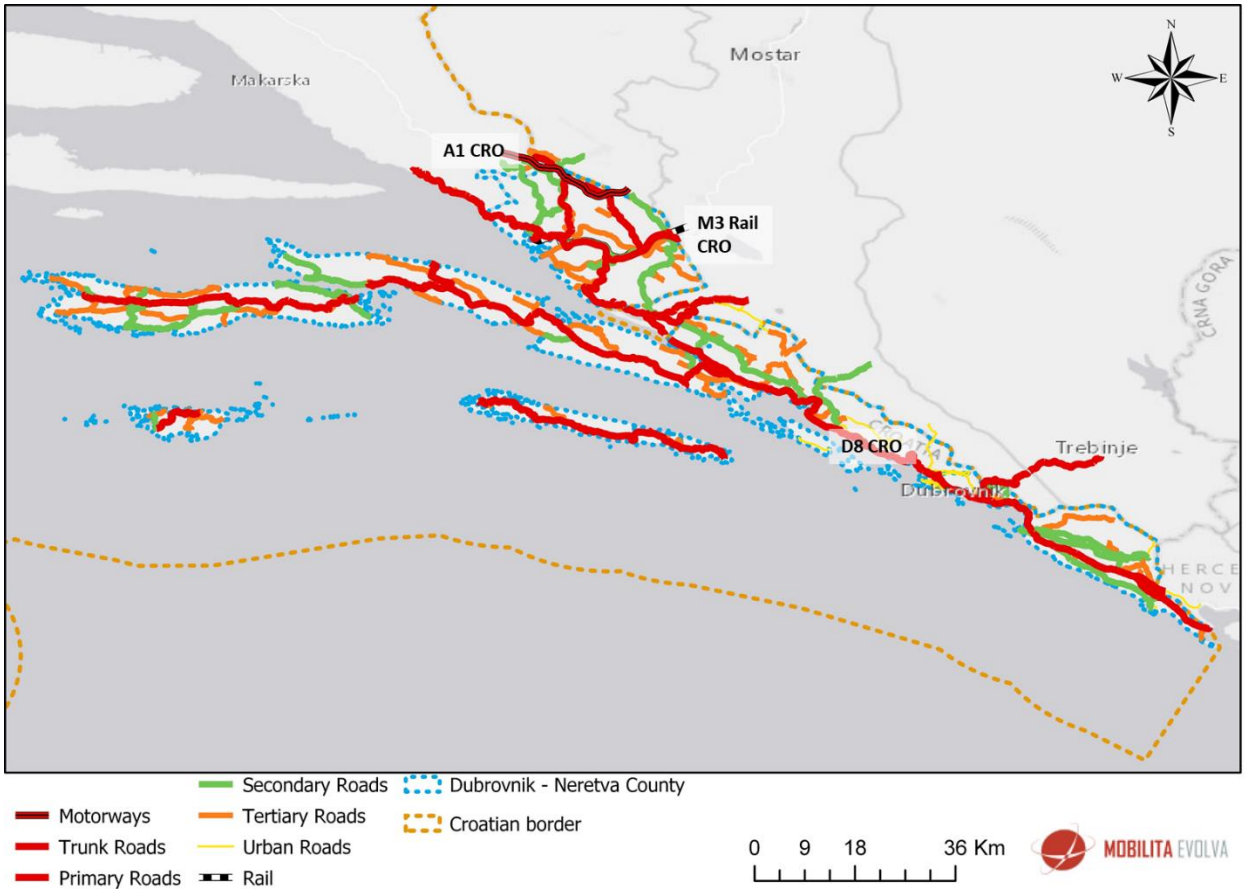


Figure 4 - Road network of the Dubrovnik - Neretva county (FUA)

2.2. ANALYSIS OF THE MULTIMODAL MOBILITY SYSTEM IN THE DUBROVNIK AIRPORT FUA

Figure 5 - Driving distances of the airport Dubrovnik

Dubrovnik airport has an easy access from Dubrovnik city: only 21 km (13 miles) from Dubrovnik. It has a single access route from the City of Dubrovnik to the airport terminal. This is the Adriatic main state road (D8). The Adriatic main state road has a transport capacity that was suitable for the time of its construction, i.e. in the 1960s.

Today's transport demand is far higher than the capacity of the Adriatic main state road in the segment from the City of Dubrovnik to Dubrovnik Airport, not only during peak periods of the tourism season, but also year-round. This situation is not sustainable and both short-term and long-term solutions need to be found in resolving this problem in order to increase mobility and accessibility, and to reduce harmful environmental impacts.

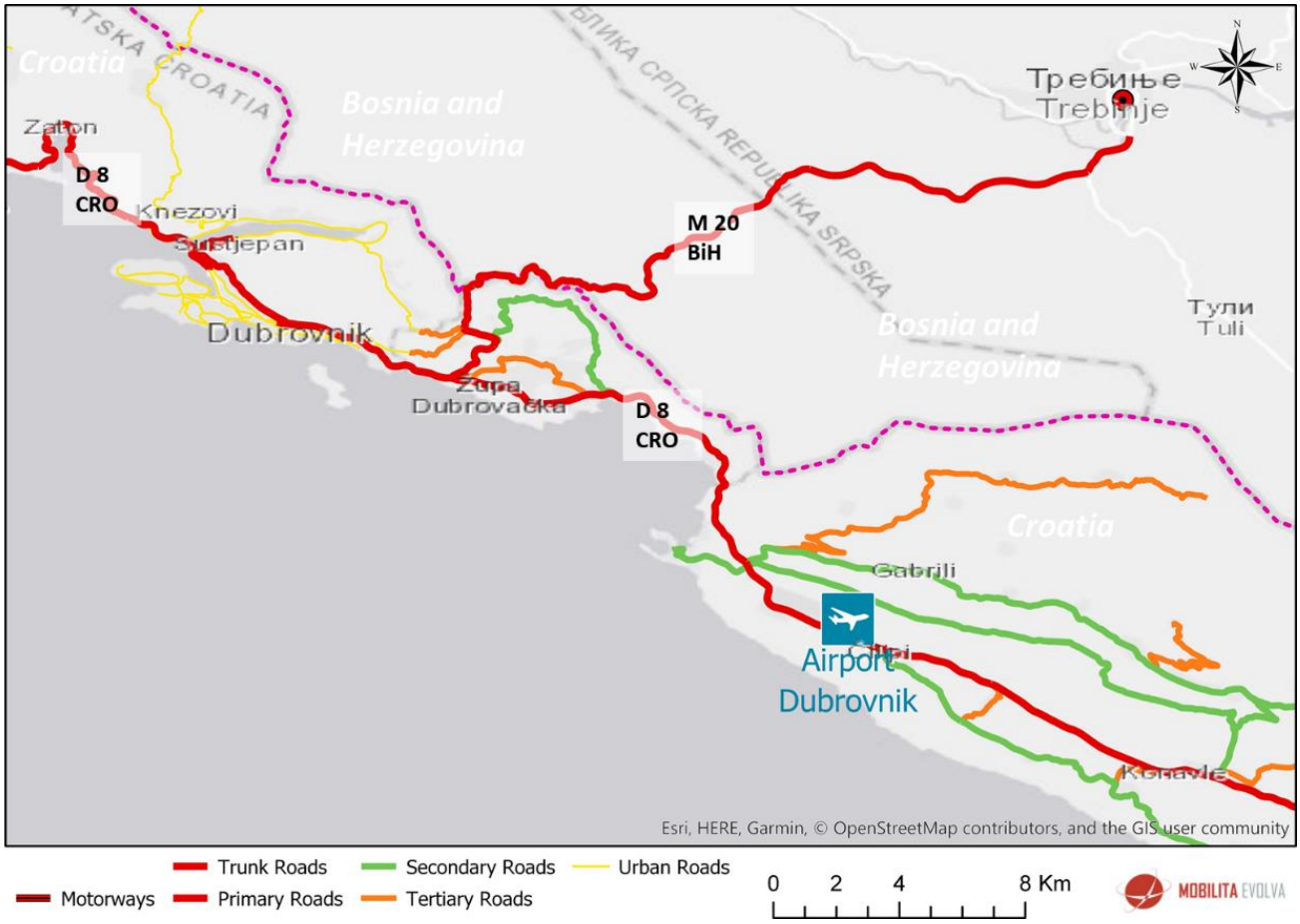


Figure 6 - Road connections to the airport

2.3. PASSENGERS TRAFFIC

Table 1 - Airport Dubrovnik passengers traffic

Year	Passengers	Passenger percentage %
2006	1,120,453	▲ 11.13
2007	1,144,038	▲ 2.1
2008	1,191,474	▲ 4.15
2009	1,122,355	▼ 5.8
2010	1,270,062	▲ 13.16
2011	1,349,501	▲ 6.25
2012	1,480,470	▲ 9.7
2013	1,522,629	▲ 2.85
2014	1,584,471	▲

		4.06
2015	1,693,934	6.91
2016	1,993,243	17.67
2017	2,323,065	16.5
2018	2,539,412	9.31

Source 1 - Dubrovnik Airport

Total passenger traffic in 2016. was 1.9 million with more than 19,000 aircraft operations. In 2017. traffic increased by 16 percent compared to 2016, which is 2,320,000 passengers. This was the first time in history that Dubrovnik Airport had traffic of more than 2 million passengers, and the trend continued in 2018. with 2,5 million passengers.

2.4. THE TRANSPORT DEVELOPMENT STRATEGY OF THE REPUBLIC OF CROATIA (2017–2030)

The Transport Development Strategy of the Republic of Croatia (2017-2030) established the following general objectives:

- changing the distribution of passenger transport towards public transport and forms of transport with zero greenhouse gas emissions. That includes public transport in agglomerations and in the local regional context (trams, local bus lines, etc.), rail transport, public maritime transport and inland waterway transport (by boat), bus transport in regional and distant lines, and walking and cycling;

- developing transport systems (their management and organisation, and the development of infrastructure and maintenance) based on the principles of economic sustainability;

- reducing the impacts of the transport system on climate change;

Specific objectives, among others, include the following:

- in certain parts of Croatia where applicable, completing the development of the tourism sector as the main economic factor for the adequate development of transport, especially in the sense of public transport and green mobility;

- improving accessibility to airports, especially by public transport.

The project Development of the Dubrovnik Airport is currently under implementation, and according to plans lasts from 1 January 2014 to 11 April 2019. This project is cofinanced by EU funds from the European Regional Development Fund "Investments in the Future!".

The reconstruction of the airport and its development project are aimed at ensuring greater competitiveness of the Dubrovnik Airport in comparison to other airports, providing a higher level of service, greater employment, and greater tourist turnover in both directions. One of the main objectives of the Dubrovnik Airport is to increase the number of passengers to about 3.98 million per year by 2032.

- reducing the impacts of the transport system on the environment (environmental sustainability);

- increasing the safety of the transport system;

- increasing the interoperability of the transport system (public transport, rail, road, maritime, air transport, and inland waterway transport);

- improve the integration of transport modes in Croatia (management, ITS, VTMIS, P&R, etc.).

2.5. PROJECT "DEVELOPMENT OF THE DUBROVNIK AIRPORT"

Since Dubrovnik Airport is located in Dubrovnik-Neretva County in Croatia, this county was geographically isolated from the rest of Croatia and the European Union due to the narrow land band and the border with Bosnia and Herzegovina. Therefore, Dubrovnik Airport plays a key role in ensuring the accessibility of the county to tourists, especially considering that more than 65% of tourists come by air.

The airport in the present state cannot accept the expected increase in traffic because its capacity is already at the margins of utilization. The constant overload of various subsystems at the airport over time would lead to a deterioration of its functionality.

Therefore, the project of the development of the Dubrovnik Airport has been recognized as one of the key investment projects in infrastructure in the Republic of Croatia. In addition, this project is in line with the Croatian Transport Development Strategy for the period 2014-2020 and the Operational Program for Transport for 2013. The realization of this project is in line with the declared

objectives of the Declaration on the Traffic Isolation of the Dubrovnik-Neretva County and with the Europe Plan 2020 and the White Paper of the EU.

The value of the project is 220,000,000 euros.

Within Phase I, the construction of a part of the C partition and the south facing canal, the official passage O3, Wi-Fi on the terminal, the TS1 transformer and the realization of the purchase of part of the land for the needs of the project was financed. The first phase of the project involving the completion of the passenger terminal was officially completed in May 2017.

Phase II consists of Reconstruction of runways, staging trails, boarding bridges and airport superstructure, construction of fire brigade facilities, general aviation facilities, construction of an administrative building and a technical block, as well as adaptation to Schengen requirements of the Airport, construction of supply facilities (the first airport in the Republic of Croatia with such technology), water supply and drainage facilities, wastewater and waste management, construction of electrofeeding facilities, construction of a new parking lot for passengers and staff, as well as construction of green areas and installation photovoltaic system, making the Airport of Dubrovnik becoming the leader in the Republic of Croatia with the use of green energy. The second phase of the project is underway and will be completed by the end of 2019. and it will make Dubrovnik Airport a state-of-the-art European airport.

3. PASSENGERS AND EMPLOYEES SURVEY

3.1. INTERVIEWING PASSENGERS AT THE DUBROVNIK AIRPORT

The purpose of making a passenger survey is to analyze the needs and habits of users of the Dubrovnik airport. There is a need to analyze the characteristics of mobility of passengers, their perception of mobility and knowledge of the transport possibilities of departure or arrival at Dubrovnik airport.

The passenger mobility survey was made in accordance with the project partner's methodology (proposed issues). It contains standardized questions to simplify data analysis and facilitate comparisons of results in the future. Additional questions were made according to the specific characteristics of the Dubrovnik Airport (eg seasonality problem) and to collect the required parameters in the I. report.

The survey was created in "Google Forms" for better data structure and simplicity. The results from Google forms have been further processed in Excel to be well presented in this report.

There were two types of passenger survey:

- a printed passenger survey - interviewing passengers personally at the Dubrovnik airport
- online traveler survey - travelers fill in a survey on Google forms (required Internet connection)

According to the needs of the project, the focus was on 70% of domestic passengers leaving Dubrovnik airport (outgoing) and passengers from neighboring countries, including Dubrovačko – neretvansku county, BiH (Municipality Neum and Ravno), Republic Srpska (Trebinje Municipality), Montenegro (Herceg Novi and Kotor). The remaining 30% of respondents are passengers outside these areas.

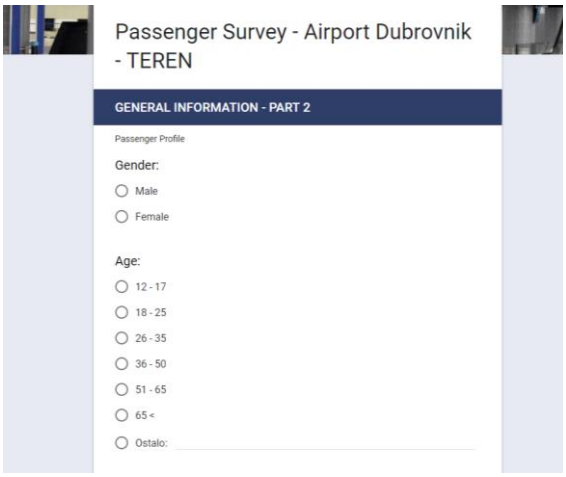


Figure 1: Online passenger survey
Source: Mobilita Evolva

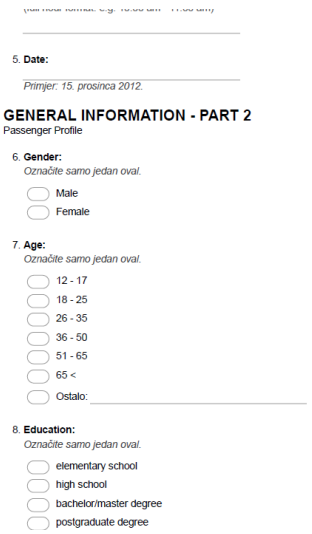


Figure 2: Online Passenger Survey
Source: Mobilita Evolva

Survey of passengers at the Durbovnik airport was carried out in the period 22.01.2018. - 26.01.2018. and online in the weeks following these dates.

Survey at the airport was carried out at three terminal locations, at Dobrota 24, Močići, 20213 Čilipi, Croatia.

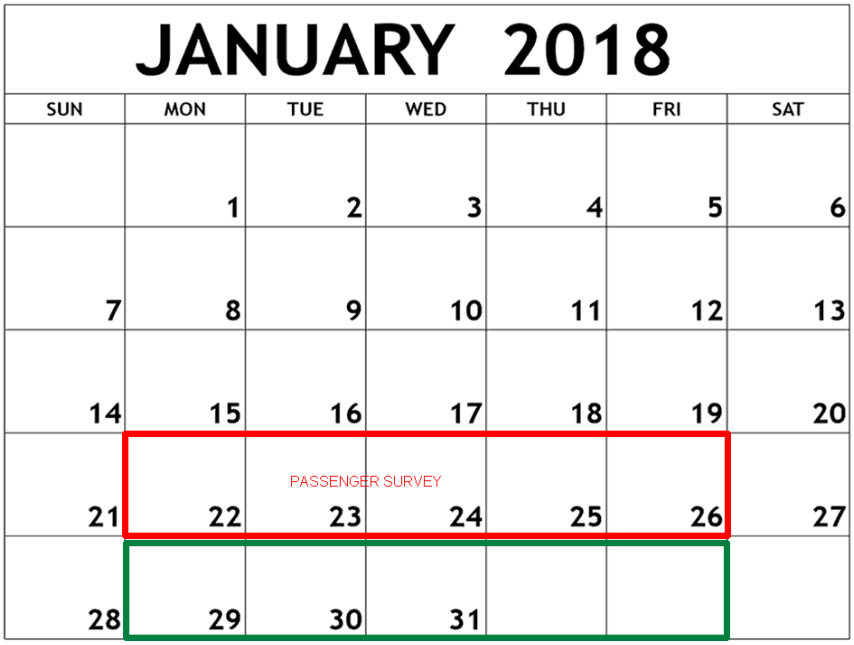


Figure 1: Passenger surveying period

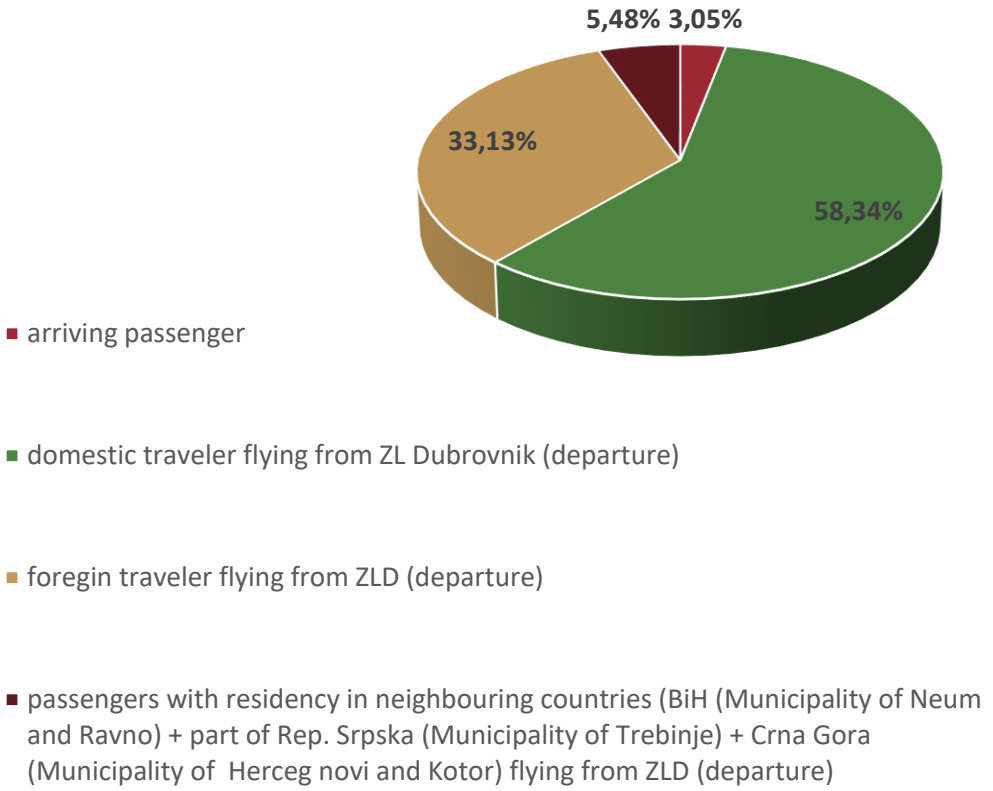
Four polling stations for passengers at the airport are:

- Check-in area
- Departure hall of international flights
- Departure hall of domestic flights
- Arrival hall

The survey was conducted in both Croatian and English on domestic and foreign passengers.

On Monday 22.01. and on Tuesday, January 23, 2018, a pilot survey was conducted to evaluate the quality of the survey question's structure. It was concluded that no additional modification is required and that the survey is at a satisfactory level functional.

Graph 1 - Surveyed passengers structure



Source 2 - Made by author

From the graph 1 it is evident that the majority of the number of domestic passengers traveling from the airport of Dubrovnik is among the total number of surveyed passengers, followed by foreign passengers traveling from Dubrovnik airport.

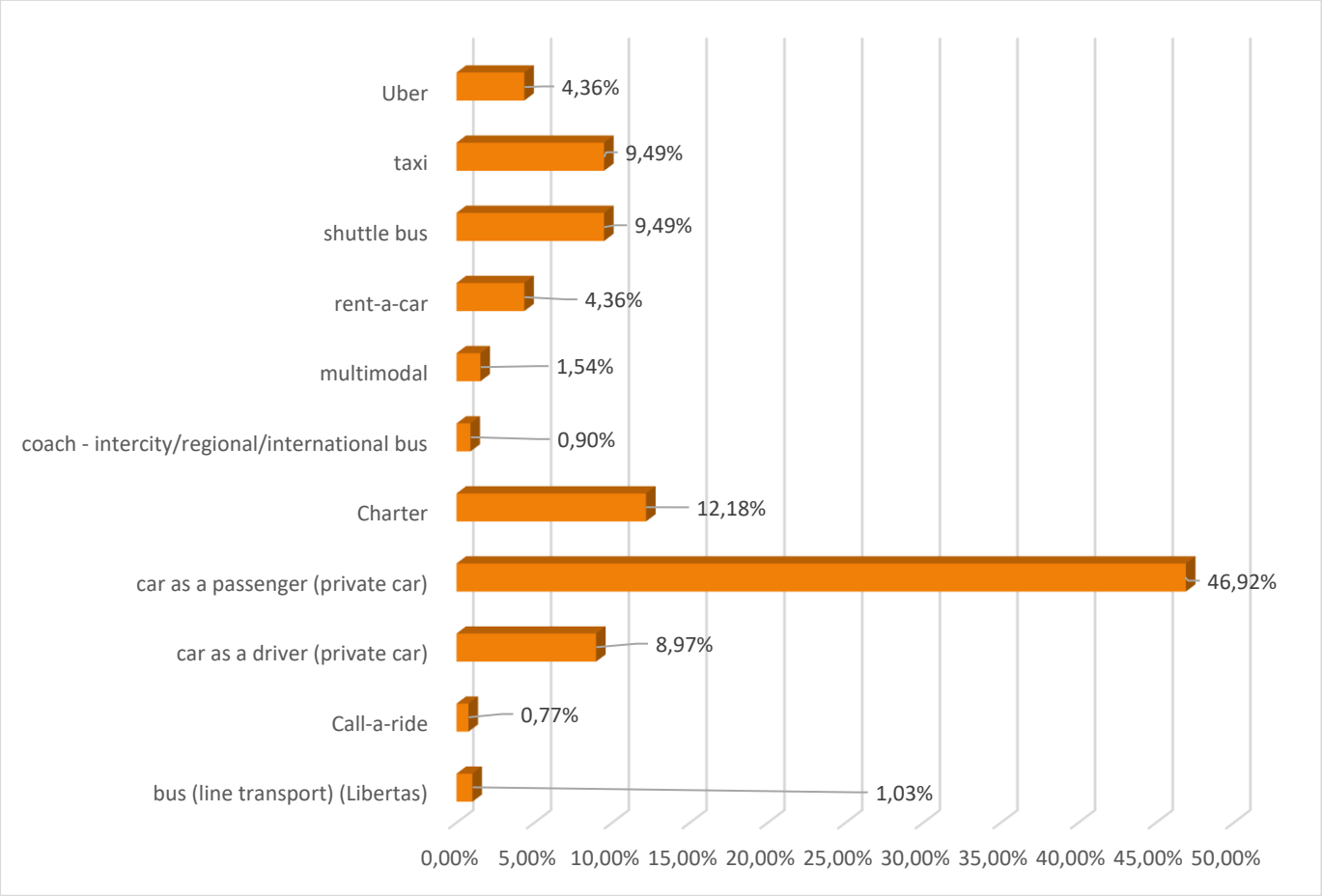
There were only 5,48% passengers from the neighboring countries of BiH (municipalities of Neum and Ravno) and part of Republic Srpska (Trebinje municipality) and Montenegro (municipalities of Herceg Novi and Kotor).

The smallest number of passengers was surveyed who had landed to the airport.

Figure 7 - Passengers origin settlements

Source 3 - Made by author

Graph 2: Modal share of passengers accessing the airport



Slika 2 - Made by author

The modal share shows the ways by means of transport, how the surveyed passengers arrived at the airport of Dubrovnik. From the graph it is evident that the largest number of airport users comes by private car as a passenger (46.92%). In the surveyed area, 12.18% of the passengers to the airport arrived with the Charter bus. Of the more representative transport there are Shuttle buses, taxi transport and passengers arriving by private car. The least represented forms of transportation are interurban, regional, international bus service and city liner transport.

3.2. EMPLOYEES INTERVIEWING

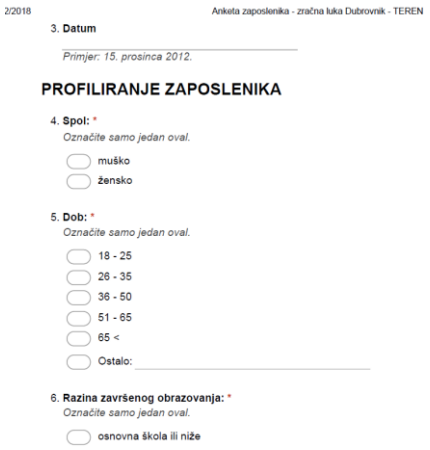
Purpose of Employee Survey was to get to know commute travel characteristics of employees working in Airport Dubrovnik, their mobility perception, travel demands and needs.

Employee surveys were also made in accordance to given Methodology (recommendations) from PP-s. Survey includes recommended standardised questions to simplify data analysis from each PP and also for future comparisons. Personalised questions considering specific situations of Airport Dubrovnik (e.g. seasonality problem) were added as well in order to collect specific parameters concluded in Activity 1.

Employee Survey was made in Google Forms which also simplifies collected data structure.

Two types of Surveys were made for employees:

- Physical Employee Survey – Interviewers surveying employees in person at the airport
- Online Employee Survey – Airport employees participating in Survey via Google Forms interface



2/2018 Anketa zaposlenika - zračna luka Dubrovnik - TEREN

3. **Datum**

Primjer: 15. prosinca 2012.

PROFILIRANJE ZAPOSLENIKA

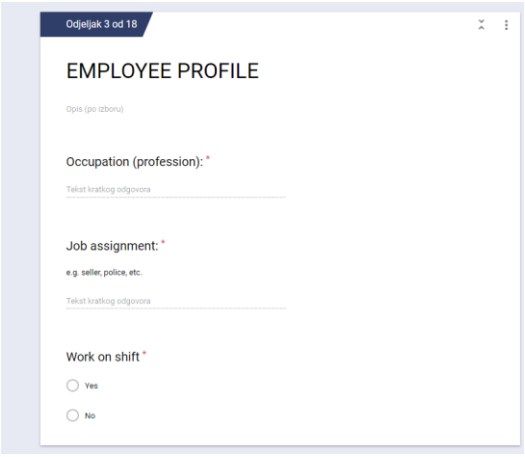
4. **Spol:** *
Označite samo jedan oval.
muško
žensko

5. **Dob:** *
Označite samo jedan oval.
18 - 25
26 - 35
36 - 50
51 - 65
65 <
Ostalo:

6. **Razina završenog obrazovanja:** *
Označite samo jedan oval.
osnovna škola ili niže

Figure 8: Questionnaire for passengers - paper

Source: Mobilita Evolva



Odjeljak 3 od 18

EMPLOYEE PROFILE

Opis (po izboru)

Occupation (profession): *

Tekst kratkog odgovora

Job assignment: *

e.g. seller, police, etc.

Tekst kratkog odgovora

Work on shift *

Yes

No

Figure 9: Online questionnaire for passengers

Source: Mobilita Evolva

Employee surveys were done in parallel with passenger surveys, from 22nd of January to 17th of February 2018.

Some employees were surveyed in person and some online.

Table 2: Period of Employee Survey - first two weeks out of three

JANUARY 2018						
SUN	MON	TUE	WED	THU	FRI	SAT
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	PASSENGER SURVEY 23	24	25	26	27
28	29	30	31			

Employees surveyed were:

- police
- exchange officers
- travel agents
- sellers
- etc.

Locations of employee surveying:

- Check-in
- Duty Free shop
- Sweets store
- Cafes
- etc.

Survey was conducted in Croatian language since employees come from native area near Airport Dubrovnik.

In coordination with Zračna luka Dubrovnik d.o.o. employee survey was also put online for employees to fill it through link and data is being collected.

At listed locations employees were surveyed in order to get information about their profile (sex, age, occupation, city of residence, etc.), about their travel patterns to the airport (mobility characterisation, indication of main mobility problems, etc.

The survey consisted of following fields:

- Survey specifications (place of interview, meteorological conditions, etc.)
- Employee profile
- Mobility behaviour characterization
- Mobility characterization
- Mobility perception

More than 150 employees in total were surveyed during period of three weeks. First week 22.01. pilot survey has taken place. During analysis it was concluded that no further changes need to be made. Survey lasted from 22.01.-17.02.2018.

3.2.1. Settlements where employees come to work from

Table 3: Ratio of employee origin to Airport Dubrovnik

Area	Surveyed employees
Cavtat	11,30%
Čilipi	18,26%
Dubrovnik	21,74%
Gruda	14,78%
Konavle	10,43%
Mlini	3,48%
Mokošica	6,09%
Popovići	4,35%
Zvekovica	4,35%
Župa Dubrovačka	5,22%
TOTAL	**100,00%**

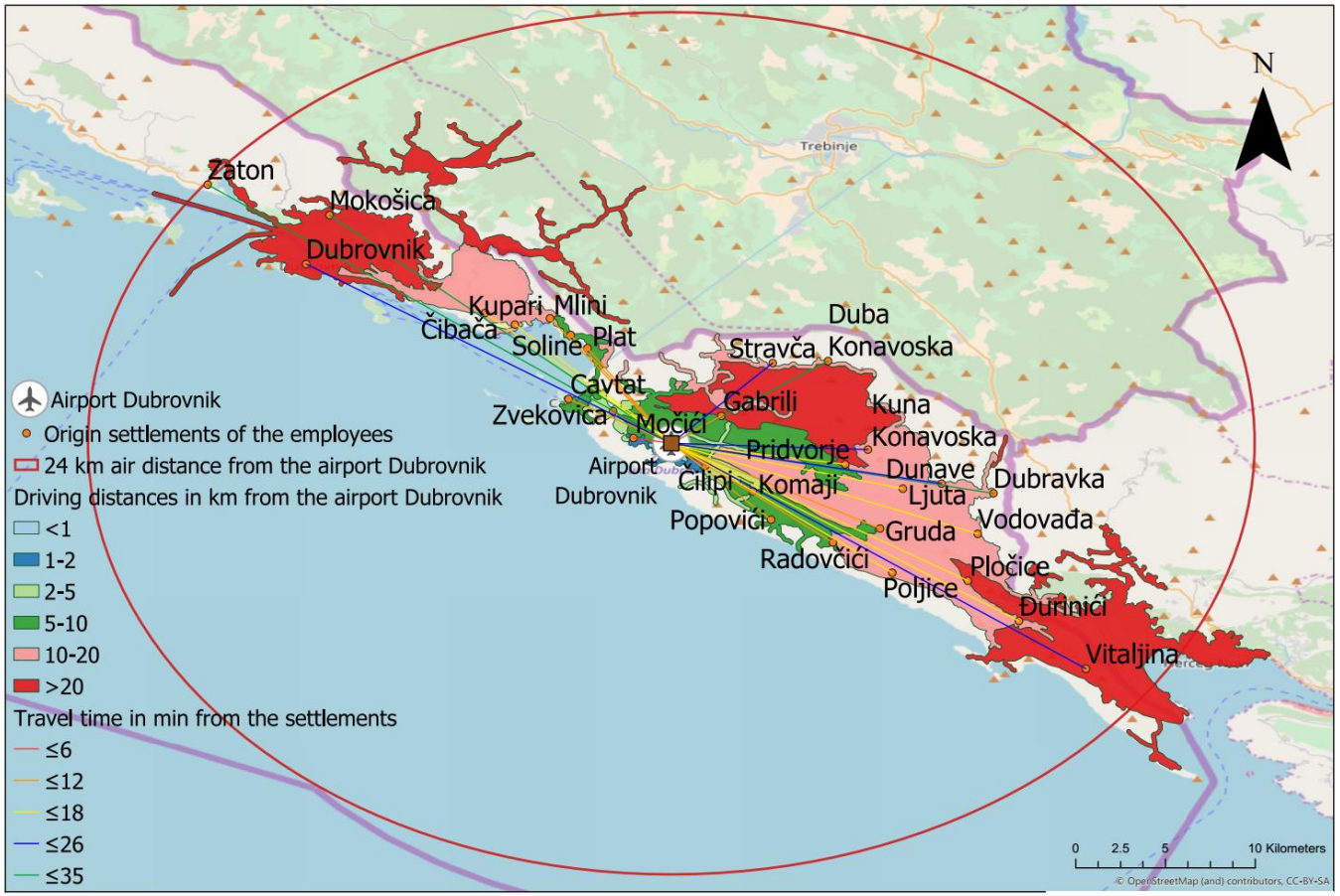
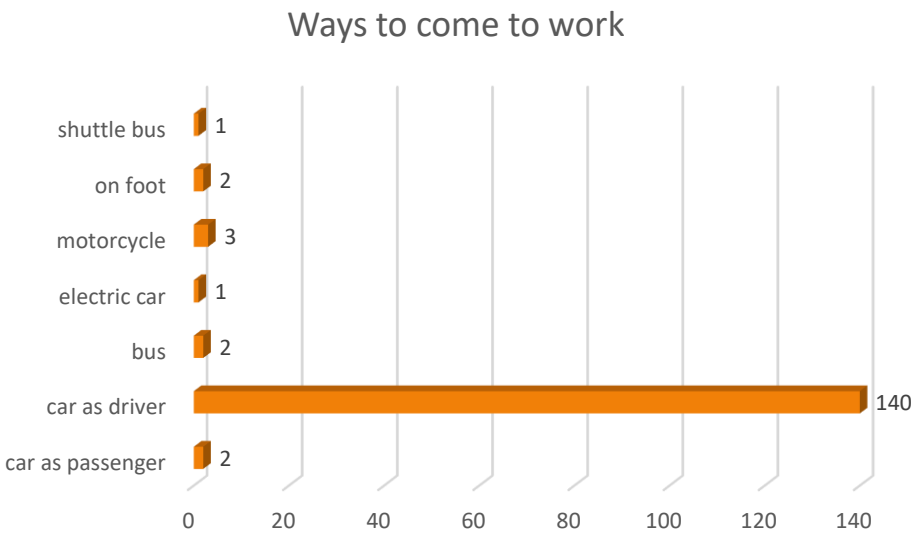


Figure 10: Employees home locations, buffer and distances
Source: Author

Graph 3: Mode of transport chosen by emploeey in commute

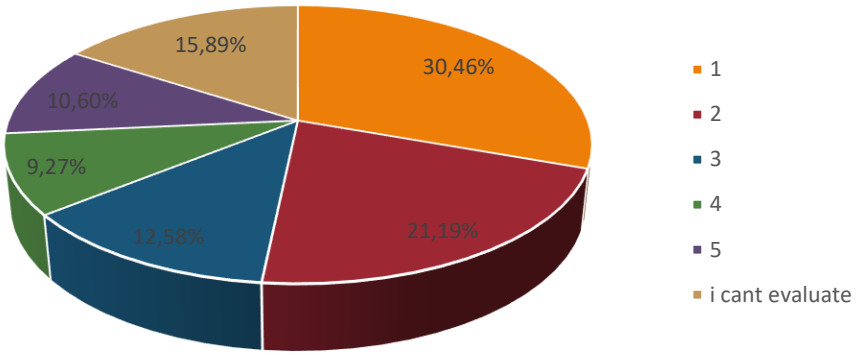


92% of surveyed employees go to work to Airport Dubrovnik every day by car. This is not good since their origin is mostly less than 10 km away from Airport Dubrovnik. Mostly they park in parking for employees and have free parking. Other modes of transport are minor.

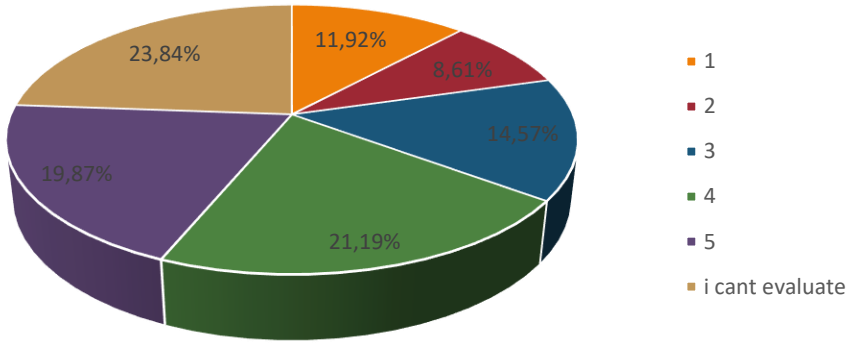
3.2.2. The level of satisfaction of employees with the existing mobility system and the perception of accessibility

The following graphs show the ratings of employees regarding road accessibility, airport signs, buses frequencies, shuttle bus rates, taxi service availability, bus accuracy, shuttle bus accuracy, taxi service accuracy, bus pricing, taxi pay-per-view, passenger information system during transportation and bicycle accessibility to the airport. Ratings ranged from 1 to 5 and cannot be estimated (1 - very bad, 2 - satisfactory, 3 - good, 4 - very good, 5 - excellent).

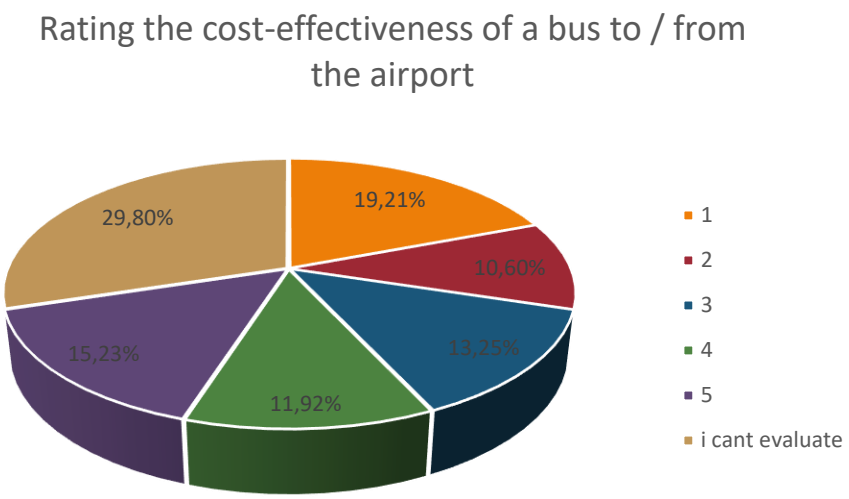
Graph 1: Frequency of the bus



Graph 2: Frequency of the shuttle bus



Graph 3: Cost - effectiveness of a bus



Graph 4: Bycicle accessibility

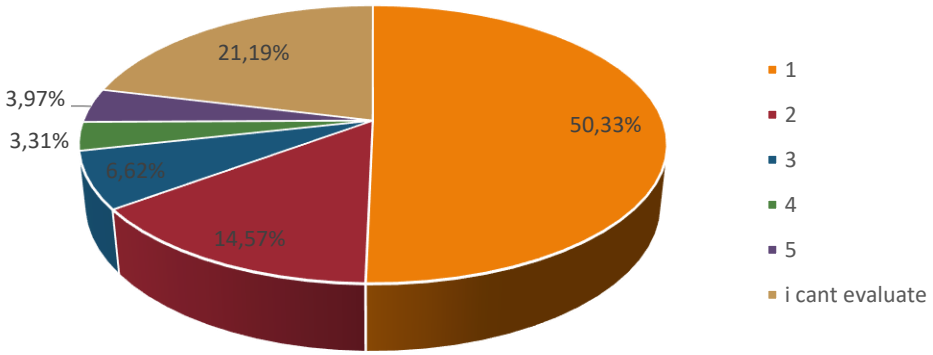
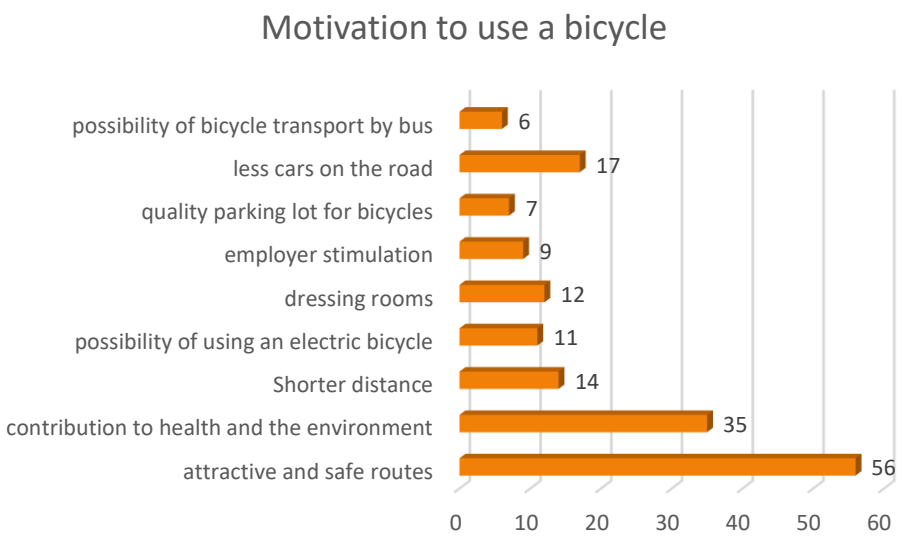


Table 4: Table of comments/suggestions

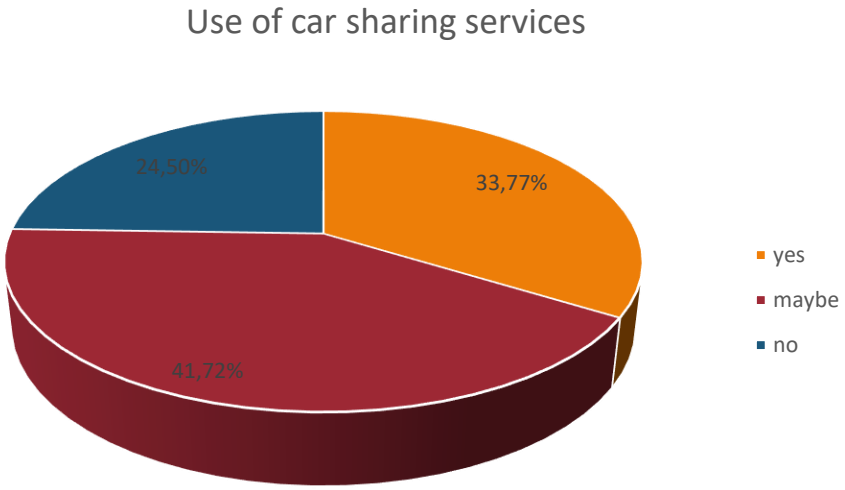
SUGGESTIONS OF THE EMPLOYEES
bicycle path
bus for employees
the bus every full hour
more parking places
separate parking plces for emloyees
better marked parking space
more frequent city lines
electric car or bicycles
100% electric car sharing

car sharing
shuttle bus for emloyees
cycling and hiking trails
smart parking

Graph 5: Motivation for bycicle



Graph 4: car sharing service



The data shown in the chart above shows the results of the survey regarding the use of car sharing services. It is visible that 33.77% of employees would agree to use the car sharing service as a way of getting to work, while 24.50% of employees would not use this service. Other employees, 41.72%, said they might use this service as a way of getting to work. Here is the possibility of awareness raising among human resources departments and potential users regarding ride-sharing and emission mitigation.

3.3. AIRPORT DUBROVNIK PILOT PROJECT

Airport:	*Dubrovnik Airport (DBV)*	**Duration:**	*15.6.2019 - 15.7.2019*
FUA:	*Municipality Konavle* *Municipality Župa Dubrovačka* *City of Dubrovnik*	**Budget:**	*4.800,00 EUR*
		Estimated number of users:	*Fill in*
Objectives:			
DBV proposals objectives: • *The objective of the project, which is to reduce energy consumption and ecological impacts of transport activities at airports and in their wider surroundings* • *Changes in mobility behaviour patterns of the airport's employees by creating innovative strategies of public authorities regarding planning of low CO2 emission mobility* • *To improve communication between airport authority and employees regarding airport environmental impact*			
Expected Impact:			
Employees Campaign: • *Recording of a video for the campaign in which employees shall have a big part* • *Promotional activities: digital platforms (social media)* • *Cooperation with a local bicycle club* *Communication mix:* *1 Print (Roll banner - Posters - Promotional brochures, Footprints with messages,)* *2 Broadcast (TV, Video)* *3 Events / Promo activities* *4 Digital media (Web sites, promotion campaigns in social media)* *5 Project branding (visual identity, support for the promotion, marketing promotional and branding activities)* *Good awareness on the project activities on the local level, with emphasise on all airport employees.*			
Challenges:			
First, the cultural heritage in Dubrovnik FUA where most of employees have used to use a car for transportation to the airport. This is the number one concern and challenge that we will address. *The next challenge (but at same time opportunity) is high season when there is little free time to organize and stimulate employees. At the same time this is part of the year when the alternative ways of transport from FUA to airport are most efficient.* *Third, limited resources that can be utilized by the airport for the purpose of conducting pilot in the form of public campaign for reassign of awareness.*			

Table 5 - Facts on Dubrovnik pilot/awareness campaign

3.4. POTENTIALS

Dubrovnik area has a favorable geographic location on the Mediterranean Sea.

It is a famous touristic destination, the touristic demand is on the rise.

The City is a port on the Adriatic Sea, historical center of luxurious tourism in Southeast Europe, it has a rich history and cultural heritage (monumental heritage protected by UNESCO) which makes Dubrovnik a metropolis of culture.

It is characterized by outstanding natural beauty with Mediterranean climate. Dubrovnik area is attractive during every season, it has a lot of sunny days, rich geomorphological features (islands, rocks, reefs, caves), large biodiversity of the area and is close to the National Park Mljet and Pelješac peninsula.

These potentials make Dubrovnik very attractive to new tourists, which also raises the demand for the number of employees at the airport and makes access to and from the Airport very important in reducing CO2 levels produced by transport.

55% of arriving passengers come by private car. This is a huge potential to switch this behavioural pattern to more sustainable modal choice (shuttle bus, city bus, …).

3.5. PROBLEMS AND CHALLENGES

Only D8, national road, is the current connection to the airport.

Relief in Dubrovnik Airport area is very difficult. The coastal zone is proportionally narrow, bordered inland by steep mountain slopes. Infrastructure interventions are crucial to change people‘s mindsets.

Both passengers and employers will choose convenience over sustainability which is resulting in use of private car, it is very complexed to convince people without a suitable alternatives to change their built habits.

Dubrovnik Airport has a unique location in the country which requires development of the air transport which then brings more passengers to the area and more employees that must use green ways to access the Airport.

4. VISION AND OBJECTIVES

Based on the analysis of the current situation / environment, the Airport of Dubrovnik defines the general vision and objectives that represent a statement of what this Strategy intends to achieve in the coming years: it defines a clear direction of movement and action in the given time period and its realization will contribute to the realization of the set vision.

Vision 1: Sustainable transportation to the Airport Dubrovnik - cycling and walking

Vision 2: Improving the ITS technologies to develop sustainable public transport

There are a large number of potential measures that will have some impact on both carbon emissions and air quality. These fall into the themes of:

- Changing travel behaviour
- Managing emissions
- Greening vehicle fleets
- Awareness-raising

7 objectives are determined as the most important for Dubrovnik airport:

Objective	Objective description	Indicator	Relevant stakeholders	Deadline
O1 - Improving the efficiency and sustainability of the transport sector	Organizationally, it is necessary to improve cooperation among relevant stakeholders and to ensure the interoperability of the entire transport system. According to the European Union's strategy, the share of ecologically acceptable modes of transport in passenger and freight	Increase the number of passengers travelling by public transport to and from the airport - 50% of passengers accessing/leaving the airport by public transport	operators, infrastruction administrators (HAC, ŽUC, HŽ Infrastrukture, ŽLU,...) the local authority units	2040.

	transport (modal split) has to be increased. In passenger transport, it is necessary to increase the share of travel by public transport, bicycle and walking. In addition to ecological features, these goals will also reduce the bad economic effects, thus increasing the efficiency of the transport system as a whole.	10% increase in share of pedestrians and cyclists in modal split		2030.
O2 - Reduction in the proportion of employees travelling alone by car to and from Dubrovnik airport	From the survey conducted among the employees, as many as 92% of respondents stated that their main mode of transport is the car as a driver.	Reduction from from 92% to 70%		2030.
O3 - Decrease in the impact of transport on the environment	Based on the White Paper and the Development Strategy of the Republic of Croatia, it is necessary to reduce the impact of environmental traffic by reducing the CO2 emissions in the atmosphere to 80-95% of 1990 values and from 2020. that the	Reduction of CO2 emission by 20%	operators, infrastruction administrators (HAC, ŽUC, HŽ Infrastrukture, ŽLU,...)	2040.

	emissions won't raise by improving energy efficiency through the realization of public transport vehicles that use renewable energy sources, the realization of other measures aimed at redistributing share of modes in favor of energy and environmentally friendly such as public transport, bicycle and hiking.	30% of taxi fleet is electric		
O4 - Increase in the use of shared mobility and soft mobility modes	In order to achieve the sustainability of the transport sector as a whole, it is important to increase the interoperability that will enable the use of the potential of every transport vision and to encourage modal transport modification to active travel (cycling and walking) and/or mobility schemes such as bicycle and sharing cars (car-sharing, ride - sharing) to reduce pollution in cities. To achieve full efficiency of the entire transport system, it is essential to devise a quality network.	10% increase in share of pedestrians and cyclists in modal split 10% of employees using ride sharing	operators, infrastruction administrators (HAC, ŽUC, HŽ Infrastrukture, ŽLU,...) the local authority units, airport authorites	2030.

O5 - Increasing the level of information to passengers and the availability of information on public transport among tourists	To make public transport easier to use, one of the key items is to increase the level of information of passengers. Every public transport user must be provided with accurate information in real time and in an easy way to maximize the ease of use of public transport. Also, as Dubrovnik is one of the tourist centers of Croatia, it is necessary to adapt the public passenger information systems to tourists by providing all information on public transport lines, departures and arrivals, location, etc. in a simple way and in one place.	creation of mobile applications, websites, implementation of information screens in vehicles and at the airport, and availability of information on all important platforms and sites in English	carriers, Dubrovnik - Neretva County, the local authorities units	2025.
O6 - Ensuring the responsibility and cooperation of the relevant stakeholders	The Republic of Croatia continues to be the main subject of building and maintaining state transport infrastructure, although other entities (regional and local self-government, private sector entities, infrastructure managers, concessionaires, etc.) are key to improving the efficiency of the transport system.	determination of responsibility for the implementation of measures.	Ministry of the Sea, Transport and Infrastructure, Dubrovnik - Neretva County, the local authorities units	2020.

O7 - Monitoring of emissions produced by transport in Dubrovnik - Neretva County		Number of measuring stations		2040.

Table 6 - Strategy objectives

To obtain these objectives and vision, interventions and/or investments needed to be defined. Every intervention has its own success indicator which ensures a supervising system of those interventions that were implemented.

4.1. ELECTRIC MOBILITY

Station-based car-sharing services could appear very successful at Dubrovnik airport, with platforms at the airport and in the Dubrovnik city center.

Combining car-sharing and electric mobility results in a “circulus virtuosis” or in other words a profi table dynamic, because car-sharing and electric mobility are mutually beneficial. The operation of a car-sharing model with electric vehicles makes sense given these considerations even though it is still facing challenges. Apart from the costs, the integration of charging is the most critical success factor for the realization of the concept and its economic success.

Since car-sharing targets short term rentals and inner city traffic, electric vehicles are actually very suitable for use in a car-sharing fleet.The battery range is currently about 100-200 km and can be regarded as adequate.

Figure 11: EV charging stations

Source 4: https://www.greenbiz.com/article/californias-great-electric-vehicle-charging-build-out

EV charging stations are installed at 8 locations from the Airport Dubrovnik to Dubrovnik city. All inspected charging stations except the one at the Dubrovnik Airport, have two AC sockets, rated output 22 kW (32A), output voltage 400V for fast charging.

The charging station at the Dubrovnik Airport has three sockets with higher rated power Table, equal voltage and is free of charge. The EV charging station at the Dubrovnik Airport was installed towards the end of 2017. and is still used for commercial and promotion purposes.

One of the main disadvantages of these vehicles is the need to build a network of charging stations. The problem is to plan their location, number and type. Electric vehicles have a limited range that depends on the capacity of the battery and its service life. The cost of production of the batteries influences the already high cost of electric vehicles compared to conventional vehicles.

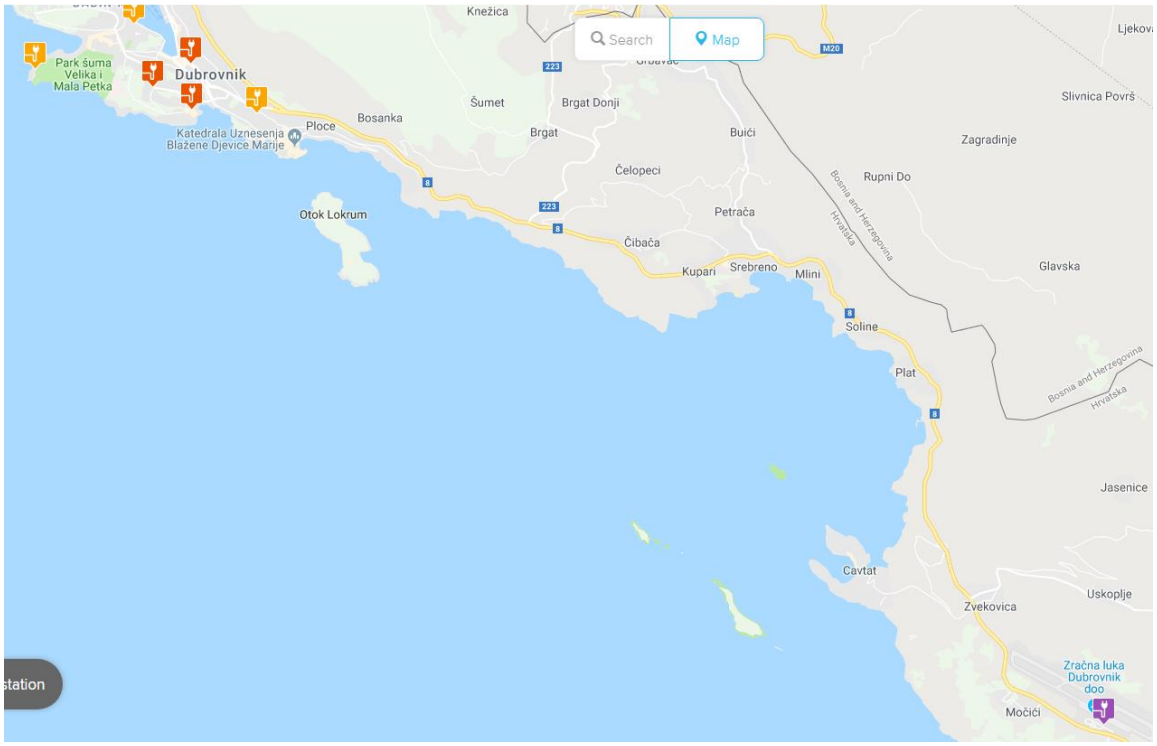


Figure 12: Location of EV charging stations in Dubrovnik - Neretva County

The main reasons for EV adoption for taxis are the same as for electric car – sharing use: Carbon footprint reduction through fossil fuel reduction. The government can stimulate this development by providing incentives, such as tax reduction, or cost benefits, such as subsidies or preferred parking options, allowance to drive on bus lanes.

Electric taxis should not be limited to electric car services. In Dubrovnik urban area electric bikes under bike – sharing service may well offer a faster, more efficient and cheaper solution.

One extremely important thing about electric vehicles is that used batteries are another source of pollution for the Earth. A sutainable way of collecting and then recycling of electric batteries must be implemented in areas where electric vehicles are being implemented. Without that step we will again have the same burning problem as we have now with CO2 emissions and plastics.

4.1.1. Guidelines for Dubrovnik Airport – Actions

Objective Title:	**Objective Number: O1, O3**

O1 - Improving the efficiency and sustainability of the transport sector O3 - Decrease in the impact of transport on the environment	
Intervention/investments: Incentives for electric taxis	**Intervention/Investment number: 1**
Origin of the action: ◯ **Transfer** (x) **New Concept** ◯ **Other**	
Action description - What will be done.	
Working with local licensing committees by encouraging alternative fuels with incentives These investments can help to achieve the objectives of boosting local economy while reducing the oil dependency and improving the environmental impact of transport.	
Minimum viable action	
Must have: Incentives for new vehicles From the beginning effective collection and recycling of used batteries should be implemented Should have: Work with local authorities to set stricter emission standards for taxis	
Responsibility - Who will implement the action?	
Responsibility: Private carriers	
Estimated budget and resources	
Costs: 500.000 € (20.000 per vehicle) Source of financing: State subsidies, EU funds, private contractors and companies	
Measuring success	
Ratio of electric taxis in the taxi fleet, at least 20% by 2030. and 30% by 2040.	
Timeline - Start and end dates	
Immediately: 2020. - long term	
City/region vision and beyond	

Stockholm-Arlanda was one of the first, by giving exclusive priority to hybrid and electric cars – a move which quickly saw all the airport taxis voluntarily move to these technologies. At Amsterdam-Schiphol, the airport company revised its taxi partnership, making cleaner taxis as a key objective. The airport is now served by a substantial fleet of 167 zero-emission Tesla Model S taxis.

Objective Title: O1 - Improving the efficiency and sustainability of the transport sector O3 - Decrease in the impact of transport on the environment	**Objective Number: O1, O3**
Intervention/investments: Install more electric vehicle charging stations	**Intervention/Investment number: 2**
Origin of the action: ◯ **Transfer** (x) **New Concept** ◯ **Other**	
Action description - What will be done.	
Due to the growing number of electric vehicles, there is a need for electric charging stations, which should be equipped with the latest technology and offer fast and reliable charging. Initially, charging facilities can be located at frequently visited locations such as city garages or shopping malls or parking lots near the city center, where parking would not be charged for such vehicles. After that, the network should be expanded to other areas and provide charging modules that can be used to share a car system or electric bikes.	
Minimum viable action	
Must have: Incentives for new vehicles, new charging stations, Recycling and collecting of battery waste Should have: Priority pick-ups	
Responsibility - Who will implement the action?	
Dubrovnik - Neretva County and local municipalities	
Estimated budget and resources	
New charging stations (5): 50,000 euros	
Measuring success	
Number of new charging stations by 2025.	
Timeline - Start and end dates	
Immediately: 2020. - 2025. - short term	

City/region vision and beyond
Fleet of electric vehicles, lowering of CO2 emissions, option of low-carbon emission access

Objective Title: O3 - Decrease in the impact of transport on the environment	**Objective Number: O3**
Intervention/investments: Priority pick-ups for electric taxis	**Intervention/Investment number: 3**
Origin of the action: ◯ **Transfer** (x) **New Concept** ◯ **Other**	
Action description - What will be done.	
Working with local licensing committees by encouraging alternative fuels. These investments can help to achieve the objectives of boosting local economy while reducing the oil dependency and improving the environmental impact of transport.	
Minimum viable action	
Must have: Permission for a priority pick - ups	
Responsibility - Who will implement the action?	
Taxi licensing authority, City of Dubrovnik, relevant municipalities, airport authorities	
Estimated budget and resources	
0 euros	
Measuring success	
Priority pick - ups for electric taxis	
Timeline - Start and end dates	
2020. - 2025. - long term	
City/region vision and beyond	
More passengers using electric taxis, more sustainable transport system	

Objective Title: O3 - Decrease in the impact of transport on the environment,	**Objective Number: O3, O4**

O4 - Increase in the use of shared mobility and soft mobility modes	
Incentives/investments: Electric bike sharing fleet for the immediate surrounding	**Intervention/Investment: 4**
Origin of the action: ◯ **Transfer** (x) **New Concept** ◯ **Other**	
Action description - What will be done.	
This is the concept from the action plan, WP2 LAiRa. It will be used by employees living in the 5 km catchement area from the airport. Bicycles equipped with an auxiliary electric motor that can be exclusively propelled by that motor. The cyclist is not necessarily required to pedal. Since terrain is very hilly around the Airport, auxiliary electric motor is very welcome to overrun that obstacle	
Minimum viable action	
Must have: Docks in the settlements around the airport where employees live, From the beginning effective collection and recycling of used batteries should be implemented Should have: Incentives for employees to use the bikes	
Responsibility - Who will implement the action?	
Private contractor, airport authorities, local municipalities	
Estimated budget and resources	
48 bikes are recommended to implement for the surrounding area: 24 electric bikes would meet the goal from this intervention. Cost: 50,000 euros	
Measuring success	
Number of employees using electric bike sharing system in the first year of implementation	
Timeline - Start and end dates	
2030. - 2040.	
City/region vision and beyond	
The measure has a direct impact on improving the sustainability of the transport system, increasing the share of cycling in the overall modal distribution and reducing the negative impacts of environmental traffic and contributing to a "healthier city". Indirectly influences raising the awareness of citizens about the benefits of using cycling and increasing the availability of the public system.	

4.2. JOINT SOFT MOBILITY ACTION PLAN IN LAIRA AIRPORT FUAS

Soft mobility itself has a vague definition and often interpreted in broad sense. In this deliverable we define soft mobility modes environmental-friendly and people-friendly transport modes including any human powered (non-motorized) or partially e-mobility modes (e.g. pedelecs, e-bike, e-scooter etc.) gaining multiple benefits to the users, environment and increase the liveability of an urban area. According to the definition, we can define under soft mobility modes the pedestrian, bicycle, roller skate, scooter and skateboard, as well as electric or electric assisted vehicles (e.g. pedelec, e-bike, e-scooter etc.), that basically use the same infrastructure just like the other soft mobility modes. These soft modes are meant to indicate alternative to car use within a certain geographic range. Referring to these sustainable mobility modes, they help optimizing urban mobility and enhance standard of living thus keeping the individual right to move.

4.2.1. Guidelines for the Dubrovnik Airport

Objective Title: O1 - Improving the efficiency and sustainability of the transport sector O6 - Ensuring the responsibility and cooperation of the relevant stakeholders	**Objective Number: O1, O6**
Interventions/Investments: Revise urban development and mobility plans in the FUA	**Intervention/Investment: 5**
Origin of the action: **Transfer** ◯ **New Concept** ◯ **Other** (x)	
Action description - What will be done.	
For the purposes of implementing the development measure of the main pedestrian-cycling route the development of a traffic analysis is necessary, based on which proposed transport solutions for pedestrian-cycling traffic will be suggested, starting with an assessment of the existing infrastructure to identify opportunities for improvement.	
Minimum viable action	

Must have: Strategy for improving walking and cycling access Should have: Complete cycling infrastructure (shapefiles, gpx, kml, dwg…) Could have: Suggest new cycling route
Responsibility - Who will implement the action?
Local and county municipalities and authorities and relevant agencies, Administrative Department for Urban Planning, Physical Planning and Environmental Protection
Estimated budget and resources
100,000 euros, county funds, relevant municipalities funds
Measuring success
Revised urban planning document and development strategy
Timeline - Start and end dates
Middle term - 2020.-2025.
City/region vision and beyond
Less congested arterial road D8 that connects all the settlements in the FUA (with Dubrovnik City). GIS transformation into 3D, expansion of data export capability, conversion and installation of modifications of PPUs and GUPs into GIS, urban planning documentation converted to GIS formats

Objective Title: O1 - Improving the efficiency and sustainability of the transport sector, **O3 -** Decrease in the impact of transport on the environment, **O4 -** Increase in the use of shared mobility and soft mobility modes	**Objective Number: O1, O3, O4**
Interventions/Investments: Investments in the new cycling and pedestrian infrastructure and maintenance of already existing trails and routes	**Intervention/Investment: 6**
Origin of the action: (x) **Transfer** ( ) **New Concept** ( ) **Other**	
Action description - What will be done.	

Connect the airport with local and regional pedestrian and cycling infrastructure in a barrier-free and safe way. Tracing routes, mowing, picking etc. is important for increasing the safety of the cycling and pedestrian netowrk, improve the quality of roads thereby increase the comfort of commuting e.g. barrier-free transport.
Must have: New cycling routes Should have: Improve existing routes, Route guidance and information: roadside traffic signs and maps with information on bicycle routes, online bicycle route planners Could have: Traffic calming measures: speed limitations on the arterial roads for motorised vehicles in areas frequently used by cyclists
Responsibility - Who will implement the action?
Konavle Municipality, Župa Dubrovačka Municipality, Dubrovnik - Neretva county, RH
Estimated budget and resources
30,000,000 euros: national funds and county funds
Measuring success
25% reduction of all staff car trips by 2030 and switch to soft mobility, Number of built km of cycling and walking trails in the area.
Timeline - Start and end dates
Long term - 2025. - 2040.
City/region vision and beyond
State of art cycling infrastructure in the Dubrovnik - Neretva County Economic regeneration, prosperity and planned growth in the County

Objective Title: **O1 -** Improving the efficiency and sustainability of the transport sector,	**Objective Number: O1, O3, O4**

O3 - Decrease in the impact of transport on the environment, **O4 -** Increase in the use of shared mobility and soft mobility modes	
Intervention/investment: Improving auxiliary infrastructure at the workplace	**Intervention/Investment: 7**
Origin of the action: ◯ **Transfer** (x) **New Concept** ◯ **Other**	
Action description - What will be done.	
To attract people to cycle and walk to work, showers and lockers must be introduced to the airport. Bike parking lots also need to be implemented or expanded.	
Minimum viable action	
Must have: bike parkings Should have: Showers, changing rooms, lockers	
Responsibility - Who will implement the action?	
Airport Dubrovnik	
Estimated budget and resources	
300,000 euros. Municipality and county funds, EU funds	
Measuring success	
• Number of auxiliary facilities at the airport and bike parking lots • share of employees using soft mobility to/from the Airports (modal split before/after the implementation)	
Timeline - Start and end dates	
2020. - 2025.	
City/region vision and beyond	
Employees using soft mobility modes for getting to work	

Objective Title: O1 - Improving the efficiency and sustainability of the transport sector, **O3 -** Decrease in the impact of transport on the environment, **O4 -** Increase in the use of shared mobility and soft mobility modes	**Objective Number: O1, O3, O4**

Intervention/investment: Awareness raising activities	**Intervention/Investment: 8**
Origin of the action: (x) **Transfer** ( ) **New Concept** ( ) **Other**	
Action description - What will be done.	
It is crucial to change peoples' minds through marketing and campaigns and to make them aware of the potential of the bicycle as an urban transport mode. Educational programmes help to communicate the benefits of urban cycling and to create respect between the transport modes to improve road safety. Positive contributions to public health, the environment and the local identity (with Public Bicycles as part of the urban landscape) are additional benefits of the Strategy.	
Minimum viable action	
Must have: Marketing and awareness raising: City-wide Campaigns including cycling events as well as flyers and posters highlighting the benefits of cycling for the user. Should have: Promotion of the health benefits of walking	
Responsibility - Who will implement the action?	
Relevant municipalities, airport authorities	
Estimated budget and resources	
10,000 euros, EU and county funds	
Measuring success	
The number of campaigns carried out, workshop, lectures	
Timeline - Start and end dates	
Short term: 2020. - 2021.	
City/region vision and beyond	
Awareness raising will hardly have any influence if cycling and pedestrian infrastructure hasn't been improved. A great place to work - A place where everyone gets to their destination and return home, safe and well.	

A great place to live - A place that is becoming quieter and where local air improves.

4.3. JOINT SHARED MOBILITY ACTION PLAN IN LAIRA AIRPORT FUAS

Certain actions/measures are recommended within this action plan:

1. Establishment of (commercial) car-sharing services
2. Implementation/promotion of bike-sharing services
3. Promotion of (informal) ride-sharing services/platforms

4.3.1. Guidelines for the Dubrovnik Airport

4.3.1.1. Implementation of bike-sharing services for immediate surrounding areas

Bike share systems provide access to bicycles for short trips at a low cost and eliminate the barriers to owning and maintaining or traveling with a personal bike. A person rents a bike at the airport and drives with it to his/her destination. An acceptable distance to bike is 10 km and optimal distance is 5 km. Bike share is designed to provide a cost-effective, environmentally-friendly and convenient travel option for many short trips. A bike share system typically consists of a fleet of user-friendly and robust bikes placed at conveniently-located stations. Bike share is a relatively inexpensive and quick infrastructure extension to the public transportation system. Bike share systems are typically structured to operate like automated bike rental for short periods. The structure encourages shorter trips whereby bikes are checked out, ridden for a short period of time, typically 30 minutes or less and returned to any station in the system for someone else to use. Most systems employ some form of pricing schedule that encourages short, frequent trips and discourages bikes being in use for long periods of time. The focus is getting to nearby destinations quickly and conveniently. Generally, it is not intended to compete with bike rental, which is designed for those interested in using a bicycle continuously for longer periods of time.

A set of incentives (primarily financial) would make bike-sharing amongst employees much more attractive.

Harsh weather conditions are considered to be the most important obstacle, while other important issues include the lack of infrastructure, non-adapted bike lanes, and preference for public transportation. This implies that further analysis in terms

of policies and mobility plan would provide the basis for a better perception of the bike - sharing system in the Airport FUA, taking into account the user demand, as well as its daily variation, in order to ensure system availability, and thus user satisfaction.

For Dubrovnik airport, a bike share service would be the most convenient for employees since 6 settlements are in the range of 5 km and 8 settlements are in the range of 10 km. Docks are needed for this in the settlements around the airport in the range of 10 km of driving distance and where the demand exists (Airport employees settlement): Cavtat, Zvekovica, Čilipi, Močići, Gabrili, Komaji, Popovići i Radovčići.

Figure 13 - 10 km driving distance from the airport Dubrovnik

Objective Title: O3 - Decrease in the impact of transport on the environment, **O4 -** Increase in the use of shared mobility and soft mobility modes	**Objective Number: O3, O4**

Intervention/Investment: Implementation of bike-sharing services for immediate surrounding areas, financial incentives for users	**Intervention/Investment Number: 9, 10**

Origin of the action:

(x) **Transfer** ( ) **New Concept** ( ) **Other**

Action description - What will be done.

Meeting with relevant bike-sharing companies, start of cooperation process and contracting of commercial bike-sharing services.
A set of incentives (primarily financial) would make bike-sharing amongst employees much more attractive.

Minimum viable action

Must have: Docks at the airport and in the origin settlements of the employees

Should have:

Could have:

Responsibility - Who will implement the action?

Responsibility: City and County administration infrastructure (charging stations) , Private Infrastructure (Bicycles and docks)

Estimated budget and resources

Costs: 200,000 € (48 bicycles), 50,000 euros annual incentives for employees
Source of financing: Local budget, state aid, EU funds
Attraction of private funds, EU funds within operational funds

Measuring success

Number of people using the system

Timeline - Start and end dates

2025. - 2040.

City/region vision and beyond

Employees parking lots could become free space for some other purpose if employees would accept this measure.
A great place to work - A place where everyone gets to their destination and return home, safe and well

4.3.1.2. Implementation of ride – sharing platform

For users, the main motivation for sharing rides is the financial benefit on individual level (e.g. shared gas costs), subsequently, also transport-related emissions can be reduced and capacities of roads and parking spaces may be enhanced. Roles and duties have to be allocated among different involved actors, e.g.: There must be an organiser/'match-maker' defined that is responsible for the enabling of matching rides and people, there must be a platform provider (e.g. "flinc1"), there must be ride providers as well as ride demanders. Airport Dubrovnik could design it's own ride – sharing platform for it's employees.

4.3.1.3. Friendly competition

Ridesharing could become a game. A team that logs the most commutes or the greatest number of kilometers gets awarded.

Objective Title: O2 - Reduction in the proportion of staff travelling alone by car to and from Dubrovnik Airport O4 - Increase in the use of shared mobility and soft mobility modes	**Objective Number: O2 and O4**
Action Title: Implementation of ride – sharing platform	**Action Number: 11**
Origin of the action: (x) **Transfer** ( ) **New Concept** ( ) **Other**	
Action description - What will be done.	
For users, the main motivation for sharing rides is the financial benefit on individual level (e.g. shared gas costs), subsequently, also transport-related emissions can be reduced and capacities of roads and parking spaces may be enhanced. Roles and duties have to be allocated among different involved actors, e.g.: There must be an organiser/'match-maker' defined that is responsible for the enabling of matching rides and people, there must be a platform provider (e.g. "flinc2"), there must be ride providers as well as ride demanders. Airport Dubrovnik could design it's own ride – sharing platform for it's employees.	
Minimum viable action	

[1] https://flinc.org/ (11.7.2018)
[2] https://flinc.org/ (11.7.2018)

Must have: Ride sharing app Should have: Awards for the employees who have the most km with ride-sharing service
Responsibility - Who will implement the action?
Airport Dubrovnik, private contractor. Airport Dubrovnik chooses a contractor and gives the main guidelines for the operation.
Estimated budget and resources
100,000 euros for the app development
Measuring success
Reduction of staff travelling alone by car from 92% to 70%
Timeline - Start and end dates
2025. - 2030.
City/region vision and beyond
A great place to work - A place where everyone gets to their destination and return home, safe and well. A great place to live - A place that is becoming quieter and where local air improves.

4.3.1.4. Implementation of car – sharing service

Car sharing allows individuals and businesses, through a membership, to access a network of vehicles on a short-term basis. A person picks up a car at one dock and can drop it off at the second one.

Car sharing differs from the traditional car rental model by offering more locations to pick up vehicles and eliminating the hassle of having to go into a branch office to pick up and drop off a vehicle.

Objective Title: **O3 -** Decrease in the impact of transport on the environment, **O4 -** Increase in the use of shared mobility and soft mobility modes	**Objective Number: O3, O4**
Intervention/Investment: Implementation of car – sharing service	**Intervention/Investment Number: 12**
Origin of the action: ◯ **Transfer** (x) **New Concept** ◯ **Other**	

Action description - What will be done.
The exact guidelines for the Dubrovnik Airport would be: meeting with relevant car-sharing companies, start of cooperation process, contracting one company and monitoring of implementation process and user behaviour. After that a procces of implementation will begin. A hub at the airport will be needed and a hub in Dubrovnik city. Promote the car-sharing scheme by advertising in communal areas and local internet is of vital importance.
Minimum viable action
Must have: Hubs at the airport and the City of Dubrovnik Should have: More hubs in City of Dubrovnik (bigger hotel areas, port, old city,…) Could have: Provide priority parking spaces (most convenient part of car park) for car-sharers.
Responsibility - Who will implement the action?
City administration (guideline and infrastructure), private investors: car - sharing companies(implementation), airport staff
Estimated budget and resources
220.000€ (110.000 per system) Source of financing: Local budget, private investors
Measuring success
Statistics from the private operators on annual and monthly number of passengers
Timeline - Start and end dates
2025. - 1st two hubs: one at the Airport and one at the Main station in Dubrovnik, long term intervention
City/region vision and beyond
Car- sharing users will reduce number of occupied parking spots in the city.

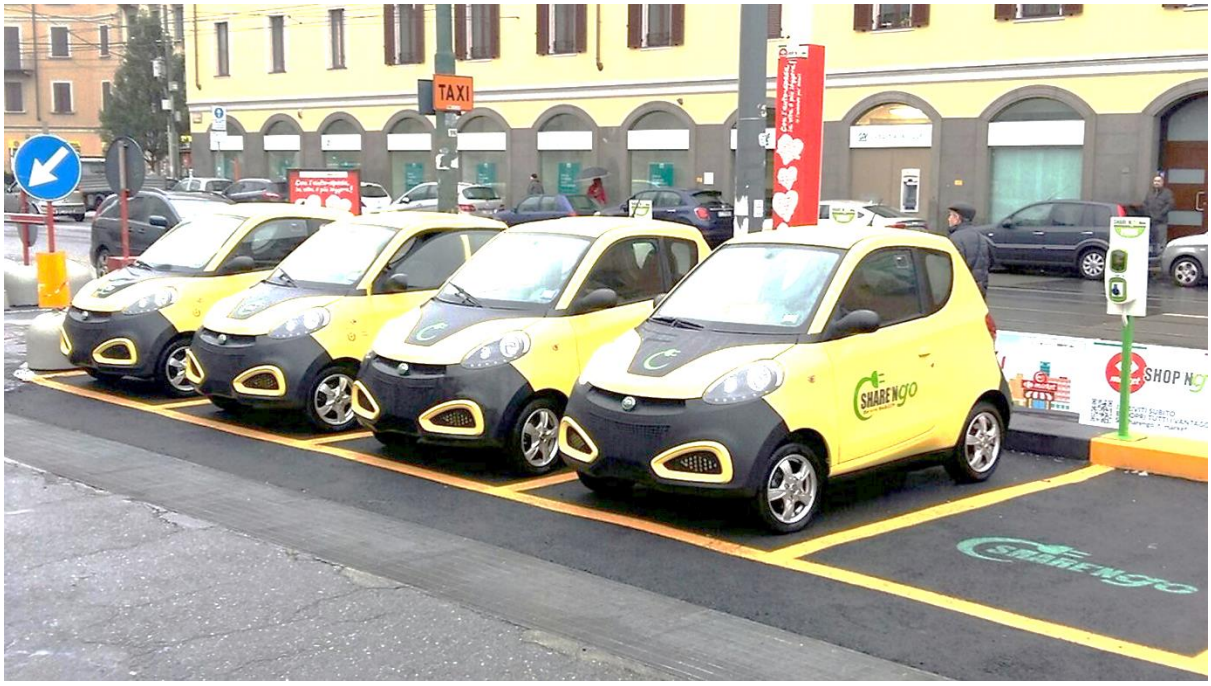


Figure 14 - Car-sharing

Source 5: https://tiresandparts.net/news/parts/survey-says-consumers-prefer-carsharing-due-convenience/

4.4. ITS Mobility

Intelligent transport systems (ITS) are considered as transport-related development that increases safety as well as network efficiency and mitigates negative environmental effects. Information and communication technologies form the backbone of ITS. Considering efficient ITS mobility for (central) Europe, activities need to be coordinated properly. The deployment of ITS developments proceeds differently, always depending on the technological and economic progress in a region or country. Applications that belong to ITS mobility are for example toll systems, automated and connected driving, management of stationary and flowing traffic and multimodal travel information. The accessibility of airports can be described by listing road or rail infrastructure, but also by having information and communication technology that enables or simplifies a journey through providing relevant travel information. In the LAirA context, ITS mobility focuses on multimodal travel information and reliability in terms of landside accessibility by road and rail.

4.4.1. Guidelines for the Dubrovnik Airport

Through the implementation of ITS mobility measures, all the transport modes described above should be affected. This means that every transport mode that is available in the region to commute to/from the airport (as well as their transport data) should be involved in the considerations and implementation process.

4.4.1.1. Deployment or enhancing of ITS infrastructure and services at airports

Objective Title: **O1 -** Improving the efficiency and sustainability of the transport sector, **O3 -** Decrease in the impact of transport on the environment, **O5 -** Increasing the level of information to passengers and the availability of information on public transport among tourists	**Objective Number: O1, O3, O5**
Intervention/Investment: 1. Deployment or enhancing of ITS infrastructure and services at airports, 2. Establishment of contact with travel data providers and clarification of an airport's role and its potential contributions	**Intervention/Investment Number: 13, 14**

Origin of the action:
( ) **Transfer** (x) **New Concept** ( ) **Other**

Action description - What will be done.

Providing accurate and timely information to transport users is a critical element of business and management of the transport system. System development includes the introduction of mobile applications, display of station information, the existence of simple layout pages, built-in information systems in all vehicles, etc. Such information infrastructure will enhance work and management of the entire traffic system and provide greater reliability and "user friendly" service to travelers to unify all approaches to the city through a simple, accessible and multilingual Internet platform.

Responsibility - Who will implement the action?

Cities, municipalities and counties in the area of FUA, Infrastructure Administrators, Private Operators

Estimated budget and resources

30,000 euros: EU funds, airport funds, county funds, City of Dubrovnik funds, Municipality of Konavle and national funds

Measuring success

- number of passengers using public transport.

Timeline - Start and end dates
Long term, starts: Immediately
City/region vision and beyond
Smart Airport

Set-up of working group, definition of goals for enhancing traffic management at airports, identification of ITS supply and needs at the airport location. A local working – group would be the best option to distinguish and coordinate all the issues regarding the ITS technologies. A working group mainly operated by certain departments of the airport can be set-up and implemented. The working group may come together twice a year also inviting external experts/stakeholders dealing with ITS topics and being responsible for national decision making.

4.4.1.2. Establishment of contact with travel data providers and clarification of an airport's role and its potential contributions

A common data and mapping basis for transport-related data seems to be appropriate for supplying a region with intelligent transport services (assumed that sensors, radars etc. are available/equipped at vehicles and infrastructure for collecting the data).

4.4.1.3. Establishment of platform where real-time data of different modes of transport is available e.g. on privately operated buses as well

This step is needed so the route - planning app can be introduced.

Figure 15 - Using data to figure out traffic

4.4.1.4. Integration of route planning application/add-on to existing airport apps build upon cooperation with transport providers

The application should have all the real time info on city buses or shuttle buses. Since Dubrovnik city center is closed for the traffic and bus stops are sometimes far away from the desired destination the app should have very precise info how to reach a point on foot when dropping off the bus.

An app should also have an option for personal profile where users are enabled to give their recommendations or add some points of interest along the route so that others pay attention while driving on the bus or even visit that spot. The app should also have the comparisson graph with CO2 emissions per mode integrated when user chooses bus over a car or vice versa.

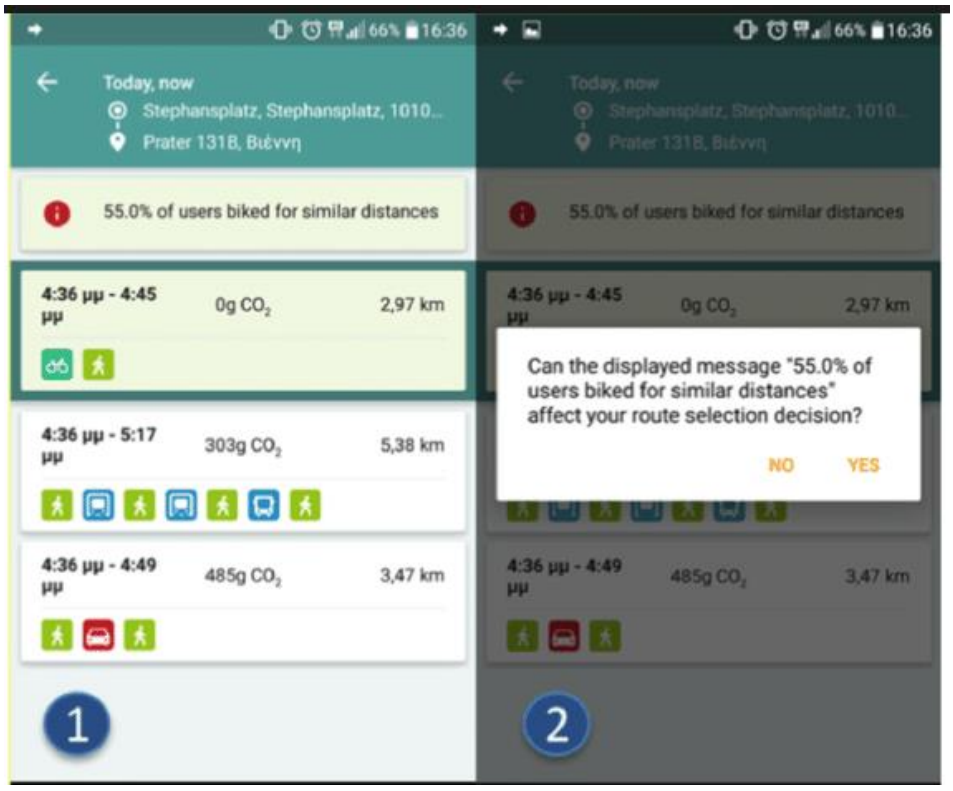


Figure 16 – Route planning app with CO2 emissions per mode

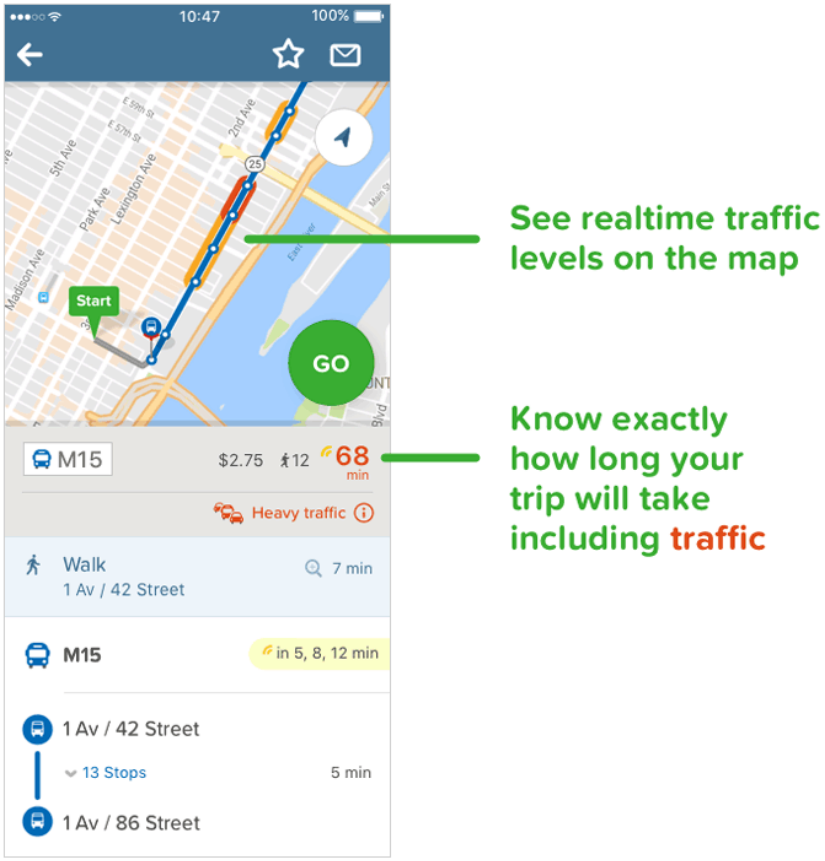


Figure 17 - Traffic app

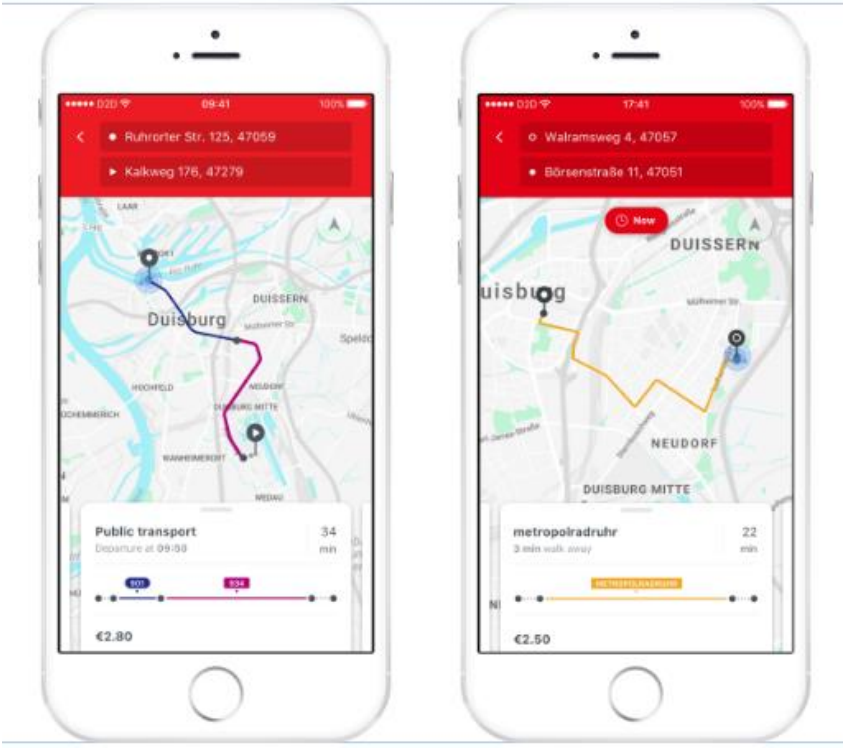


Figure 18 - An example of route - finding app 1

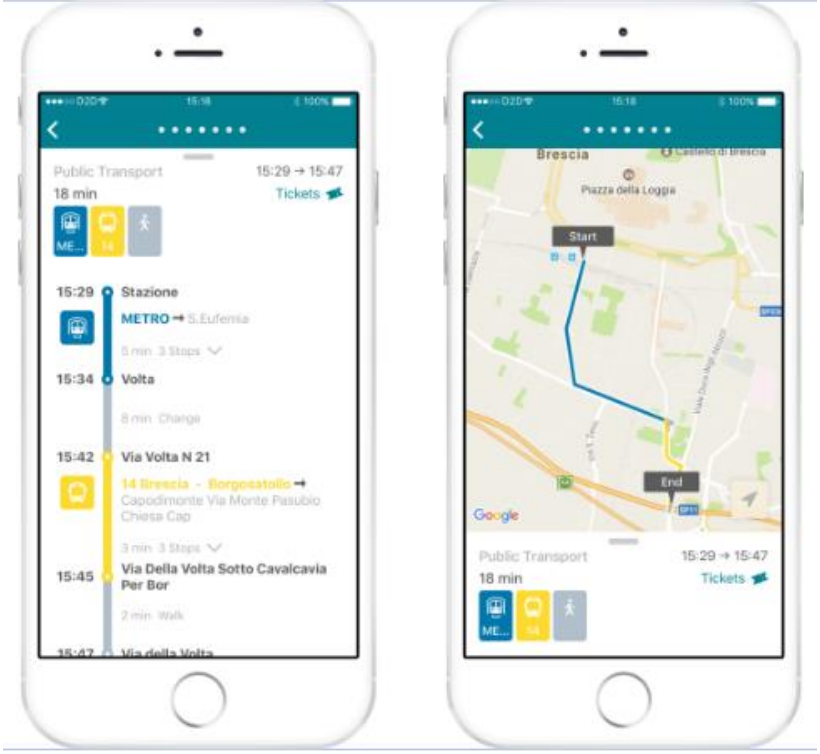


Figure 19 - An example of route - finding app 2

Objective Title: **O1 -** Improving the efficiency and sustainability of the transport sector, **O3 -** Decrease in the impact of transport on the environment, **O5 -** Increasing the level of information to passengers and the availability of information on public transport among tourists	**Objective Number:** **O1, O3, O5**
Intervention/Investment: 3. Establishment of platform where real-time data of different modes of transport is available e.g. on privately operated busses as well 4. Integration of route planning application/add-on to existing airport apps build upon cooperation with transport providers	**Intervention/Investment Number: 15, 16**
Origin of the action: **Transfer** ◯ **New Concept** (X) **Other** ◯	

Action description - What will be done.
Establishment of platform where real-time data of different modes of transport is available e.g. on privately operated busses as well. The application should have all the real time info on city buses or shuttle buses. Since Dubrovnik city center is closed for the traffic and bus stops are sometimes far away from the desired destination the app should have very precise info how to reach a point on foot when dropping off the bus. An app should also have an option for personal profile where users are enabled to give their recommendations or add some points of interest along the route so that others pay attention while driving on the bus or even visit that spot. The app should also have the comparisson graph with CO2 emissions per mode integrated when user chooses bus over a car or vice versa. The need for continuous collection of traffic data, along with a regular data collection plan, is needed for the establishment of a common database to improve and manage the data and information needed to implement strategic guidelines and improve the quality of traffic management.
Minimum viable action
Must have: Route planning application with real time data Should have: Calculation of CO2 savings when choosing public transport over private transport
Responsibility - Who will implement the action?
County and relevant city administration, Airport administration Relevant data for improvement and development of public transport should be delivered to the competent authority (Traffic Office / Traffic Administration) which manages and supervises the established integrated transport in the area of coverage.
Estimated budget and resources
Establishment of platform where real-time data of different modes of transport is available: 200,000 euros Integration of route planning application/add-on to existing airport apps build upon cooperation with transport providers: 100,000 euros Resources. Local budget and national incentives
Measuring success
• Number of users using the app annually • increase in number of people using public transport (sold bus tickets)

Timeline - Start and end dates
2025. - 2040. - long term
City/region vision and beyond
The measure has a direct impact on improving the efficiency and sustainability of the transport sector, improving traffic safety and security and contributing to a "healthier city".

4.4.1.5. A taxi sharing app for the arriving/departing passengers

Objective Title: O1 - Improving the efficiency and sustainability of the transport sector, **O3 -** Decrease in the impact of transport on the environment	**Objective Number: O1, O3**
Intervention/Investment: A taxi sharing app for the arriving/departing passengers	**Intervention/Investment Number: 17**
Origin of the action: **Transfer** ◯ **New Concept** (x) **Other** ◯	
Action description - What will be done.	
A passenger places a request on the app and finds a match who wants to go the same route (similar to Tinder). For the simplification purposes and raising the matches percentage a waiting dock in the Dubrovnik city center should be installed as Dubrovnik city has the most departures/arrivals of all the cities in the region. A dock should be at the airport, too. Taxis will be serving these requirements. When going to the Dubrovnik airport: A person posts a desired pick – up time on the app in the scope of 30 minutes. When someone else posts the same time they match until at least 2 people are per car. The app sends a notification to the taxi driver about this request and taxi driver picks people up and drives them to their desired destination. When a person arrives at the airport he posts that he is going to Dubrovnik City. The app shows him where the dock is and there he waits until a match appears. Advertising of this app is crucial as well as raising the awareness of the contribution to the ecology when using it. It could also be integrated within existing airport app. Strategy for data sharing and cooperation among suppliers/service providers needs to be done in order to accomplish this measure.	
Minimum viable action	

Must have: A taxi sharing app Should have: Show the comparisson between prices and CO2 emissions of a classic and shared journey
Responsibility - Who will implement the action?
Airport administration, private contractor, taxi operators
Estimated budget and resources
20,000 euros - private funds
Measuring success
• Reduce trips with one person in taxi
Timeline - Start and end dates
Starting: Immediately
City/region vision and beyond
• Less congested roads • more efficient transport system • taxis become more affordable thus increasing the revenues for taxi companies

4.5. WAYFINDING

The aim of wayfinding is to help all people navigate through airports quickly, without anxiety of their surroundings.

Wayfinding should point them in the correct direction and ensure that it leads to the destination, whether this is the car park, station or boarding gate: when a passenger reaches a decision point, they must be guided through with wayfinding.

Airports are large and complex facilities, where operators need to communicate a vast amount of information to users. They need to provide this information in a clear, timely and relevant way to users who are often disorientated, in a hurry or distracted.

The airport can only function as a transport hub including public transport if users can find their way through the facility: any departure information, onward connections, retail offering or exit information is only effective if it is easy for a passenger to find. Wayfinding is the structure upon which visual guides are based.

In the LAirA IT tools questionnaire for TMB from January, 2019. the action plan for the passengers was as follows:

IT Tool Airport Passengers

Campaign Action Plan:

- Creating a slogan for the campaign, defining the communication activities, drafting a concept and designing posters and brochures
- Drafting a concept and designing stickers in form of footprints with messages of a reduced emission impact when riding the bus. The stickers will guide the passengers to the exit onto the bus station
- Inserting English subtitles in the video

4.5.1. Guidelines for Dubrovnik airport

Principle 1	Begin the wayfinding where the passenger relies on airport information, before they leave the Arrivals area.
Principle 2	Provide simple information, targeted at people who are unfamiliar with the airport.
Principle 3	Use standardised, visual way markers.
Principle 4	Provide a consistent wayfinding style throughout airport campus.
Principle 5	Show the way - lead the passenger the whole way.
Principle 6	Confirm to the passenger that they have reached their destination.

4.5.1.1. Promoting Public Transport and Introducing the Iconography

Location	After the passenger has passed through passport control, before they reach baggage claim.
Role	Introducing the public transport options, showing departure information and routes available. Note that the separate *Bus and Coach* icons are introduced at this time so that a passenger can follow those icons through the rest of the journey.

There should be a sign for the shuttle bus and a sign for Libertas city bus.

LIBERTAS DUBROVNIK

ATLAS

KORKYRA INFO korčula dubrovnik rental & travel agency

SHUTTLE BUS

4.5.1.2. Making the Association to the Transport Destination

Location	In baggage claim area.
Role	With the formality of passport control area having passed, the passenger may have a few moments of dwell in the baggage claim area, waiting for their bags to arrive. At this time, it is more appropriate to introduce the destinations that the public transport mode can offer, so that the passenger, now aware of the options, icons and branding can make an informed, considered choice.

Figure 20 - Cavtat

Figure 21 - Dubrovnik

4.5.1.3. Avoiding the Moment of Doubt when Emerging into the Public Area

Location	Immediately upon emerging from the Arrivals door.
Role	To ensure that when a passenger emerges from the formal Arrivals area into the public Arrivals waiting area,

	and is confronted with a sea of greeters, name cards and signposts, they can quickly see the direction to the public transport mode and leave this overwhelming area.

This is an idea from Narita Airport in Japan. Each lane could lead to one stop: shuttle bus, taxi, city bus, car-share hub,...

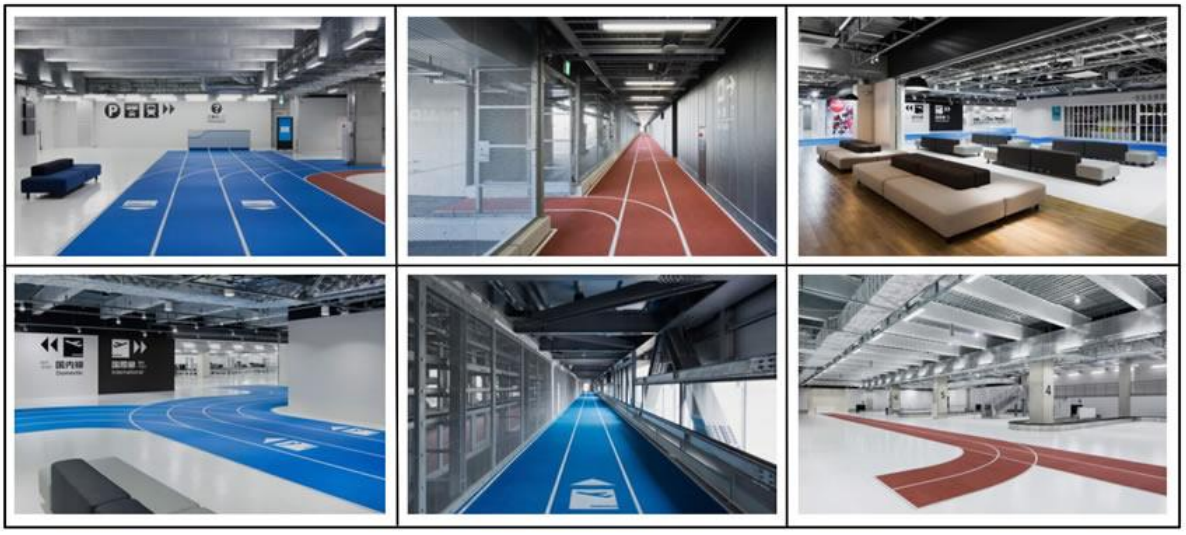


Figure 22 - Wayfinding at the Narita airport

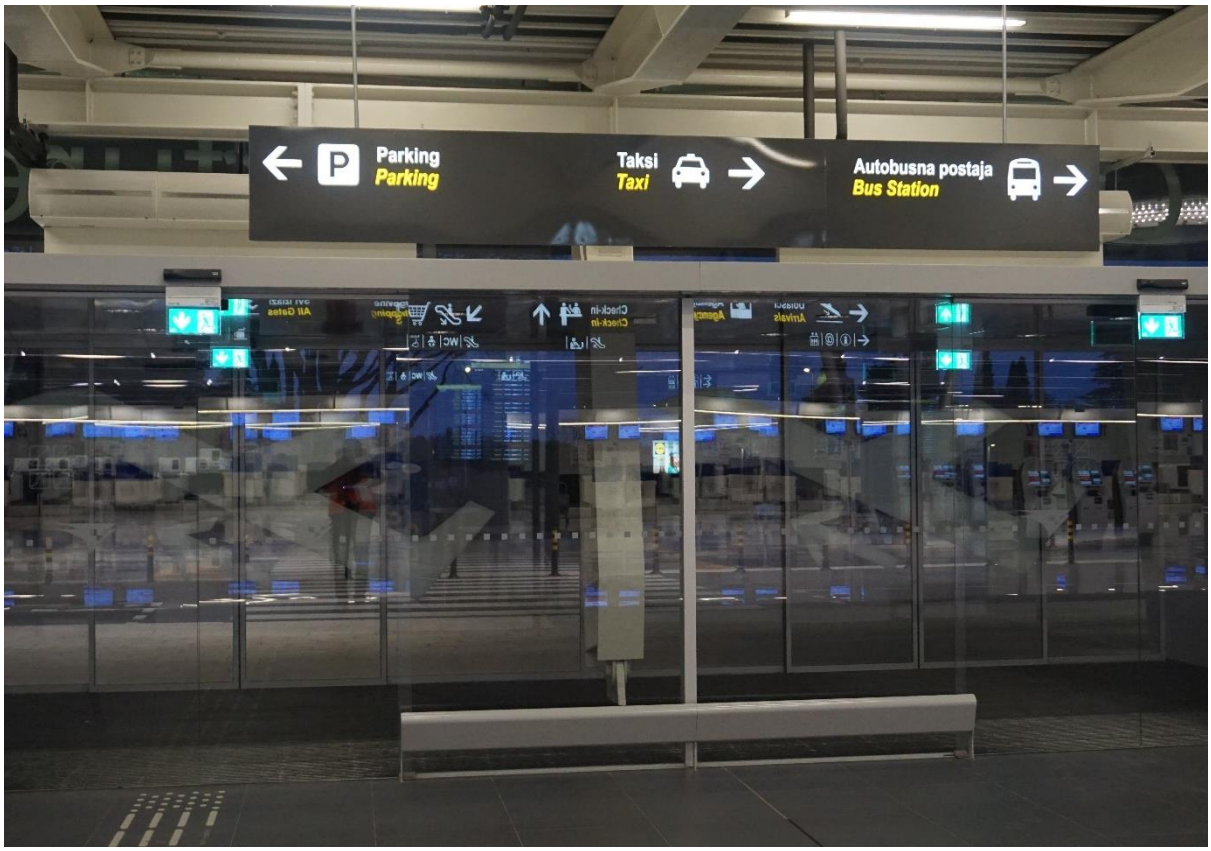


Figure 23 - Current situation at the Dubrovnik Airport

4.5.1.4. *Using Icons to Lead the Way Through the Terminal*

Location	Through the public area of the airport
Role	Once a public transport service, destination and icon has been identified and established, using this name and icon in all subsequent wayfinding provides a visual way marker to lead the passenger through to the station.

4.5.1.5. *Identifying the Transport Destination*

Location	At the entrance to the station
Role	To welcome and confirm to the passenger that they have arrived at the public transport station. This reassurance removes any anxiety about whether a passenger has walked the right way.

Figure 24 - Atlas shuttle bus stop

Objective Title: O1 - Improving the efficiency and sustainability of the transport sector, **O3 -** Decrease in the impact of transport on the environment, **O5 -** Increasing the level of information to passengers and the availability of information on public transport among tourists	**Objective Number:** **O1, O3, O5**

Intervention/Investment: Wayfinding at the airport	**Intervention/Investment Number: 18**
Origin of the action: ◯ **Transfer** (x) **New Concept** ◯ **Other**	
Action description - What will be done.	
Stickers will be placed on the floor and on the walls and pillars at the airport so that passengers can orientate themselves easily	
Minimum viable action	
Must have: Wayfinding concept Should have: Interactive screens across the airport Could have:	
Responsibility - Who will implement the action?	
Airport authorities, county authorities	
Estimated budget and resources	
Design costs: 10,000 euros, implementation 20,000 euros Airport funds, EU funds	
Measuring success	
• More arriving passengers using public transport	
Timeline - Start and end dates	
2020. - long term	
City/region vision and beyond	
More passengers going from the airport Dubrovnik to Dubrovnik city by public transport	

4.6. MONITORING OF EMISSIONS PRODUCED BY TRANSPORT IN DUBROVNIK – NERETVA COUNTY

Objective Title: O7 - Monitoring of emissions produced by transport in Dubrovnik – Neretva County	**Objective Number: O7**
Intervention/Investment: Measuring and monitoring of the air quality at the permanent measuring stations	**Intervention/Investment Number: 19**
Origin of the action: ◯ **Transfer** (x) **New Concept** ◯ **Other**	
Action description - What will be done.	
1 new permanent station, near the airport in Čilipi. Reports on measuring and monitoring the air quality	
Minimum viable action	
Must have: 1 new permanent station Should have: Reports on air quality every month Could have: Application with real time data	
Responsibility - Who will implement the action?	
Croatian Meteorological and Hydrological Service, County Road Administration	
Estimated budget and resources	
Local and EU funding: 150.000 euros 80,000 euros for the permanent station 50,000 euros for monthly reports 20,000 euros for the application	
Measuring success	
• New measuring stations • Number of submitted reports	
Timeline - Start and end dates	
Start: 2020. - long term	
City/region vision and beyond	
There's a saying "If you can't measure it, you can't manage it"	

5. RESULTS

Vision: *Low carbon emission access to Poznan Airport*				
objective	**Intervention/investment title**	**Responsible**	**Budget**	**Timeline**
O1 - Improving the efficiency and sustainability of the transport sector	1. 30% of taxi fleet is electric 2. Install more electric vehicle charging stations 3. Revise urban development and mobility plans in the FUA 4. Investments in the new cycling and pedestrian infrastructure and maintenance of already existing trails and routes 5. Improving auxiliary infrastructure at the workplace 6. Awareness raising activities 7. A taxi sharing app for the arriving/departing passengers	City of Dubrovnik, Konavle Municipality, Župa Dubrovačka Municipality, Dubrovnik - Neretva county, RH, Croatian Roads	1. 500,000 € 2. 50,000 € 3. 100,000 € 4. 30,000,000 € 5. 300,000 € 6. 10,000 € 7. 20,000 €	
O2 - Reduction in the proportion of staff travelling alone by car to and from Dubrovnik Airport	1. Implementation of ride – sharing platform, Friendly competition	Airport Dubrovnik, private investor	1. 100 000 €	
O3 - Decrease in the impact of transport on the environment	1. Priority pick-ups for electric taxis 2. Electric bike sharing fleet for immediate surrounding 3. Implementation of bike-sharing services for	County and relevant city administration, Airport administration	1. 0 € 2. 50,000 € 3. 250,000 € 4. 220,000 €	

	immediate surrounding areas, financial incentives for users 4. Implementation of car - sharing service			
O4 - Increase in the use of shared mobility and soft mobility modes				
	1. Implementation of bike-sharing services for immediate surrounding areas, financial incentives for users	City and county administration, Private companies	1. 250,000 € for the first year	
O5 - Increasing the level of information to passengers and the availability of information on public transport among tourists	1. Deployment or enhancing of ITS infrastructure and services at airports, 2. Establishment of contact with travel data providers and clarification of an airport's role and its potential contributions 3. Establishment of platform where real-time data of different modes of transport is available e.g. on privately operated busses as well 4. Integration of route planning application/add-on to existing airport apps build upon cooperation with transport providers 5. Wayfinding at the airport	Cities, municipalities and counties in the area of FUA, Infrastructure Administrators, Private Operators, Airport Administration	1. 30,000 € 2. , 3., 4. - 300,000 € 5. 30,000 €	
O7 - Monitoring of emissions produced by transport in Dubrovnik - Neretva County	1. Measuring and monitoring of the air quality at the permanent measuring stations	Croatian Meteorological and Hydrological Service, County Road Administration	1. 150,000 €	

6. CONCLUSION

"Effective action on low carbon transport can't be driven by climate considerations alone. Transport is only truly sustainable if, in addition to decarbonising transport - we also make a significant contribution to delivering on the Sustainable Development Goals (SDGs) on, inter alia, road safety, air quality, health and access for all - including for disadvantaged groups." - Paula Caballero.

Dubrovnik area has a very favourable touristic movements. It is currently one of the most popular areas to visit in Europe. It will only become more popular in the coming years. Tourists coming from all over the world will easily adapt to new technologies that will become available after this Project.

Some issues could occur with employees since the mentality in Dalmatia does not favour anything new but in the upcoming years it will definitely change.