



LAirA

Landside Airport Accessibility

Report no.2: Analysis of Multimodal Mobility in FUA Towards Dubrovnik Airport

January 2018

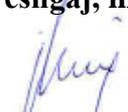
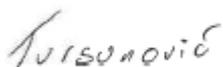
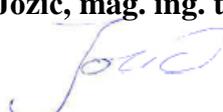
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1. INTRODUCTION

This report gives an overview of the complete landside accessibility to the Dubrovnik Airport, It gives a detailed analysis of all transport modes currently operating in the Dubrovnik-Neretva County as a Functional Urban Area (FUA) of the Dubrovnik Airport. The In order to present the given information more vividly, the maps give a graphical representation of the airport accessibility with several transport modes.

The complete Dubrovnik –Neretva County transport network and infrastructure network are described in relation to the Dubrovnik Airport location.

Final chapters present current innovations and their potential to bring the transport system to a higher sustainability level in the environmental and safety segment, and to make the trip from the Dubrovnik airport to the surrounding central agglomerations more attractive.

2. DUBROVNIK – NERETVA COUNTY (FUA)

Functional Urban Area of the Dubrovnik airport includes the Functional region South Dalmatia (FRSD), i.e. boundaries of the Dubrovnik-Neretva County. The Dubrovnik airport is the main airport of the Functional region South Dalmatia.

2.1. SIZE

Dubrovnik-Neretva County is the southernmost Croatian County, located at the territorial outskirts, it is the outermost part from the country's capital, 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.

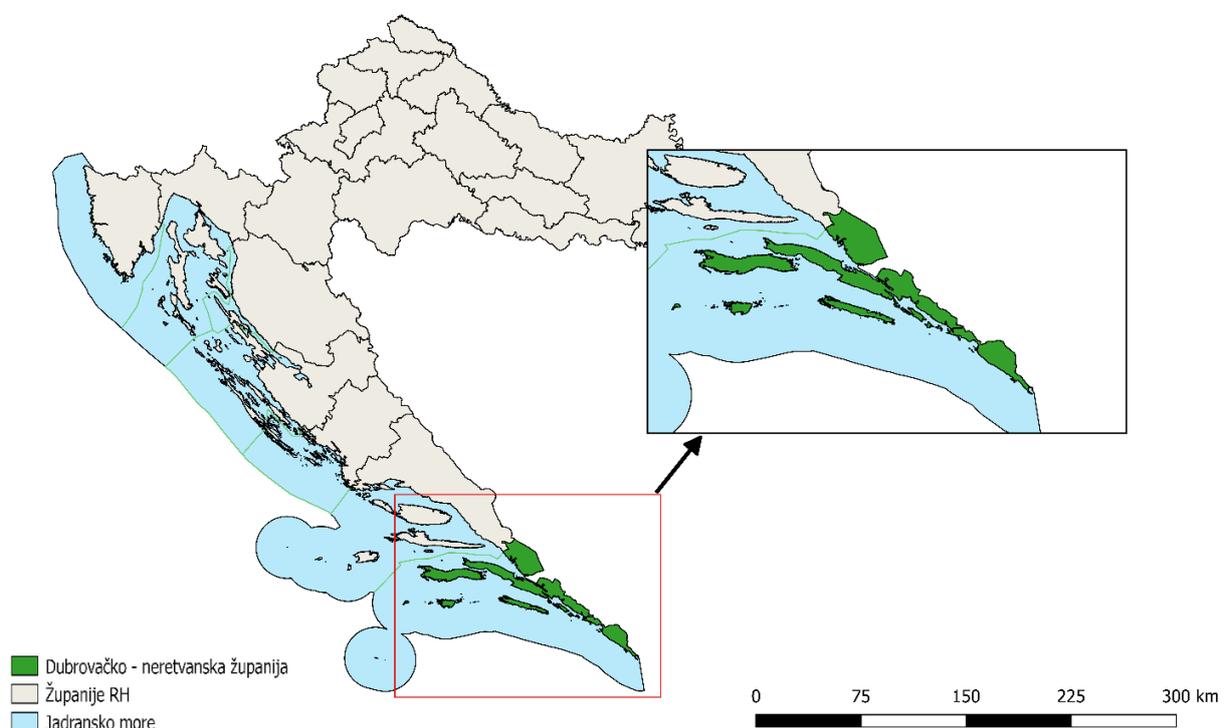


Figure 1: Functional region South Dalmatia (Dubrovnik – Neretva County)

Source: Author

The County spreads on the Adriatic – Ionian route (A1 motorway Zagreb-Dubrovnik, section Ploče - Dubrovnik), from the Ploče Interchange to the Osojnik Interchange and the state borderline with Bosnia and Herzegovina.

Table 1: Dubrovnik-Neretva County in numbers

Dubrovnik – Neretva County	Land	Sea	Total
Surface area - DNC	1782,49 km ²	7489,88 km ²	9272,37 km ²
Surface area - Croatia	56609,59 km ²	33200,00 km ²	89809,59 km ²
% of Croatia's surface area	3,1%	23%	10,32%

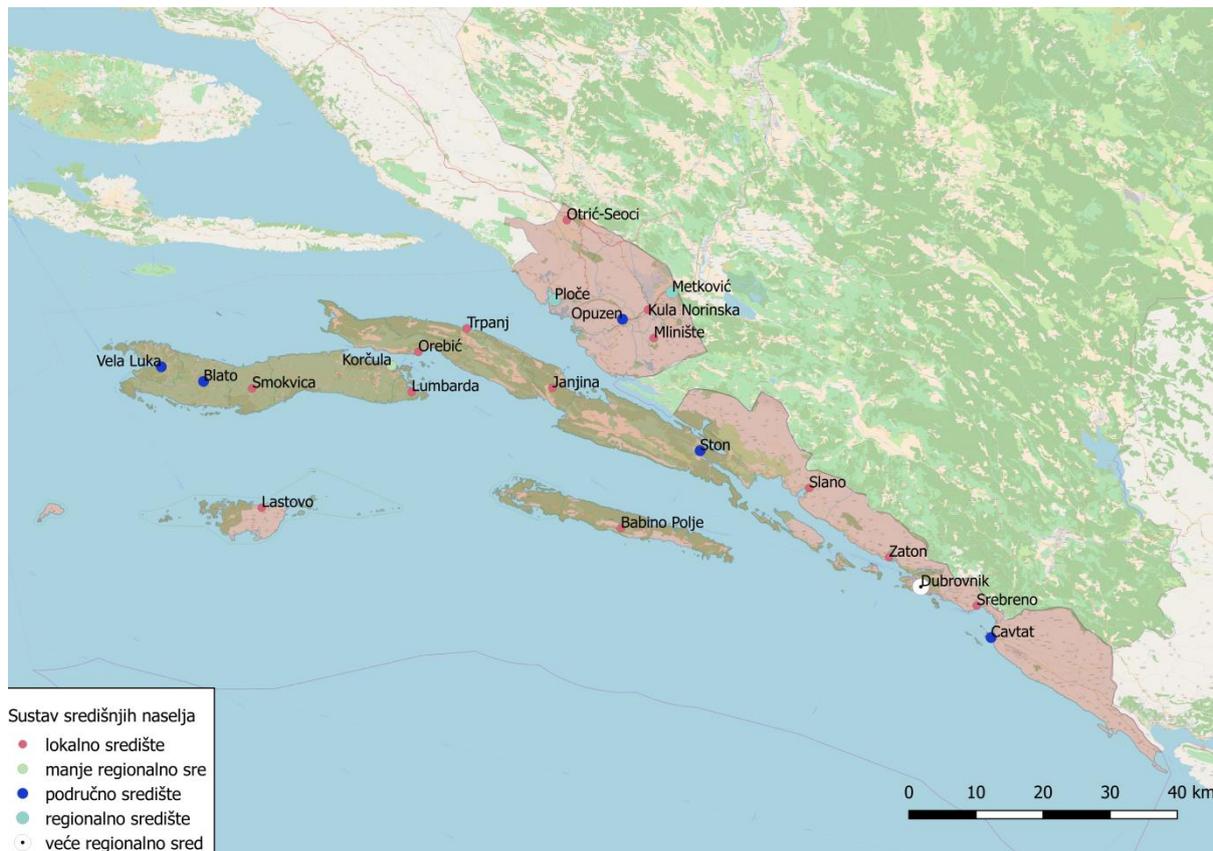
Source: Author using data from the Croatian Bureau of Statistics (CBS)

The County has a total surface area of 9.272,37 km² (which is 10,32% of Croatia's surface area). Out of this, 1.782,49 km² (3,1% Croatia's surface area) is on the mainland, and 7.489,88

km is at sea (80,78% of the County's surface area or 23% of Croatia's sea). County's coastline is 1.024,63 km long..

County's territorial sea is almost double the size of the mainland part, but having in mind that the business zone at sea stretches all the way to the central Adriatic parts, surface area of the DNC maritime zone is significantly larger, covering 80% of its total area.

The coastal part of the County, and islands include the Pelješac peninsula and 223 islands, cliffs and reefs. Most significant inhabited islands are Korčula, Mljet, Lastovo and a group of Elaphiti Islands with the island of Koločep, the southernmost inhabited Croatia's island. Administratively, the County is organized in 22 local government units, i.e. 5 towns and 17 municipalities.



The county centre is Dubrovnik. Towns are: Dubrovnik, Korčula, Metković, Ploče and Opuzen. Municipalities are: Blato, Dubrovačko Primorje / Dubrovnik coastal region, Janjina, Konavle, Kula Norinska, Lastovo, Lumbarda, Mljet, Orebić, Pojezerje, Slivno, Smokvica, Ston, Trpanj, Vela Luka, Zažablje and Župa Dubrovačka.

2.2. POPULATION

According to the 2011 population census, the DNC had 122.568 in 2011, or 2,86% of the total population of Croatia. In the period between 1991 and 2011, population in the DNC decreased by 2,98%. The spatial distribution of the population indicates that 78.455 inhabitants lived in five towns of the DNC, i.e. 64% of the total County population. The remaining 36% lived in 17 municipalities (2011 population census). The City of Dubrovnik has the highest population number (42.615), i.e. over one third (34,77%) of the total population. Konavle are the largest

municipality with 8.577 inhabitants and the smallest municipality is Janjina with only 551 inhabitants.

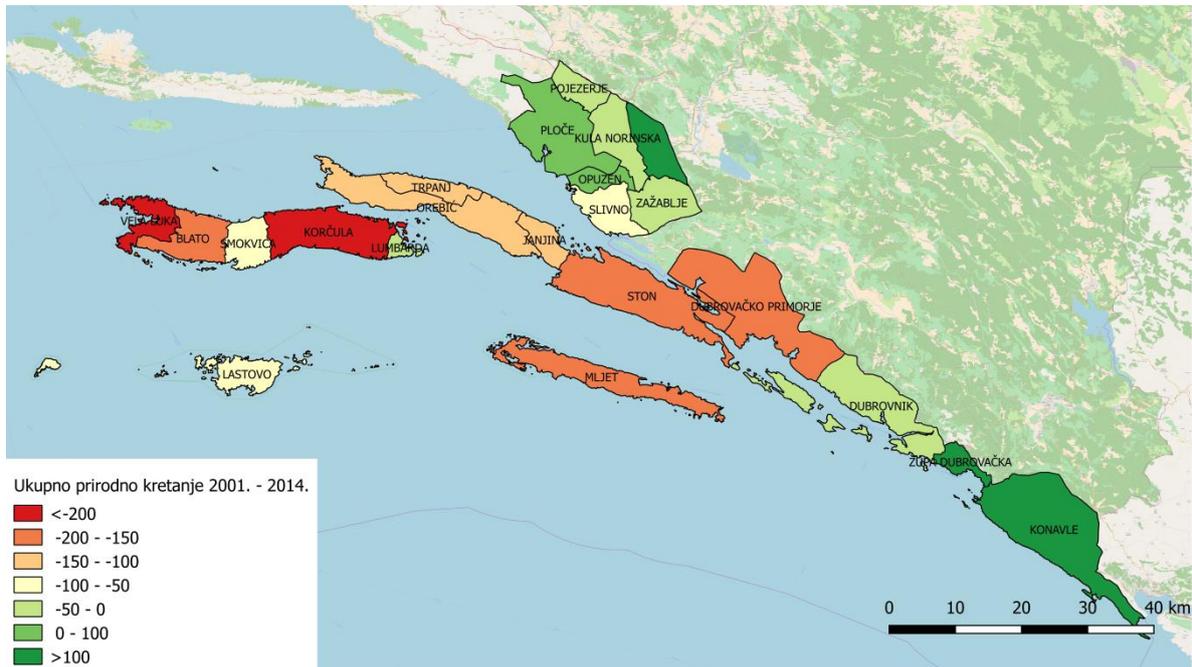


Figure 2: Overall natural change in population of the County's municipalities and towns in the period 2001 - 2014.

Source: Author using data from the Statistical Yearbook of the Republic of Croatia 2001 - 2014

As a rule always the same towns and municipalities show positive trends: Metković, Opuzen and Ploče as well as Konavle and Župa Dubrovačka (Šterc, S. and Šterc F., 2016.). Further population increase is to be expected, primarily in the Cavtat and Zvekovica areas, followed by other agglomerations along the Adriatic Road which are not far away from the largest town centres in the municipality (Cavtat, Čilipi).

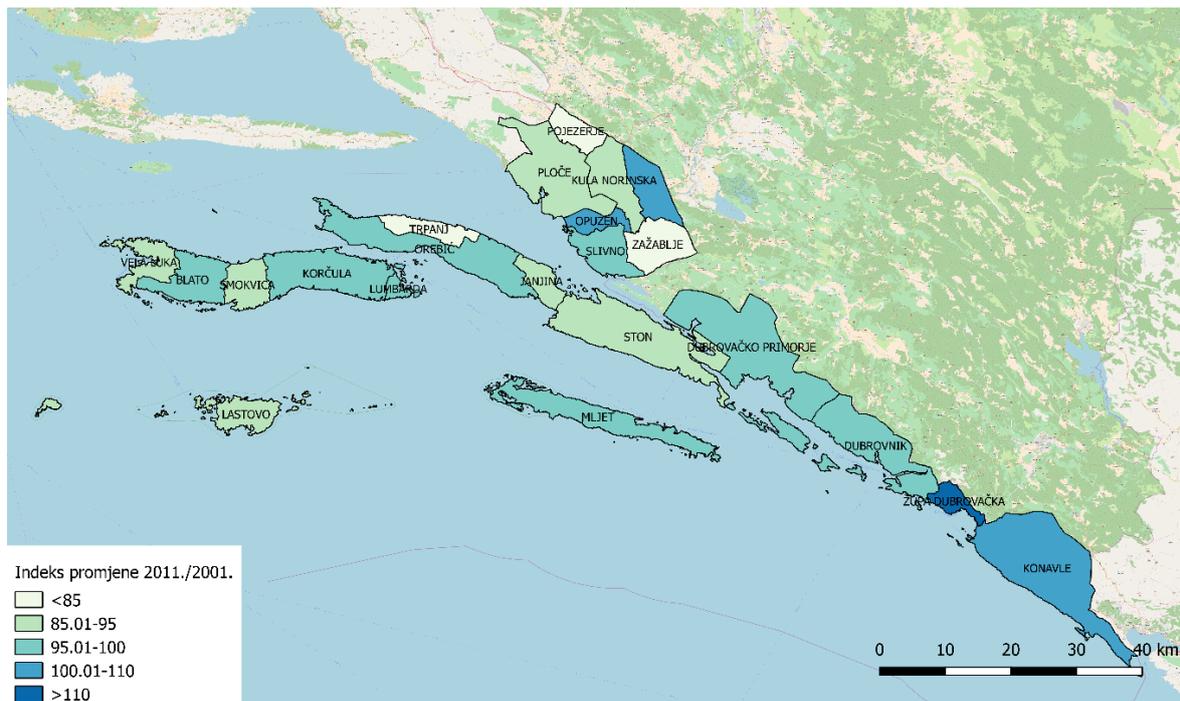


Figure 3: DNC population change index

Source: Prepared by author using the 2001 and 2011 Census of population, households and dwellings, CBS

According to the Spatial plan, population immigration will be the main factor of population increase, while stagnation and population drop is to be expected in other agglomerations in the inland. Population density (according to the 2011 Population census) in the Dubrovnik-Neretva County is 68,82 inhabitants/km², which is lower than the Croatian average (75,7 in h/km²). The complete county marks an overall population decline, which is -0,2% or a total of only 302 inhabitants. In general, the County marks a population decline and “ageing” of the islands and rural parts, along with litoralization – population concentration in towns and coastal areas.

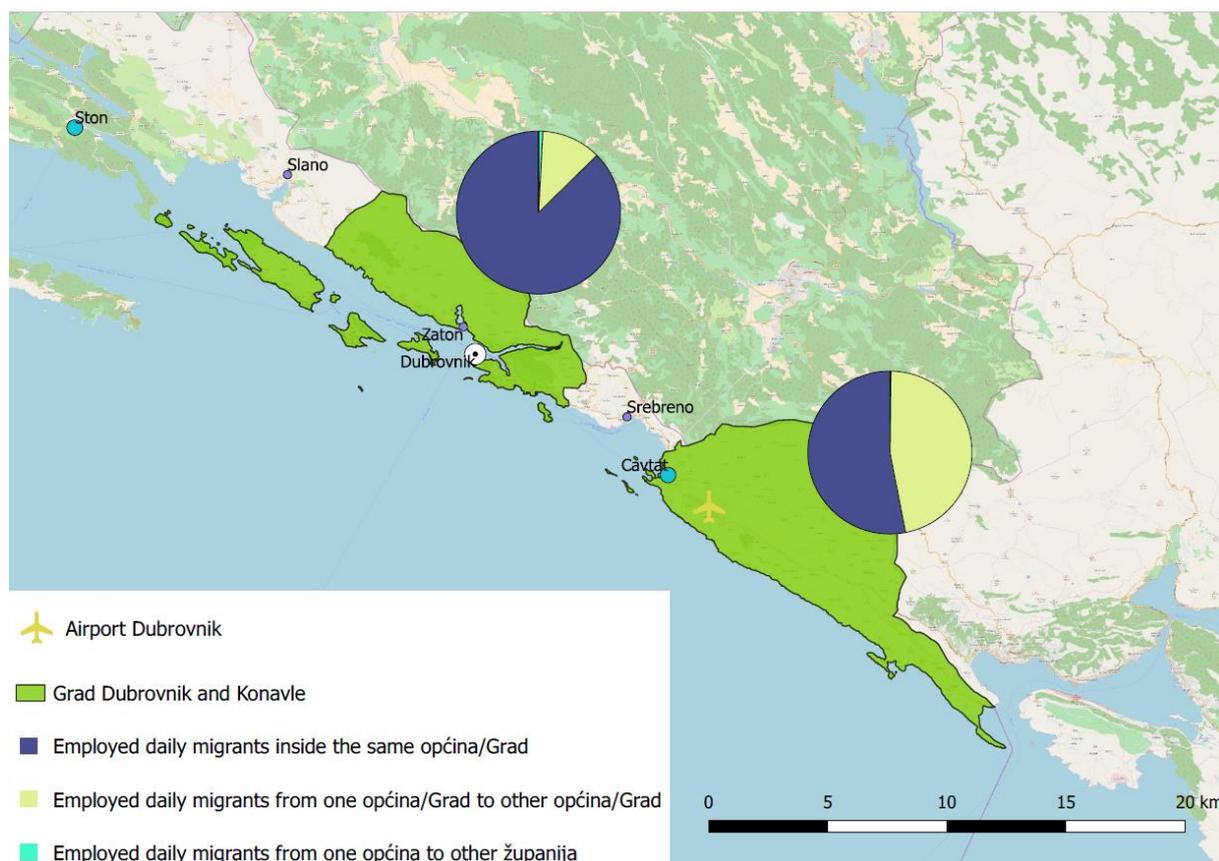


Figure 4: Konavle municipality and City of Dubrovnik according to daily migrations / commuting of employed population, 2011

Source: Prepared by Author according to population census from 2011, CBS

Only 4 administrative – territorial subdivisions mark a population increase since 2001, these are: Konavle, Metković, Opuzen and Župa Dubrovačka. Župa Dubrovačka marks the highest population increase, followed by Metković, Konavle and Opuzen respectively.

2.3. KONAVLE MUNICIPALITY

The Homeland war interrupted positive demographic trends in the Konavle municipality, with the Dubrovnik Airport situated in it. This resulted in a population drop in the period 1991-2001, which also marked the highest drop in population in the last 150 years (-9,1%). Lower birth-rates and population emigration are the main determinants of change. After the year 2001, an increase in the municipality's population level was recorded (3,96%). Highest population increase have the municipalities Zvekovica (42,5%), Dubravka (11,3%) and Čilipi (11,3%).

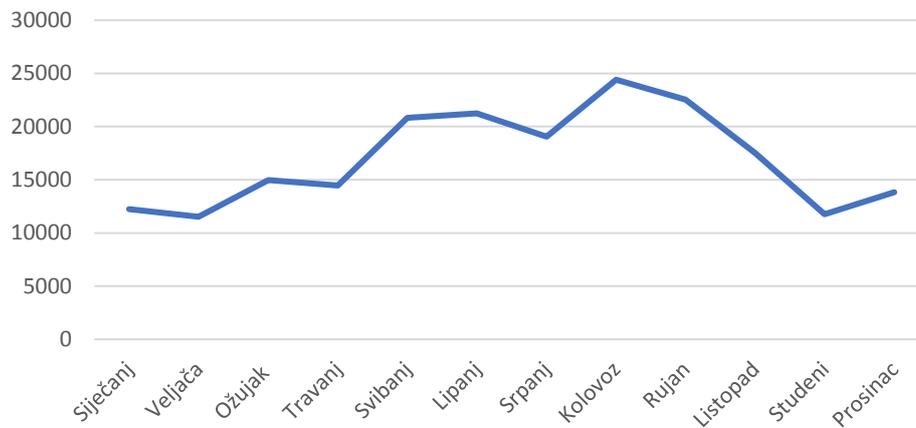
- Car wash – *gross surface area 180 m²*
- Substation (TS 1 – east) and catering service offices, Levels: ground level+1 – *gross surface area 750 m²*¹

Overall quantity of transported cargo (goods and mail) is presented in the graph X, per months and amounts to 204, 3 tons.

¹ Urban Development Plan, 2016, Trames Consultants

Graph 1: Cargo transport at Dubrovnik Airport

Quantities of transported goods and mail in 2017 (kg)



Source: Dubrovnik Airport Ltd.

Emergency services of the Dubrovnik Airport:

- Emergency medical unit,
- service for runway cleaning: equipment: 1 Sweeper Truck Steyr Frimokar, 2 snow ploughs, fire fighting vehicles category II
- fire fighting vehicles:
 - Rosenbauer (capacity 9000 l water, 1000 l foam, pump 600 l/min),
 - Ziegler (9100 l water, 1100 l foam, pump 6000 l/min),
 - Rosenbauer Simba (11600 l water, 1200 l foam, 200 kg powder, pump 7000 l/min)
- Technical vehicle mark Ford.

3.1. EMPLOYEES AT THE DUBROVNIK AIRPORT

Economy of the Konavle municipality is based on agriculture and tourism (hotels). Dubrovnik Airport brought about positive opportunities for the younger population to find employment, and be less engaged in agriculture.

Table 3: Employees at the Dubrovnik Airport

	DUBROVNIK AIRPORT NUMBER OF EMPLOYEES (2017)	
	LANDSIDE	AIRSIDE
Permanent employees	43	351
Seasonal employees		180
Student employment service		160
Number of employees during peak months at Dubrovnik Airport	 1100	

Source: Author using data obtained from the Dubrovnik Airport Ltd.

Unemployment level in the Konavle municipality is only 3%.

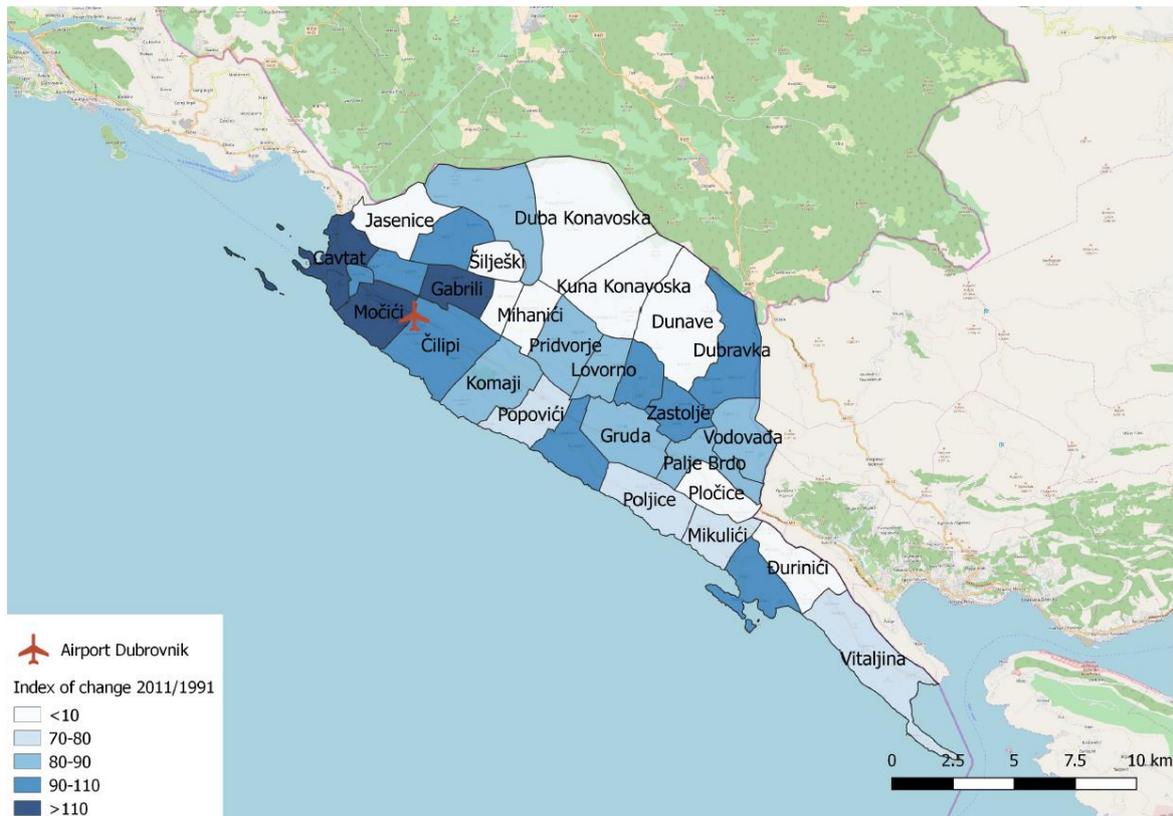


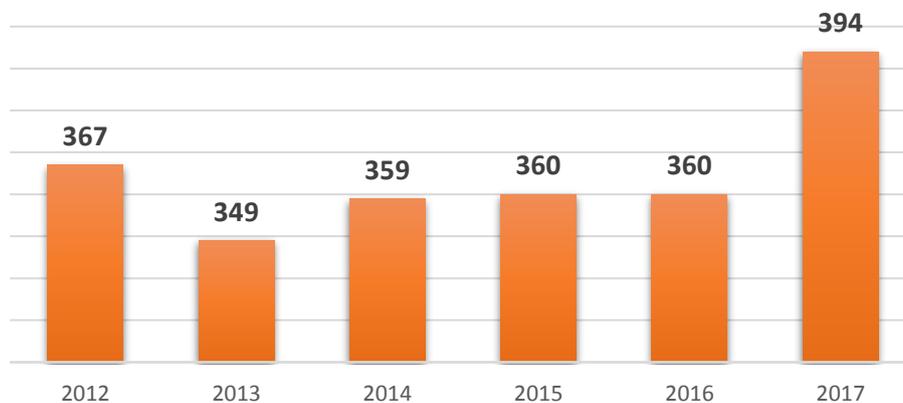
Figure 6: Population change index in the Konavle municipality 2011 and 1991.

Source: Author using data from the Census of population, households and dwellings from 1991 and 2011, CBS

There are 44 companies and enterprises operating at the Dubrovnik Airport, i.e. there are 44 leased business premises, as presented in Table X, undertaking business activities also presented in Table X. Most of them are rent-a-car companies (27%), followed by tourist agencies (16%) and banks – ATMs – Automated teller machines (16%). Air carriers and shops cover 7%.

Graph 2: Number of employees at the Dubrovnik Airport in the period 2012 - 2017

Employees at the Dubrovnik Airport 2012 - 2017



Source: Author based on data from the Dubrovnik Airport Ltd.

Table 4: List of companies operating at the Dubrovnik Airport (2017)

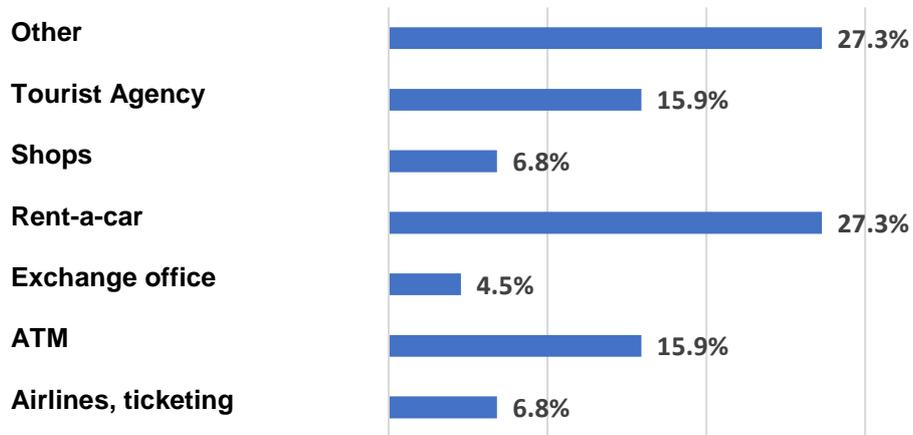
	Lessee	Business activity
1	TURKISH AIRLINES	<i>Airline - ticketing</i>
2	BRITISH AIRLINES	<i>Airline - ticketing</i>
3	CROATIA AIRLINES d.d.	<i>Airline - ticketing</i>
4	ERSTE BANK	<i>ATM</i>
5	HPB banka d.d.	<i>ATM</i>
6	PRIVREDNA BANKA d.d.	<i>ATM</i>
7	RAIFFEISEN BANKA d.d.	<i>ATM</i>
8	SBERBANK d.d.	<i>ATM</i>
9	SOCIETE GENERALE d.d.	<i>ATM</i>
10	ZAGREBAČKA BANKA	<i>ATM</i>
11	OTP BANKA d.d.	<i>ATM and bank office</i>
12	EXCHANGE CORPORATION d.o.o.	<i>Exchange bureau</i>
13	IN KAPITAL D.O.O.	<i>Exchange bureau</i>
14	A-ANTICUS RENTA A CAR (ex ATLAS)	<i>Rent a car</i>
15	ANTERRA D.O.O.	<i>Rent a car</i>
16	AVANT CAR DOO	<i>Rent a car</i>
17	FLEET RENT A CAR (AUTOCLASSEM) D.O.O.	<i>Rent a car</i>
18	NAVITEX d.o.o.-	<i>Rent a car</i>
19	NOVA GRATIA d.o.o.	<i>Rent a car</i>
20	ORYX GROUP d.o.o.	<i>Rent a car</i>
21	SPECTATOR-AUTONAJAM (AUTONAJAM doo)	<i>Rent a car</i>
22	UNILINE D.O.O.	<i>Rent a car</i>
23	UNIRENT D.O.O.	<i>Rent a car</i>
24	URBAN AVIS	<i>Rent a car</i>
25	VIATOR	<i>Rent a car</i>
26	DIAMOND CENTER	<i>Shop</i>
27	MAJOR D.O.O.,	<i>Shop</i>
28	P-GRUPACIJA d.o.o.	<i>Shop</i>
29	ATLAS	<i>Tourist agency</i>
30	DUBROVNIK TRAVEL DOO	<i>Tourist agency</i>
31	ELITE TRAVEL D.O.O.	<i>Tourist agency</i>
32	TRAVEL EUROPE d.o.o.	<i>Tourist agency</i>
33	KORKYRA D.O.O.	<i>Tourist agency</i>
34	NEWREST DUBROVNIK d.o.o.	<i>Catering</i>
35	Laetans d.o.o.	<i>Beauty services, manicure</i>
36	ENTER DUBROVNIK	<i>Storage area</i>
37	SECURITAS HRVATSKA	<i>Security company</i>
38	Zavod za hitnu medicinu DNŽ	<i>Emergency medical unit premises</i>
39	EUROJET INTERCONTINENTAL	<i>Handling agent</i>
40	Hrvatska kontrola zračne plovidbe d.o.o.	<i>Air Traffic Control</i>
41		<i>Customs service employees area and Airport Police Station Čilipi,</i>
42	MINISTARSTVO FINANCIJA	<i>Coffee machines</i>
43	MORH	<i>Rest area for fire fighting pilots</i>
44	ANNIMI COMMERCE	<i>Shipping and freight forwarding service</i>



Source: Dubrovnik Airport Ltd.

Table 5: Companies present at the Dubrovnik Airport in % (2017)

Companies at the Dubrovnik Airport in %



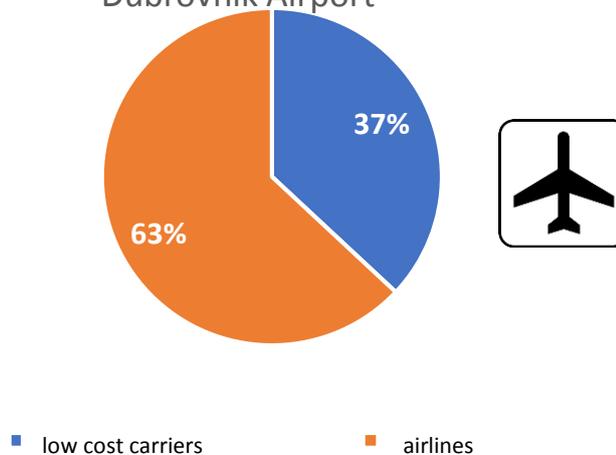
Source: Author using information obtained from Dubrovnik Airport Ltd.

3.2. AIRLINE COMPANIES PRESENT AT THE DUBROVNIK AIRPORT

High quality supply and offer of low cost carriers present at the Dubrovnik Airport must be ensured because it is a key factor influencing the competitiveness of the Dubrovnik Airport with the region outside the Dubrovnik-Neretva County. The poll undertaken in the period 22-26 January 2018 showed that the citizens and tourist from Montenegro (Herceg Novi, Podgorica) and Bosnia and Herzegovina (Mostar) chose flights from the Dubrovnik Airport although the Tivat and Podgorica Airports are nearer, because of lower prices or because of direct flights to international destinations (Frankfurt for example).

Graph 3: Number of airlines at the Dubrovnik Airport

Percentage of low-cost carriers at the Dubrovnik Airport



Source: Dubrovnik Airport Ltd.

Table 6: Airlines flying from/to the Dubrovnik Airport

AIRLINE	CLASSIFICATION
CONDOR	low-cost carrier
EASY JET	low-cost carrier
GERMANWINGS	low-cost carrier
JET2.COM	low-cost carrier
JETAIRFLY	low-cost carrier
MONARCH AIRLINES	low-cost carrier
NORWEGIAN AIR SHUTTLE	low-cost carrier
TRANSAERO	low-cost carrier
TRANSAVIA FRANCE	low-cost carrier
VUELLING AIRLINES	low-cost carrier
FINNAIR	airline
SAS	airline
AER LINGUS	airline
AIR SERBIA	airline
AUSTRIAN AIRLINES	airline
BRITISH AIRWAYS	airline
TURKISH AIRLINES	airline
CROATIA AIRLINES	airline
IBERIA	airline
LUFTHANSA	airline
THOMAS COOK	airline
TRAVEL SERVICE	airline
AEROFLOT	airline
EUROLOT	airline
FLYBE	airline
S7 AIRLINES	airline
TRADE AIR	airline

Source: Dubrovnik Airport Ltd.

Key companies need to be attracted, ones that can have a crucial impact on the future travel market (i.e. regular flight airlines, low-cost carriers, tour operators, destination management companies, international shipping companies and postal service companies), as well as charter airlines on the international market and the ones contributing to the tourist branch.²

² Master plan of the Dubrovnik Airport, Airport Consulting Vienna GmbH, 2012, pg. 142

Graph 4: 10 airlines at the Dubrovnik Airport according to the percentage of transported passengers

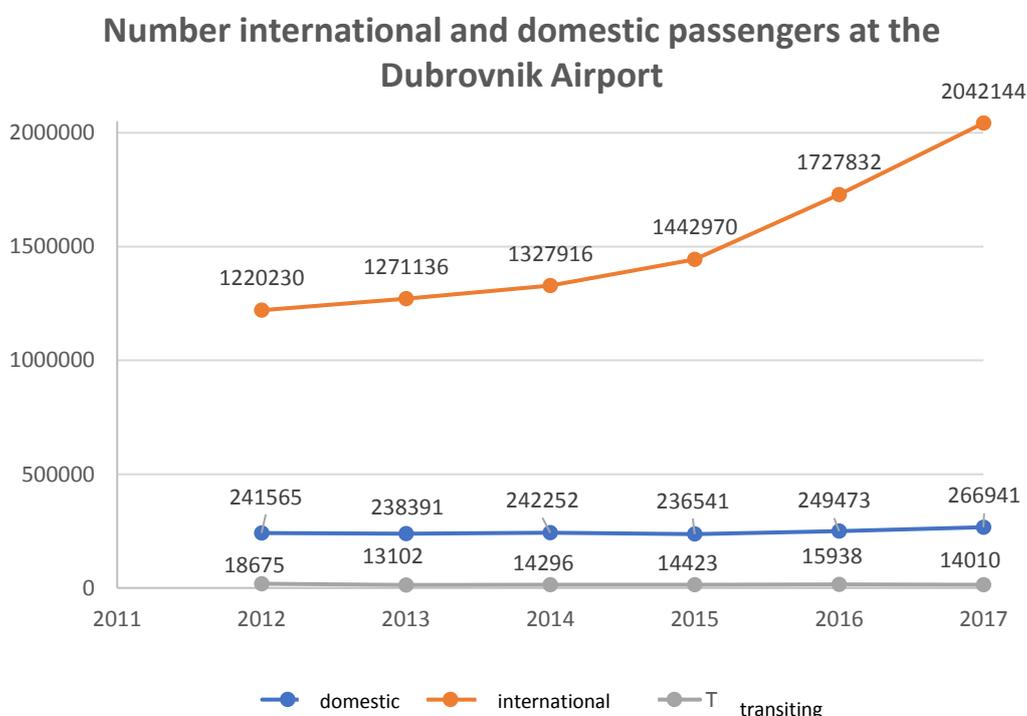


Source: Dubrovnik Airport Ltd.

3.3. TYPE OF PASSENGERS OF THE DUBROVNIK AIRPORT

The number of passengers at the Dubrovnik Airport is constantly increasing, It is expected that the total number of passengers in 2025 will reach 2 999 082, which is 675 987 more passengers compared to the year 2017. In 2017 the yearly number reached 2 323 095 passengers. This is an increase of 842 625 passengers compared to the year 2012 . Out of these 2 323 095, over two million are international passengers, as seen in the following tables.

Graph 5: Number of passengers at the Dubrovnik Airport (2012-2017)



Source: Author using data obtained from the Dubrovnik Airport Ltd.

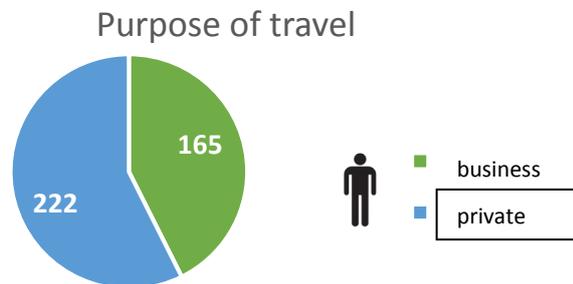
Graph 6: Number of passengers at the Dubrovnik Airport 2012-2017



: Author using data obtained from the Dubrovnik Airport Ltd.

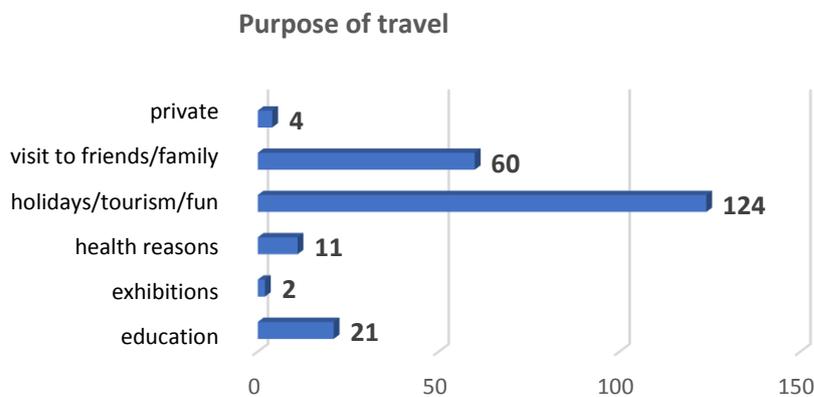
Graph 7: Purpose of travel

Dubrovnik is a tourist destination oriented towards luxury market supply. Over 50% of passengers of the Dubrovnik Airport travels for private purposes, i.e. as tourists. When analysing domestic passengers, they mostly travel on the Dubrovnik-Zagreb route, thus replacing a long bus ride from Dubrovnik to Zagreb.



Source: Results of poll

Graph 88: Purpose of travel



4. Source: Results of poll

4. MOBILITY

The following chapter gives an overview of the complete system of mobility in the Dubrovnik-Neretva County in relation to the Dubrovnik Airport and the way it defines the landside accessibility to the airport.

4.1. DISTANCE TO THE NEAREST TOWN CENTRE AND AIRPORTS

The City of Dubrovnik is the nearest urban centre to the Dubrovnik Airport, some 20 km away. Dubrovnik is one of the most important Croatian historical and tourist centres, emphasising the importance of the Dubrovnik Airport, especially in the summer season Dubrovnik has app. 42.615 inhabitants according to the 2011 population census.

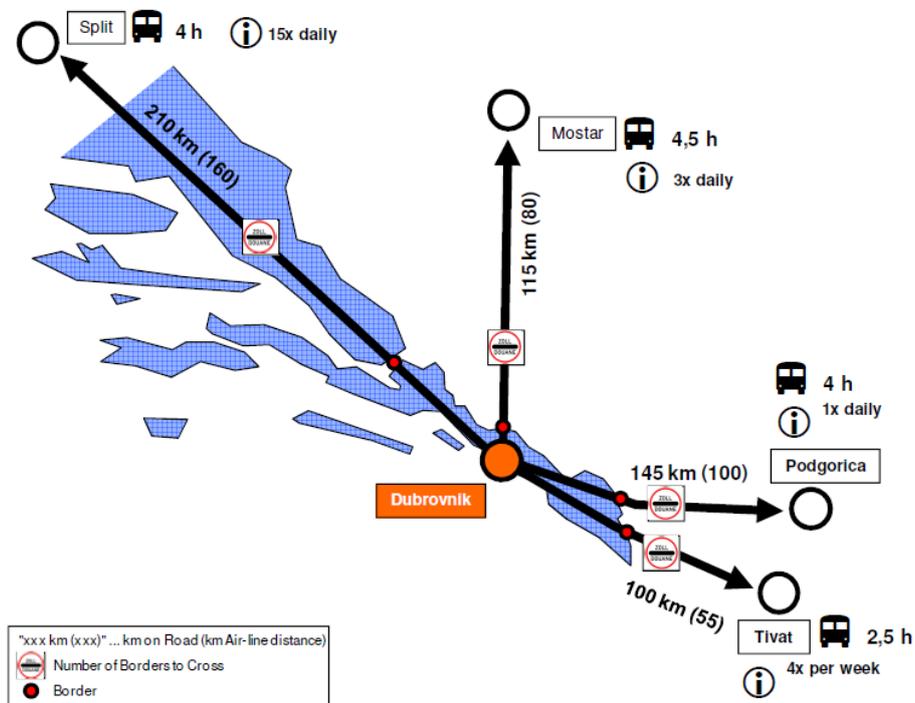


Figure 7: Distance and trip duration from Dubrovnik by bus

Source: Master plan of the Dubrovnik Airport, Airport Consulting Vienna GmbH, 2012, pg. 104

The nearest airport to the Dubrovnik Airport is the Tivat Airport, some 51 km away. The Maps below and Table X show graphical representations of the distances.

Table 7: Distance between the Dubrovnik Airport and the most important regional centres in km

	Dubrovnik Airport
Tivat	51,54 km
Podgorica	170,61 km
Mostar	147 km
Split	210 km
Dubrovnik	20,55 km
Trebinje	40,55 km

Source: Prepared by author



Figure 8: Distance between the Dubrovnik Airport and the City of Dubrovnik as well as other neighbouring urban centres
Source: Prepared by author

4.2. PARKING INFRASTRUCTURE

4.2.1. CAPACITIES

In accordance with the Regulation of the use of parking areas for visitors and airport employees, parking areas are categorized according to the marks / signs given in Table below.

Table 8: Categorization and number of parking spaces at the Dubrovnik Airport

Mark	PARKING AREA	NUMBER OF PARKING SPACES (PS)
P1	Main parking area for passenger cars	281 PS
P2	Parking area behind the fuel service building	74 PS
P3	Parking area in front of the cargo block	93 PS
P4	Car rental parking area	96 PS
P7	Parking area for busses, vans and passenger cars in front of the passenger terminal building – Building B	(24 + 9 minibus) 33 PS
P8	Parking area for busses and vans in the first lane immediately in front of the passenger terminal, building B	2 PS
P9	Parking lot for the holders of taxi concessions with a permit issued by the Dubrovnik Airport, directly in front of the passenger terminal „Building B”	5 PS
P11	Parking lot in front the Head Office building, intended for Dubrovnik Airport employees and visitors	
P12	Parking lot next to the „rent a car“ offices	54 PS
TOTAL		638 PS

Source „According to Regulation on the use of parking areas for visitors and employees of the Dubrovnik Airport the parking areas are categorizes as follows“, pg. 1



Figure 9: The Dubrovnik Airport Parking area plan
Source: Master Plan of the Dubrovnik Airport, pg. 222

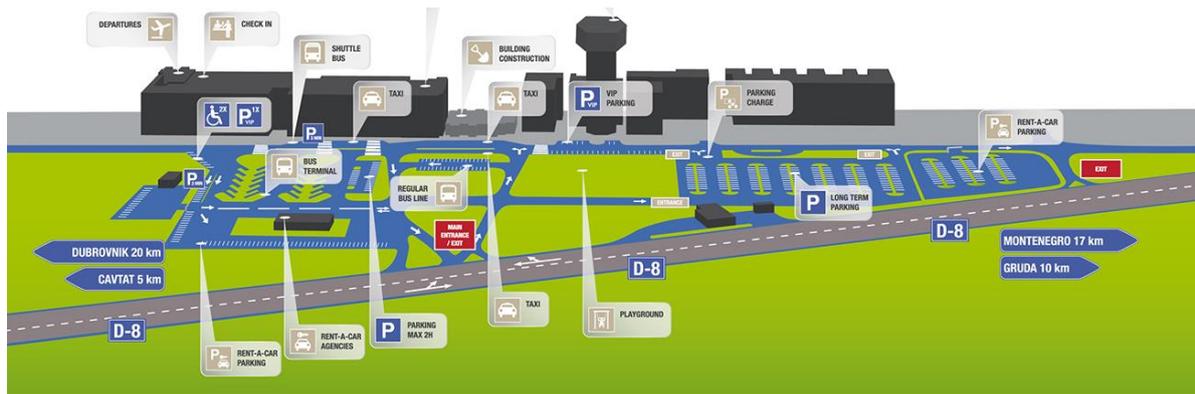


Figure 10: Parking areas at the Dubrovnik Airport

Source: Dubrovnik Airport Ltd.

Parking areas are categorized as follows:

- P1 - Main parking lot for passenger cars and employees of the Dubrovnik Airport.
- P2 - Parking lot behind the aviation fuel service for employees, visitors and taxi concessions with a permit issued by the Dubrovnik Airport.
- P3 - Parking lot in front of the cargo block for employees working in the cargo block building and parking lot users with contracts. Parking card machines will be placed in the cargo block hallway. The right to use the parking lot free of charge have the following users:
 - Customs - 2 parking spaces
 - Emergency medical unit - 3 parking spaces
- P4 - Parking lot for the „rent a car“ can be used by contracted parties only.
- P11 - Parking lot in front the Head Office building, intended for Dubrovnik Airport employees, parties with a permit and visitors. The gate is opened using a parking card or by an operator – employee of the security service at the main gate. Parking spaces near the tower are marked for each user separately. The right to free of charge parking space have the following persons / users:
 - Croatia Control (HKZP)- air navigation services 1 parking space
 - Newrest 1 parking space
 - Dubrovnik Airport visitors 3 parking spaces
 - Ramboll
 - External users with charge, and airport employees

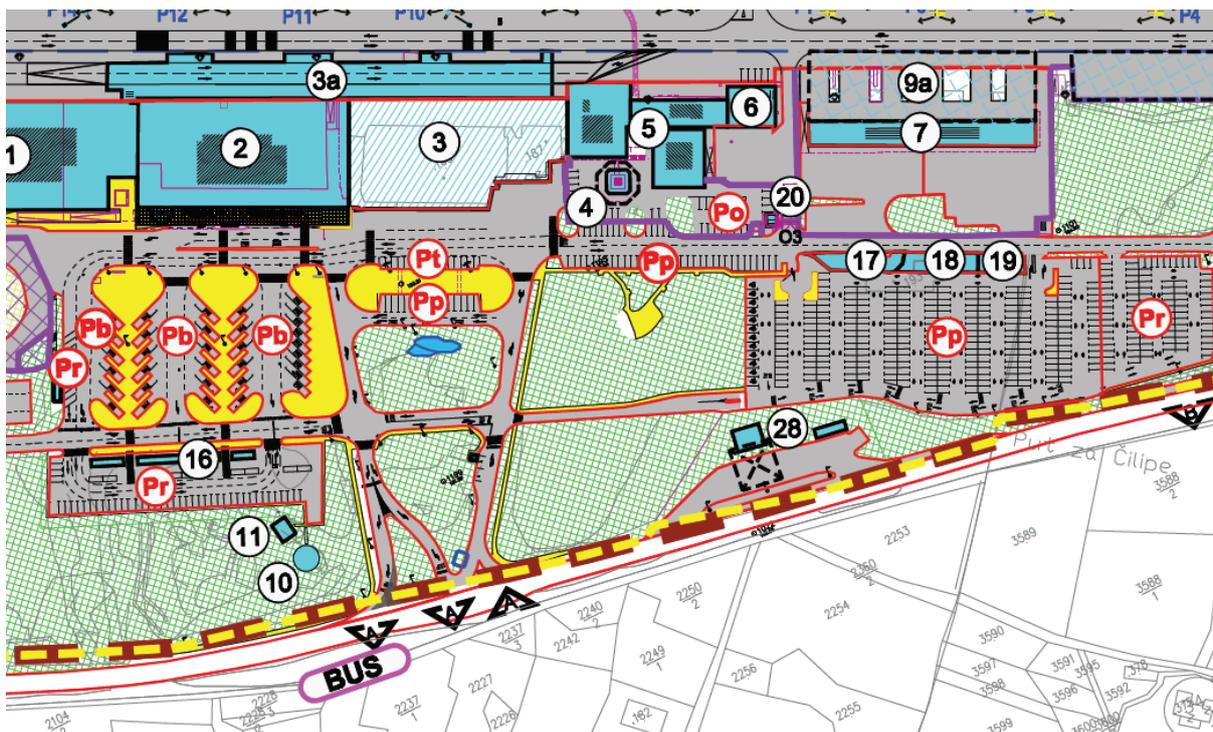


Figure 11: Layout plan of the Dubrovnik Airport parking areas

Source: Urban Development Plan (UDP 2016)

The number of parking spaces presented in Table X differs from the information and numbers obtained from the Regulation on the use of parking areas by airport employees and visitors from 2017, since the number was obtained by counting from the geodetic base map. The table is used for easier representation of the layout plan (marks).

Parking areas for stationary traffic within the airport premises are presented in Table X.

Table 9: Parking areas within the Dubrovnik Airport according to the Urban Development Plan, (UDP) for the Dubrovnik Airport, 2016

PARKING AREAS FOR STATIONARY TRAFFIC (UDP 2016)
Parking for busses and mini-busses (mark <i>Pb</i>)
Parking for Rent – a – car (mark <i>Pr</i>)
Parking for taxi cars (mark <i>Pt</i>)
Parking for Cargo (mark <i>Pc</i>)
Parking for passengers and employees (mark <i>Pp</i>)
Parking for employees only (airside) (mark <i>Po</i>)
<i>Parking spaces total</i>

Source: UDP 2016, pg. 277



Figure 12: Parking area for busses, vans and minibus (above) and rent-a-car (below)
Source: UDP 2016, pg. 170

4.2.2 PRICES

The parking charge depends on time: 15 min free of charge, up to 1hour – 10HRK, 1-2hours – 20 HRK, 2-4 hours - 25 HRK, 4-12 hours – 30 HRK, 12-24 hours - 50 HRK, each following our – 2HRK/hour, while the price of a lost parking card is 400 HRK. Detailed parking price description is given in Table X.

Gates are constructed at the parking area entrance and exits and it can be used only with a parking card or ticket issued in the Airport Commercial Sector or parking gate.

Cards for „rent a car“ parking area will be issued depending on the leased spaces as follows:

- 10 leased spaces – one card
- 11 or more leased spaces – three cards

Parking area intended for passengers in the Dubrovnik Airport will be available under conditions shown in Table X.

Table 10: Parking charges for passengers from the Dubrovnik Airport according to duration of stay

DURATION OD STAY		PRICE
max. 24h	up to 15 minutes	<i>no charge</i>
	up to 1h	<i>10 HRK</i>
	1 - 2h	<i>20 HRK</i>
	2 - 4h	<i>25 HRK</i>
	4 - 12h	<i>30 HRK</i>
	12 - 24h	<i>50 HRK</i>
	24 + every following hour	<i>(50 HRK +) 2 HRK /1h</i>
	lost parking card	<i>400 HRK</i>
max. 2h	up to 5 minutes	<i>no charge</i>
	1h – in front of building B (platform A)	<i>15 HRK</i>
	2h - in front of building B (platform A)	<i>30 HRK</i>

Source: prepared by author using data available at : www.airport-dubrovnik.hr, January 2018

Table 11: Prices and means of payment for airport employees

EMPLOYEES AND OTHER ENTITES	PRICE AND MEANS OF PAYMENT
Employees	<i>free parking parking card (lump sum) 0,00 HRK / 5,38 EUR</i>
Employees of the Police Department of the DNC, stationed at Dubrovnik Airport, customs control stationed at the Dubrovnik Airport, emergency medical units and Croatia Control (HKZP)- air navigation services	<i>parking card (lump sum) 50,00 HRK / 6,73 EUR</i>
Health and sanitation inspector	<i>parking card free of charge</i>
Employees of companies with leased business or office space at the airport - 100,00 HRK	<i>monthly parking card 100,00 HRK / 14 EUR</i>
Parking space for commercial purposes	<i>monthly parking card (one parking space) 300 HRK / 4 EUR</i>

Source: Prepared by author using data obtained from the Dubrovnik Airport Ltd.

Minimum plan dimensions for passenger cars parking space:

- one "perpendicular" PS: 5,0 m x 2,5 m;
- one "longitudinal" PS: 5,75 m x 2,0 m.

Minimum plan dimensions for bus parking space are:

- one „perpendicular“ PS: 12,0 x 4,0 m
- one „longitudinal“ PS: 17,0 x 3,0 m.

There are no parking areas for bicycles.

Table 12: Planed extension of parking lots per phases, Dubrovnik Airport Master plan, 2012

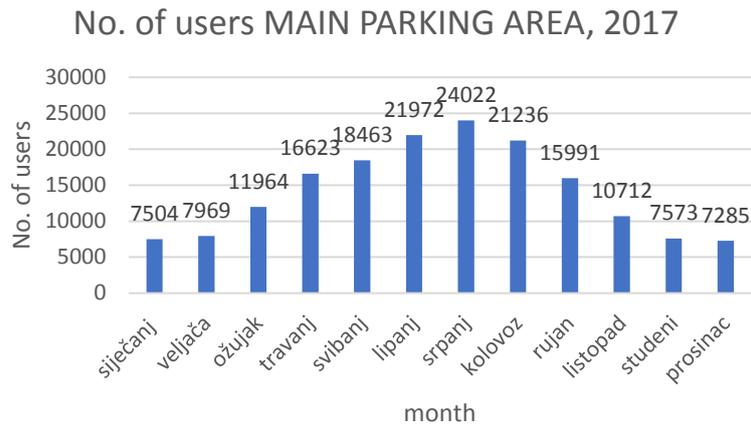
PARKING SPACES	2017	PHASE 1	PHASE 2	PHASE 3
Parking spaces for passenger cars	362	539	832	832
Parking spaces for taxi	87	87	87	157
Parking spaces for rent-a-car	156	308	308	308
Parking spaces for busses	33	36	36	48
Total parking spaces	638	970	1263	1345

Source: modified by author according to the Dubrovnik Airport Master plan, 2012, pg. 25

4.2.3 UTILIZATION OF PARKING AREAS

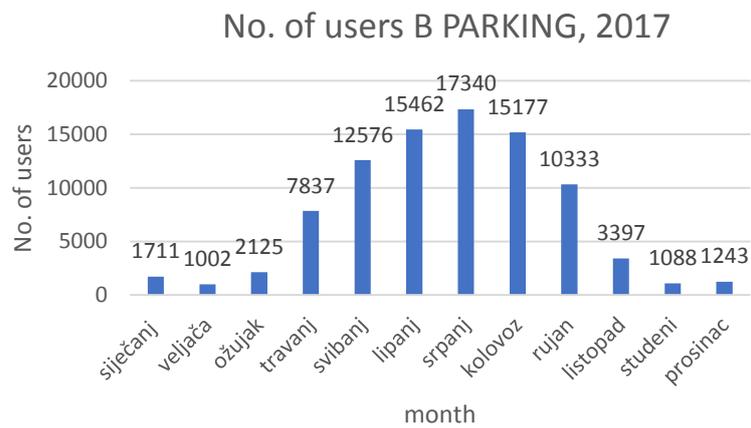
The following graph shows the utilization of parking areas per months. The Dubrovnik Airport Ltd. has the ownership of this data.

Graph 9: Numer of users of the main parking area per months in 2017



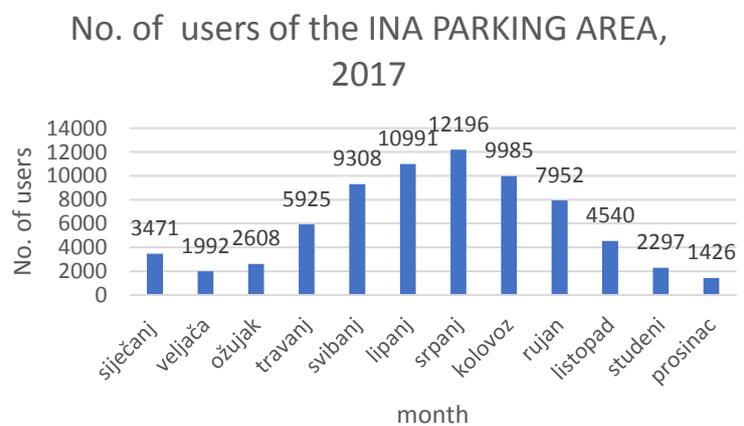
Source: prepared by author using data from the Dubrovnik Airport Ltd.

Graph 10: Number of users of Building B parking area per month in 2017



Source: : prepared by author using data from the Dubrovnik Airport Ltd.

Graph 11: Number of users of the INA parking area per month in 2017



Source: Prepared by author using data from the Dubrovnik Airport Ltd.

All parking spaces intended for the rent-a-car and taxi cars are occupied during the summer season.

4.2.4 SOLAR POWERED GENERATORS

The urban Development Plan includes construction of a solar powered generator plant for production of electricity which would be sold per incentive prices into the public electricity grid. According to the Plan these solar powered generator plant would be 250m² and situated above the cargo parking area. The exact surface area would be defined in the detailed design documentation.



Figure 13: Example of solar powered generator above the cargo parking area

Source UDP, 2016, pg. 280

4.2. ROAD NETWORK

The specific geographic and transport position of the Dubrovnik-Neretva County imposes and the development of transport infrastructure as a key local and regional development factor. Having in mind that 72% of emissions are caused by road traffic and only 1% by rail traffic, it is evident that alternative solutions must be sought.

The County's road network includes 2 motorways, 16 state roads, 33 county roads and 78 local roads. In all, the road network is not up to expectations. Roads passing through settlements are not sufficiently solved, especially in the Neretva River valley, City of Dubrovnik and Župa Dubrovačka municipality. Most local and county roads are in bad condition, mostly used for local, intra-county connection and under the responsibility of the County Road Administration. In order to connect the County with other parts of Croatian territory and with Europe, the County's Regional Development Plan includes continuation of construction of the Ploče-Dubrovnik motorway on the Adriatic – Ionian route, construction of the Pelješac bridge with access roads as well as construction of the express road Dubrovnik-Čilipi-Debeli brijeg. The Pelješac Bridge has an important role in connecting parts within the County, Dubrovnik and its wider area, the Pelješac peninsula and islands of Mljet, Korčula and Lastovo with the Neretva River region. Connection of Pelješac, Korčula and Lastovo is also of vital importance for the local community but also for future development of tourism.³

The following figure presents the most important road, the state road D-8 (Adriatic motorway), the only access by road to the Dubrovnik Airport.

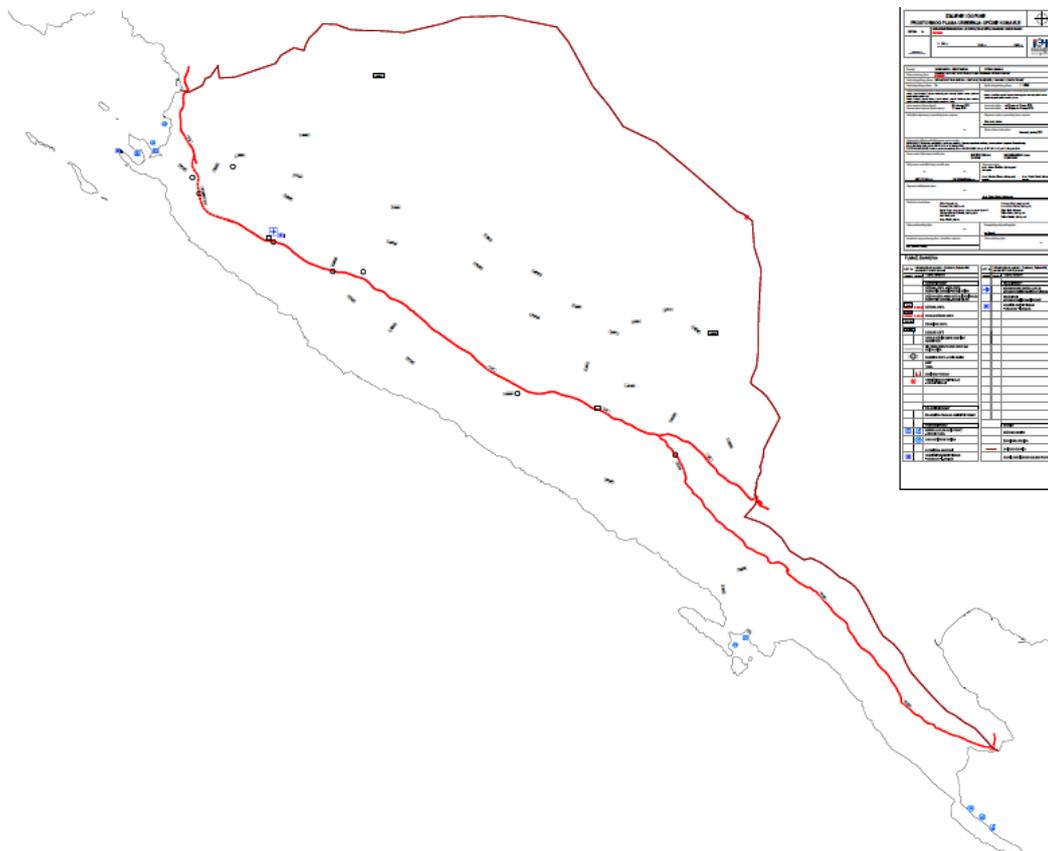


Figure 14: State road D-8 (Adriatic motorway)

Source: Regional Development Plan of the Konavle County

³ Development Strategy of the Dubrovnik – Neretva County 2016–2020

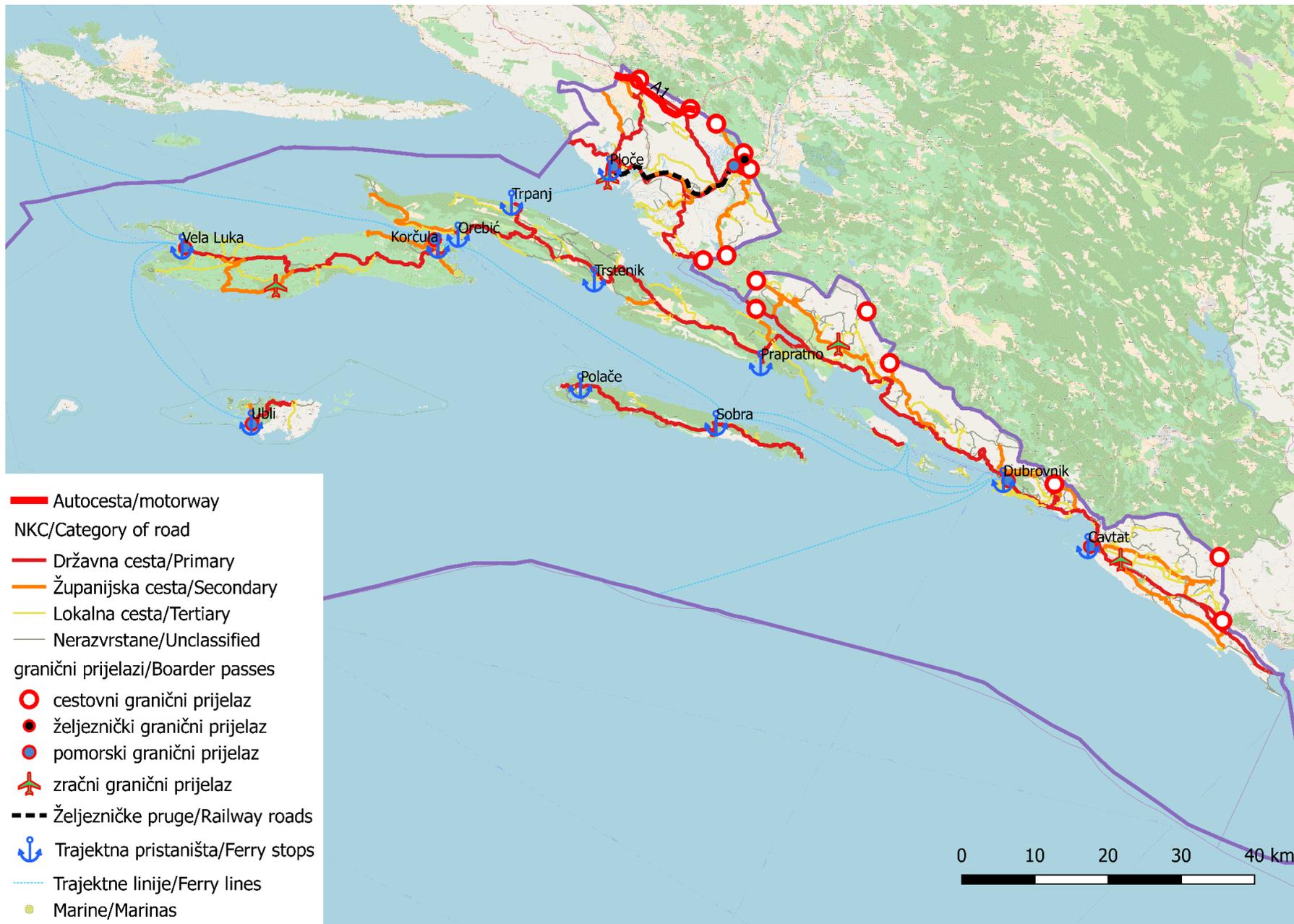


Figure 15: Transport system in the DNC
Source: prepared by author

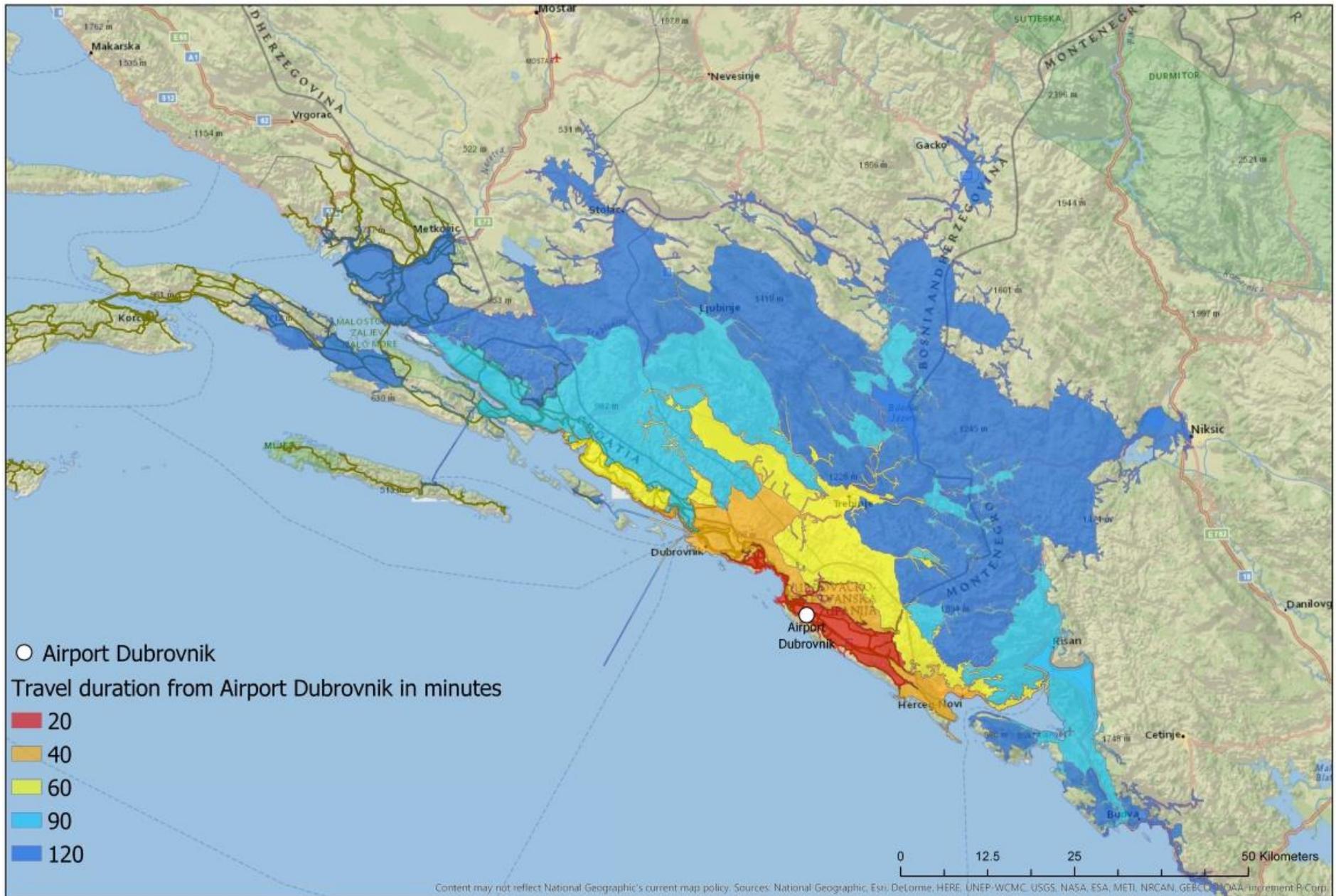


Figure 16: Duration of travel from the Dubrovnik Airport to other parts of the DNC and the region
 Source: prepared by author

According to the County Road Administration, county roads in the DNC are:

Lovište – Viganj – Orebić; D8 – Ploče; Rogotin (D8) – Komin – Krvavac – Kula (D62); State border crossing with Bosnia and Herzegovina – Prud – Metković (D62); Buk - Vlaka – Podgradina – Opuzen; Metković – Mlinište – State border crossing with Bosnia and Herzegovina; Vela Luka – D118; D118 – Blato – D118; Blato – Prižba – Brna – Smokvica; Račišće – Korčula; D118 – Lumbarda; Žuljana – Dubrava; Sv. Nikola – Bistrina Bridge; State border crossing with Bosnia and Herzegovina – Rudine Slano – A.G. Grada Dubrovnika; Ošlje – county road Ž6228; Pasadur – Ubli; Luka – Hodilje – Ston; State border crossing with Bosnia and Herzegovina – Slano; Cavtat – Zvekovica; Zvekovica – Drvenik – county road Ž6241; state road D8 – Radovčići – Mikulići – state road D516; Dubravka – Gruda; county road Ž6240 – Molunat; Brgat – Grbavac – Petrača – state road D8; Korčula: state road D118 – port; Prigradica – Blato; Zvekovica – Vučje Ždrijelo – Ljuta – county road Ž6241; state road D8 – Slano; Kapja – Smokvica – Čara – Dubovo, Mali Prolog – Karamatići – Ploče; Klek – Badžula.

State roads in the Dubrovnik-Neretva County are (source: Regional Development Plan of the Konavle municipality):

- state road DC-516: Karasovići (state road DC-8) – State Border Crossing Konfin (DC-8)
- state road DC-8: Župa Dubrovačka municipality boundary – State Border Crossing Karasovići (Montenegro state borderline).

The figure below presents the road transport network with more details shown near the Dubrovnik Airport.

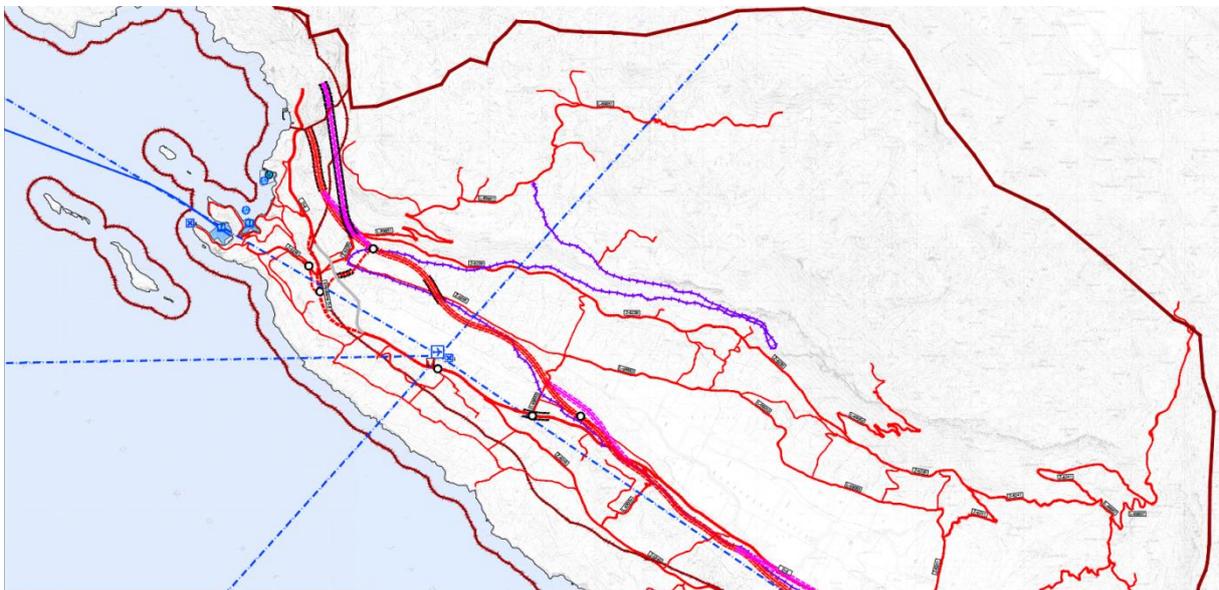


Figure 17: Road network in the Konavle municipality around the Dubrovnik Airport

Source: Regional Development Plan of the Konavle municipality

4.3.1. PEDESTRIAN TRAFFIC

Areas for pedestrian traffic within the zone covered by the Urban Development Plan of the Dubrovnik Airport:

- existing sidewalk along the terminal buildings;

- planned sidewalk along the season terminal building zone, with varying width, ranging between app. 7,0 – 22,0 m
- extended pedestrian walkway, width 3,0 m along the right side of the main entrance / exit road separated from the traffic lanes by a median strip
- planned pedestrian walkway on both sides of the frontage road, width 1,5 m *and cross section 1b*;
- extensions of pedestrian walkways, width 3,0 m along the main roads
- planned 2,9 m wide pedestrian walkway passing freely through the green strip up to the planned bus stop on the motorway;
- planned walkway stretching along the north garage wall, minimum width 5,0 m
- pedestrian islands next to the bus stops;
- other marked surfaces

Public lighting needs to be installed on all pedestrian walkway surfaces.

A closed pedestrian overcrossing is planned, to connect the public garage building and the terminal building – block C , as well as a pedestrian overcrossing between the public garage building and the administration building.⁴

4.3.2. BICYCLE TRAFFIC

The County lacks bicycle lanes. Currently, there are three bicycle lane routes . Measures for bicycle traffic improvement in the County include: construction of bicycle lanes in the County area and continuous maintenance of existing bicycle lanes. The measures also include promotion of a bike as means of transport for short distance trips as well as continuous implementation of programs and courses on the awareness and advantages of bicycle transport, to be implemented in pre-schools, schools, organized lectures and public discussions for the general public.⁵

⁴ UDP of the Dubrovnik Airport, 2016

⁵ www.edubrovnik.org/wp-content/uploads/2017/01/Z%CC%8CRS-DNZ.pdf (siječanj, 2018)

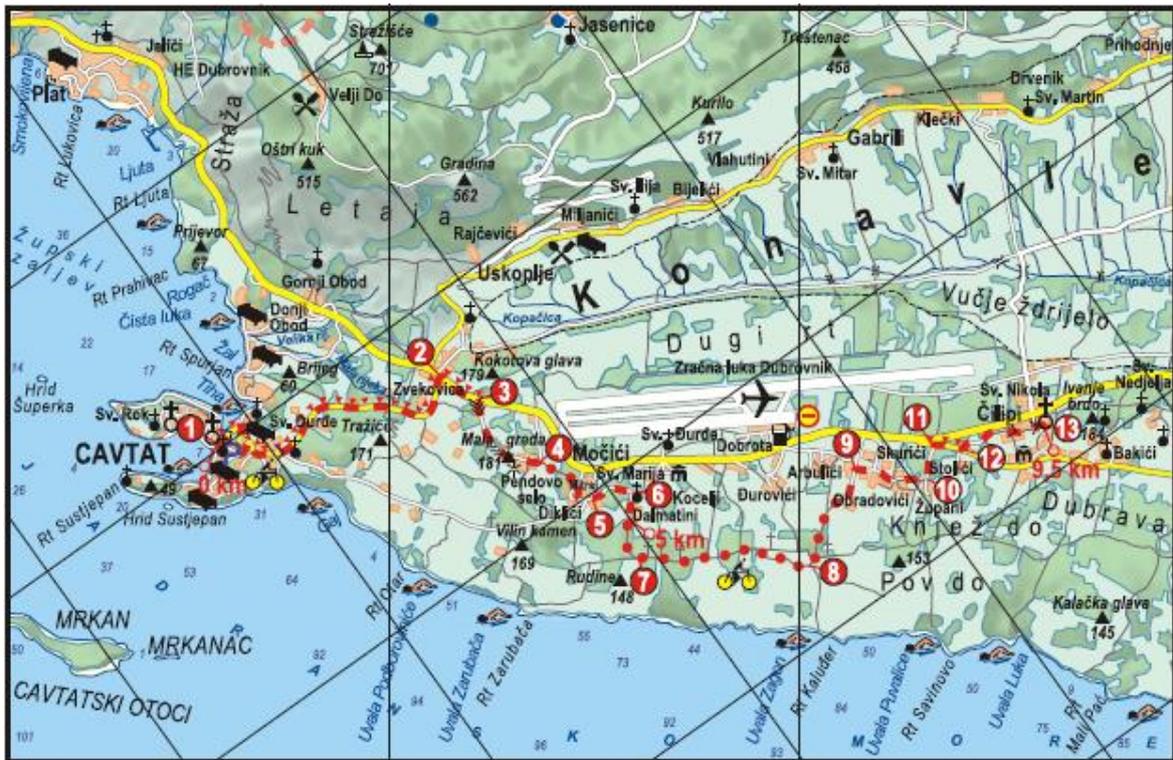
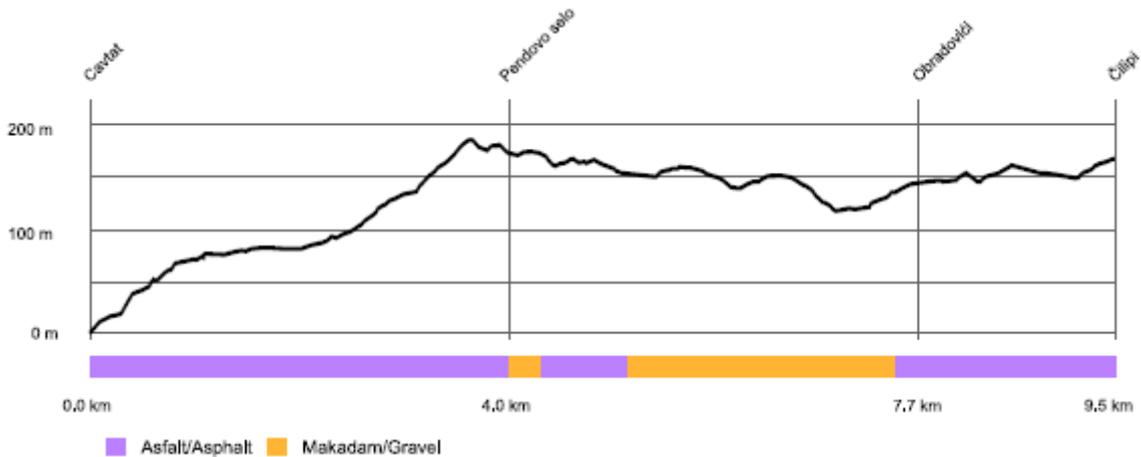


Figure 18: Bicycle route Cavtat-Močići-Čilipi

Source: Cavtat-Močići-Čilipi newsletter

Table 13: Percentage of paved/asphalted and unpaved/macadam surface of the Cavtat-Močići-Čilipi bicycle route



Source: Cavtat-Močići-Čilipi newsletter

There are three bicycle routes for recreational purposes in the area of the Konavle municipality (Dubrovnik Airport):

- Cavtat-Močići-Čilipi
- Cavtat-Zvekovica-Miljaši
- Čilipi-Gruda-Ljuta-Pridvorje

The EuroVelo 8 bicycle route (Mediterranean route) passes through the Dubrovnik-Neretva County. It is a part of high quality bicycle routes which connect the whole of Europe. Significance of this Mediterranean route for Croatia is the fact that it spreads along the complete Croatian coastline, from Istria to the Dubrovnik – Neretva County, continuing further on through Montenegro to Athens. In is 5.888 km long and 1.100 km passes through Croatia. It runs through 11 states, from Cyprus to the town of Cadiz in Spain.

These are all routes for recreational purposes and in order to provide good access to the Dubrovnik Airport by bicycle is a municipal bicycle route development strategy, i.e. better utilization of the already existing recreational routes for short trips (place of work - home).

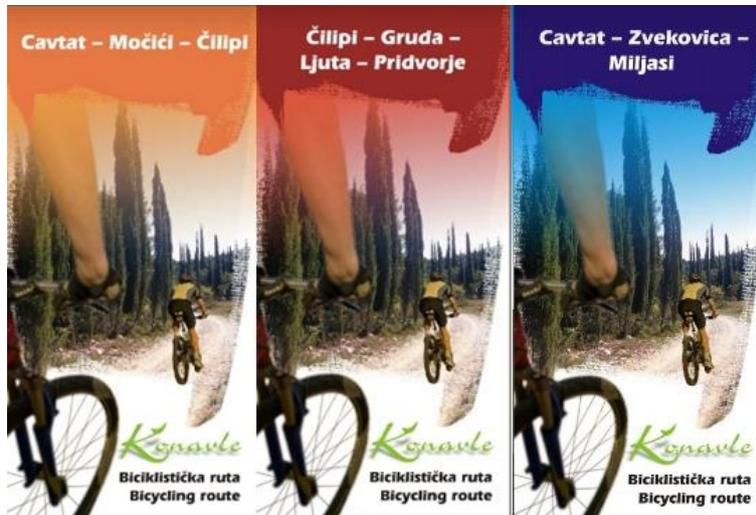


Figure 19: Newsletters for bicycle routes in the Konavle municipality area
Source: : Newsletters for bicycle routes in the Konavle municipality area

4.3. GAS STATION AT THE DUBROVNIK AIRPORT AREA AND ALTERNATIVE FUELS

The INA gas station in the Dubrovnik Airport area is at the address: Dobrota 25, 20213 Čilipi. It can be reached by the state road D-8 (Adriatic motorway). Working hours are between 06 - 22h , Monday to Sunday and on holidays.

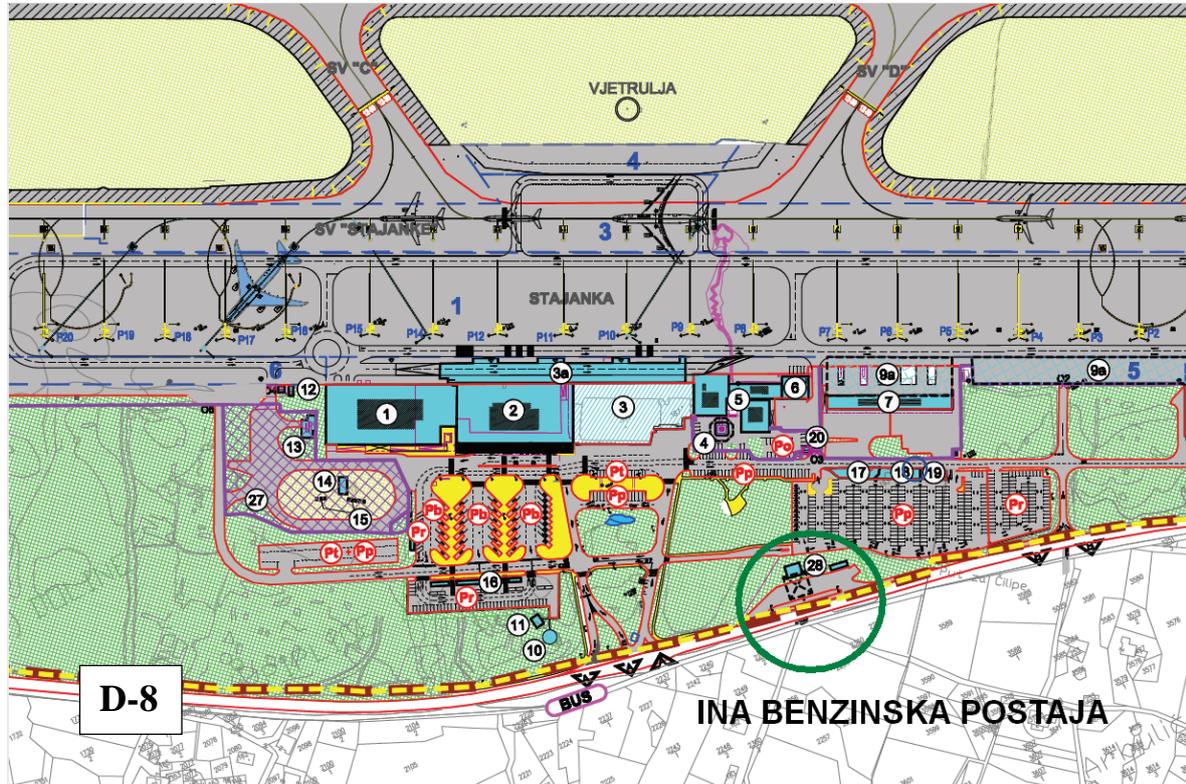


Figure 20: Gas station at the Dubrovnik Airport

Source: Urban Development Plan, 2016, Trames Consultants

Table 14: Gas station offer / supply

Fuels	Other services	Payment options
<ul style="list-style-type: none"> • Eurosuper BS 95 - 9,78 HRK • Eurosuper BS 95 Class Plus - 9,88 HRK • Eurosuper BS 100 Class Plus - 10,32 HRK • Eurodiesel BS - 9,23 HRK • Eurodiesel BS Class Plus - 9,33 HRK 	<ul style="list-style-type: none"> • bottled gas • lubricants • consumer products • car wash • self-service car wash • AutoBar (restaurant) • souvenir shop • exchange office • Pet Point • baby room • NON-STOP • HotSpot 	<ul style="list-style-type: none"> • INA card • AX • DC • EC/MC • VISA • DISCOVER • MOL • DKV • UTA

Source: prepared by author

INA, d.d. is a mid-level European oil company with a leading role in oil operations in Croatia and a significant role in the region. INA Group includes several companies completely or in part owned by INA, d.d.

The Figure below shows the locations of gas stations in the DNC in relation to the Dubrovnik Airport.

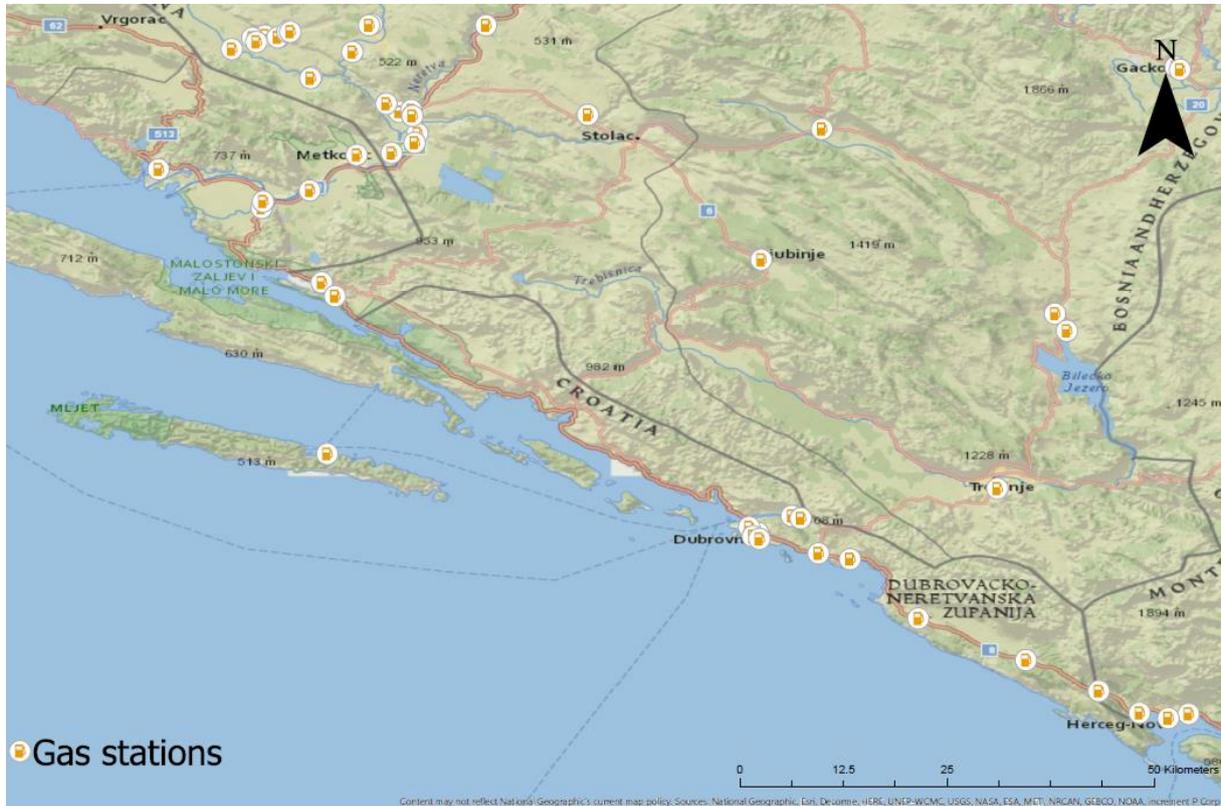


Figure 21: Locations of gas stations in the DNC and surrounding areas
Source: Prepared by author

4.4. ELECTRIC VEHICLE CHARGING INFRASTRUCTURE (EV)

EV charging stations are installed at nine locations in the Dubrovnik-Neretva County. Their locations and technical characteristics are given in Table X. Three out of nine charging stations are located in the City of Dubrovnik, at three different locations. In order to use these charging station, identification is required by means of Radio-frequency identification (RFiD), SMS or application. 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.

- 4/9 charging stations are intended for all vehicle types
- 5/9 charging station are for passenger cars only

Owners of EV charging stations:

- HEP - Hrvatska elektroprivreda (3)
- JU NP Mljet (1) (National Park Mljet)
- Općina Ston (1) (Ston Municipality)
- no information (4)

EV charging station at the Dubrovnik Airport was installed towards the end of 2017 and is still used for commercial and promotion purposes. This is why information on its use is not available. Out of the nine EV charging stations, five are free of charge and for four the data is not available.

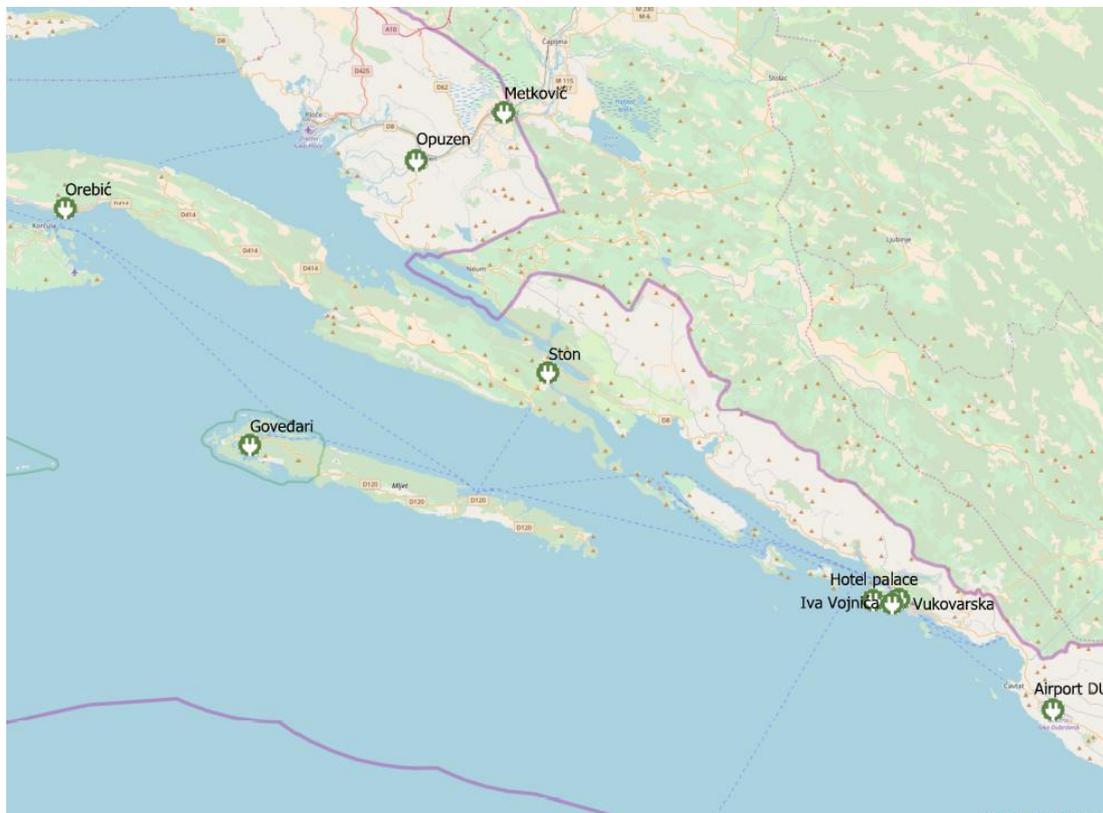


Figure 22: EV charging stations in the Dubrovnik-Neretva County (DNC)

Source. prepared by author

Table 15: Location and technical characteristics of EV charging stations in the DNCi

LOCATION	CHARACTERISTICS	GENERAL INFORMATION	ACCESSIBILITY	PAYMENT
Trg kralja Tomislava, 20350 Metković	Two sockets (AC) rated output 22 kW (32A) output voltage 400V, fast charging	identification needed by means of RFID, SMS, Application, Owned by: no information	<i>no information/passenger cars only</i>	<i>no information, HEP (HR02)</i>
Petra Kresimira IV 107, 20250 Orebić, (Aminess Grand Azur Hotel)	Two sockets (AC) rated output 22 kW (32A) output voltage 400V, fast charging	identification needed by means of RFID, SMS, Application, Owned by: no information	accessible to general public / all vehicle types	<i>free of charge, HT (HR01)</i>
Poduzetnička zona bb, 20355 Opuzen / Business zone in Opuzen	Two sockets (AC) rated output 22 kW (32A) output voltage 400V, fast charging	identification needed, Owned by: HEP - Hrvatska elektroprivreda, available for passenger cars only, working hours: non-stop	<i>no information/passenger cars only</i>	<i>no information, HEP (HR02)</i>
Goveđari, 20226 Otok Mljet, (National Park Mljet 2)	Two sockets (AC) rated output 22 kW (32A) output voltage 400V, fast charging	identification needed, Owned by: National Park Mljet, working hours non-stop	<i>no information/ all vehicle types</i>	<i>free of charge</i>
Put braće Mihanovića , 20230 Ston	Two sockets (AC) rated output 22 kW (32A) output voltage 400V, fast charging	identification needed (RFID), Owned by: Ston Municipality, available to general public, passenger cars only, working hours: non-stop	accessible to general public / <i>passenger cars only</i>	<i>free of charge, HT (HR01)</i>
Vukovarska 19, 20000 Dubrovnik	Two sockets (AC) rated output 22 kW (32A) output voltage 400V, fast charging	identification needed (RFID), Owned by: HEP - Hrvatska elektroprivreda, Working hours: non-stop	accessible to general public / <i>passenger cars only</i>	<i>no information, HEP (HR02)</i>
Masarykov put 20, 20000 Dubrovnik (Hotel Palace)	Two sockets (AC) rated output 22 kW (32A) output voltage 400V, fast charging	identification needed, other information unavailable	<i>no information / all vehicle types</i>	<i>no information</i>
Iva Vojnića 31a, 20000 Dubrovnik	Two sockets (AC) rated output 22 kW (32A) output voltage 400V, fast charging	identification needed (RFID), Owned by: HEP - Hrvatska elektroprivreda, Working hours non-stop	accessible to general public / <i>passenger cars only</i>	<i>free of charge HEP (HR02)</i>
Čilipi, 20213 Dubrovnik (Zračna luka Dubrovnik)	Three sockets, rated output 50kW (125 A) and 43 kW (63 A), output voltage 400V	identification needed, Owned by: no information, Working hours: non-stop	accessible to general public / all vehicle types	<i>free of charge, HT (HR01)</i>

Source: www.puni.hr (February 2018)

4.5. ACCESSIBILITY OF AIRPORT BY RAIL

The County has only one railway line extending from Ploče to Metković and further on to Sarajevo and Central Europe. It belongs to Class one railway lines and is full reconstructed. The railway line has great significance because it represents the nearest connection between Central Europe and the Mediterranean and is the only natural exit Of Bosnia and Herzegovina to the sea.

Except this line the DNC has no railway transport. The line is at the very north of the DNC and has no connection to the Dubrovnik Airport..

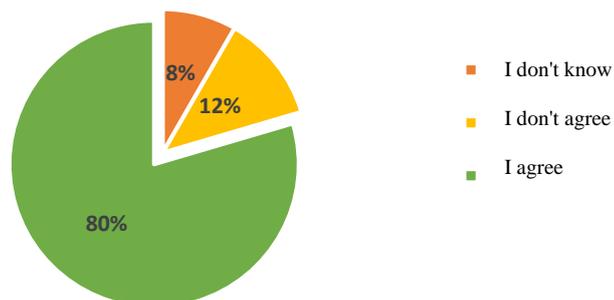


Figure 23: Railway line location in relation to the Dubrovnik Airport

Source: taken and modified from the Report on HŽI (Croatian Railways) network 2018

Table 16: Opinions of passengers on the need to connect Dubrovnik Airport with the City of Dubrovnik and the region by rail

Dubrovnik Airport needs to be connected with the town of Dubrovnik and the region by high-speed rail



Source:: prepared by author using results of the poll

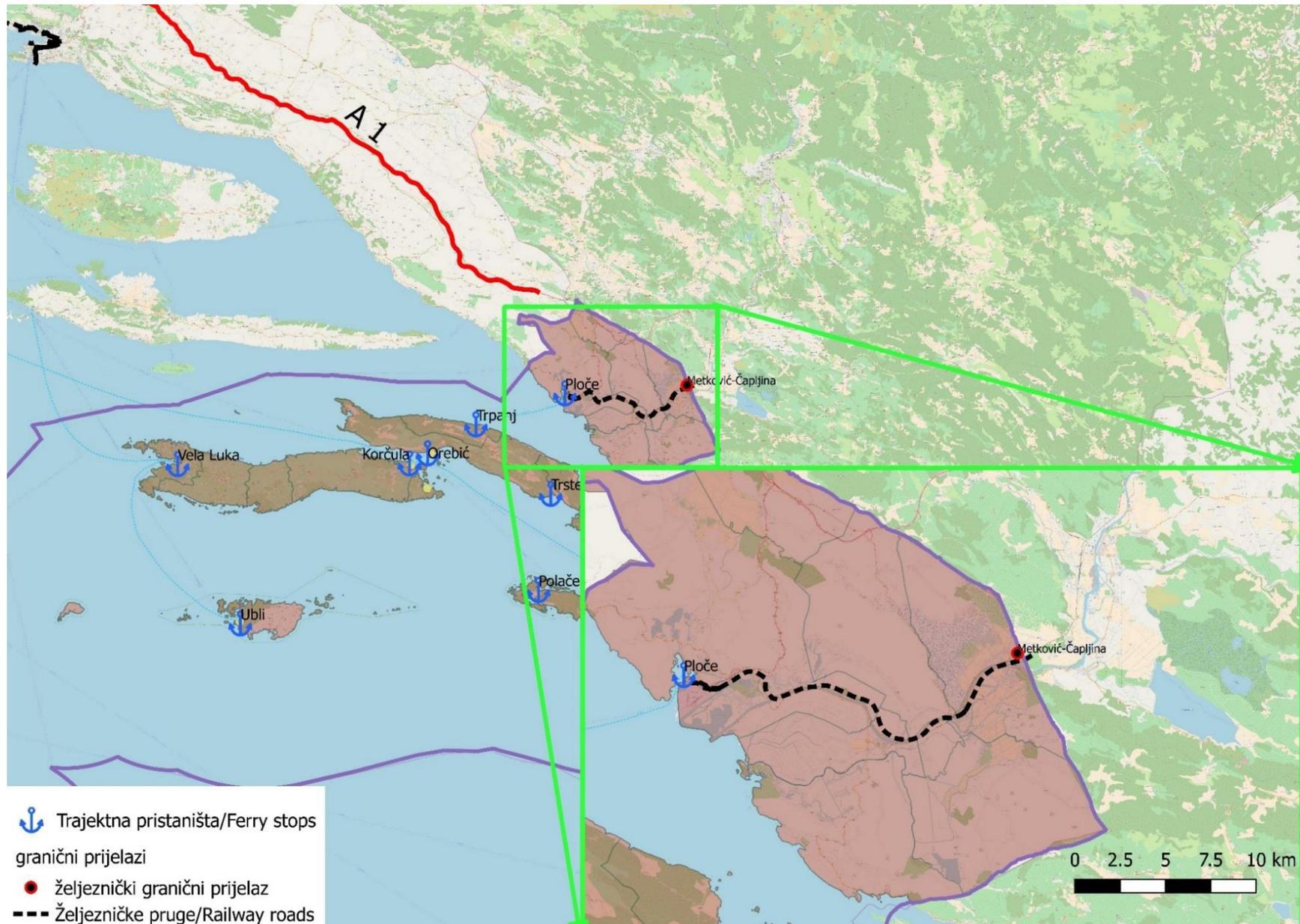


Figure 24: Position of railway line within the FUA (DNC)
 Source: prepared by author

4.6. TAX SERVICES

There are 106 licensed taxi drivers, members of the Konavle Taxi Drivers Association operating in the Dubrovnik Airport area.

„KONAVLE TAXI DRIVERS ASSOCIATION“

**NUMBER OF REGISTERED
OPERATORS - LAND**

97



**NUMBER OF REGISTERED
OPERATORS AT SEA**

3



The exact number of registered taxi operators in the DNC is not completely available. According to the Development Strategy of the Dubrovnik-Neretva County 2016–2020, 309 taxi concessions have been issued in the DNC, mostly in the City of Dubrovnik and the least in the Neretva River valley. The number of concessions is increasing only in Dubrovnik and in other local government units the situation is not changing. Plavi Taksi Dubrovnik or Taksi Dubrovnik Ragusa operate in the Dubrovnik area.

TAXI KONAVLE			
LOCATION		PRICE	
		€	KN
LOCO	HR	13	100
CAVTAT	HR	16	120
PLAT	HR	20	150
MLINI	HR	24	180
SREBRENO	HR	27	200
DUBROVNIK	HR	35 - 40	260 - 300
ACI MARINA	HR	40	300
ORAŠAC	HR	50	370
SLANO	HR	80	580
STON	HR	100	750
OREBIĆ	HR	190	1400
MAKARSKA	HR	240	1800
SPLIT	HR	320	2400
NEUM	BiH	120	900
MEĐUGORJE	BiH	200	1500
MOSTAR	BiH	220	1650
SARAJEVO	BiH	400	3000
BORDER CROING	MNE	35	260
HERCEG NOVI	MNE	60	450
TIVAT	MNE	120	900
KOTOR	MNE	120	900

BUDVA	MNE	140	1050
SV. STEFAN	MNE	160	1200
PETROVAC	MNE	180	1350
BAR	MNE	200	1500
PODGORICA	MNE	220	1650

Izvor: izradio autor

4.7. INTEGRATED TICKETING

the Dubrovnik – Neretva County does not have an integrated passenger transport system and ultimately, it does not have an integrated ticketing system for several transport modes. The Inland and maritime transport need to be integrated.

4.8. CAR SHARING

At this time there are no car-sharing services available or operating in the DNC area or on the Dubrovnik Airport area, but there are some indicators that this service could be established by 2020. The company Avantcar, a rent-a-car company operating at the Dubrovnik Airport will start a car-sharing pilot programme with a vehicle fleet 100% consisting of electric Vehicles (EV). Construction of new EV charging stations is planned in the Dubrovnik Airport terminal building area. More information of the car-sharing project is given in the chapter on innovations.

4.9. RENT-A-CAR SERVICES

There are 7 rent-a-car companies operating at the Dubrovnik Airport. These are:

- ANTERRA d.o.o.
- ANTICUS d.o.o.
- AUTO BENUSSI d.o.o.
- AUTO CLASSEM d.o.o.
- AUTONAJAM d.o.o.
- AVANT CAR d.o.o.
- GENUS PROJEKT
- MACK d.o.o.
- NAVITEX d.o.o.
- NOVA GRATIA d.o.o.
- OBRT PEUGEOT CLUB
- ORYX GROUP d.o.o.
- PRAXMARER I SABLJO d.o.o.
- SUB ROSA d.o.o.
- UNI LINE d.o.o.
- UNI RENT d.o.o.
- VIATOR d.o.o.

Some vehicle types used by rent-a-car companies at the Dubrovnik Airport are: Fiat Panda, Opel Astra I, Mazda 6, while a higher standard of offer includes Jaguar F-pace, Range Rover Sport etc.

The company A-Anticus has 900 cars for rent during the summer season at the Dubrovnik Airport. Since this company has 50 parking spaces at the airport, most cars are outside the Dubrovnik Airport parking areas. The company Unirent has 90 vehicles at disposal during the summer season.

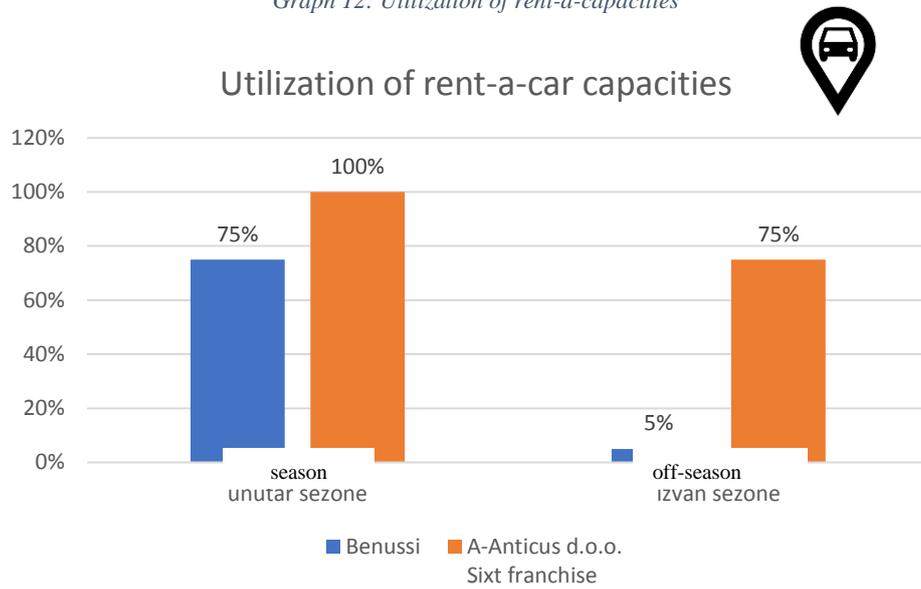
Table 17: Characteristics of Rent-a-car companies

	VEHICLE FLEET UTILIZATION		LOCATIONS AT THE AIRPORT DURING SEASON	AVERAGE DAILY NUMBER OF RENTALS (SEASON)
	SEASON	OFF-SEASON		
MACK	200 cars	70 cars	<i>x</i>	40-50 cars / day
UNIRENT	50 cars	10 cars	5	<i>no information</i>
A-Anticus d.o.o. Sixt franchise	75%	5%	50 (3 locations) + majority of cars outside airport area	<i>x</i>
BENUSSI	90 - 100% (400-450 cars)	60 - 75% (30-40 cars)	<i>x</i>	<i>x</i>

Source: Prepared by author according to information from rent-a-car companies

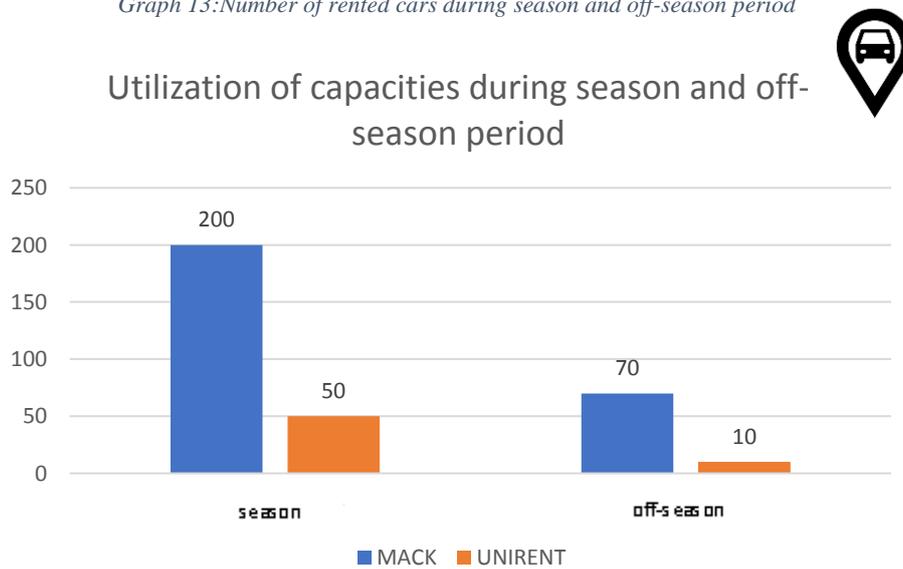
Information presented in the table and graph show a disparity in the utilization of vehicle fleet during the season and the off-season period.

Graph 12: Utilization of rent-a-capacities



Source: Prepared by author according to information from rent-a-car companies

Graph 13: Number of rented cars during season and off-season period



Source: Prepared by author according to information from rent-a-car companies

5. SERVICES PROVIDING MOBILITY

The main modes of transport connecting the Dubrovnik Airport with the DNC are:

- regular bus transport service Libertas
- shuttle bus Atlas
- shuttle bus Korkyra (season)
- bus lines Autotrans (DB Arriva)/Dalmacija bus
- taxi service
- rent-a-car

The Dubrovnik Airport is linked with the DNC and the region by means of regular bus lines, shuttle bus lines, inter-city bus lines and taxi services. Bus transport seems to be the dominant transport mode. Atlas shuttle busses operate after arrival of every regular flight, for a price of 40 HRK (one-way ticket), public transport operator Libertas lines connect Dubrovnik and neighbouring municipalities, and taxi services are available as well. There are regular departures of the carrier Autotrans/Dalmacija bus, at a price of 40,00 HRK + 5% discount for online ticketing. The company Korkyra also offers shuttle bus services, connecting the Dubrovnik Airport with the whole DNC, but only during the tourist season.



Figure 25: Bus stations from the City of Dubrovnik to the Dubrovnik Airport
Source: Prepared by author

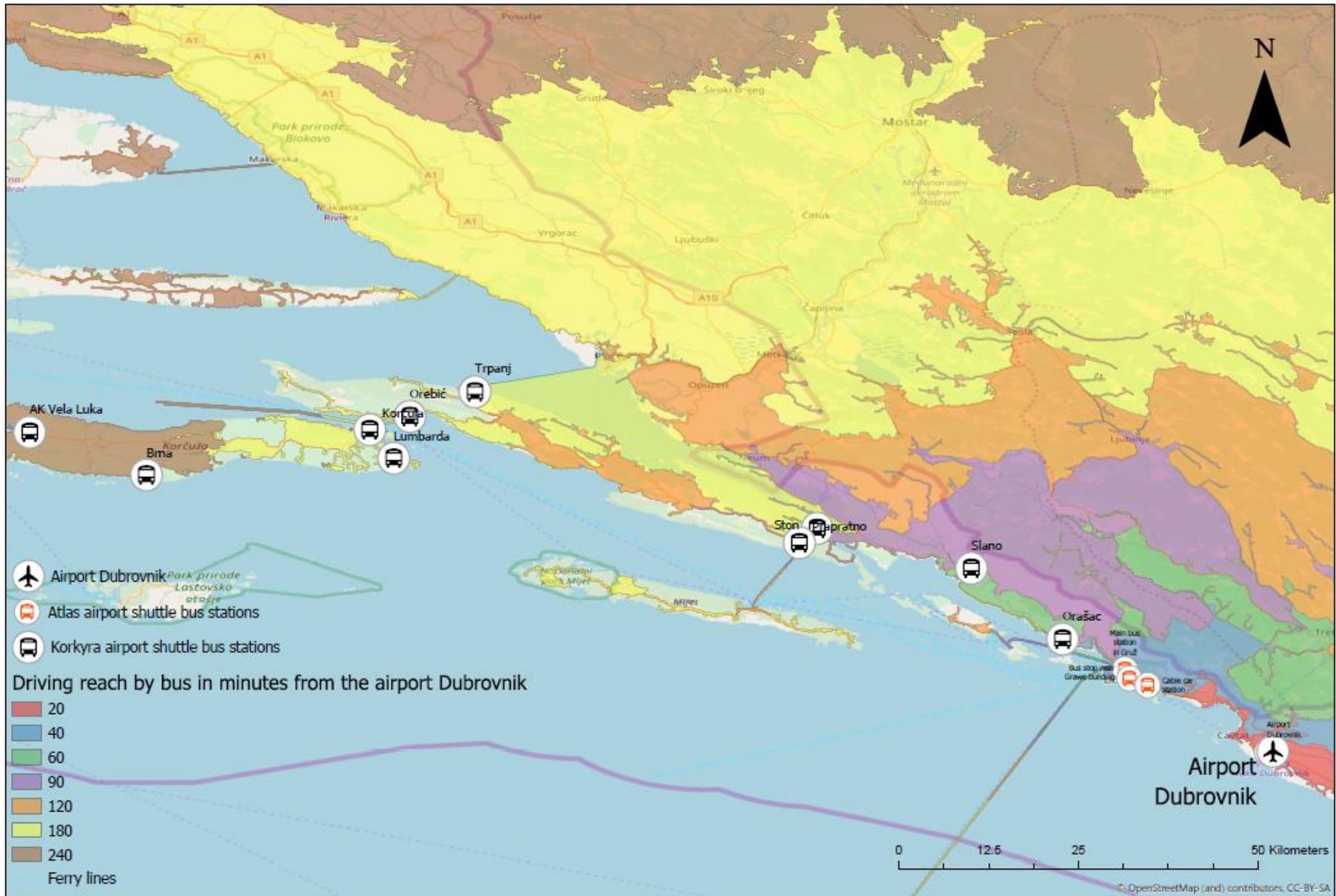


Figure 26: Dubrovnik-Neretva County coverage by shuttle bus stops and their distance from Dubrovnik Airport in minutes (Atlas, Korkyra)

Source: Author

Table 18: Services providing mobility at the Dubrovnik Airport – shuttle bus transport

	CARRIER	AREA OF COVERAGE	SERVICE PROVIDED	PRICE	SCHEDULE
SHUTTLE BUS	Atlas 	City of Dubrovnik, Konavle Municipality	Dubrovnik Airport – Main Bus Terminal Gruž, Dubrovnik (Obala Ivana Pavla II, 20000, Dubrovnik) <i>all year</i>	- 40 HRK one-way ticket - 70HRK round trip ticket	- 120 minutes before every international departure - 90 minutes before every domestic flight - after every scheduled arrival to Dubrovnik
	Korkyra 	DNC area	<ul style="list-style-type: none"> • Orašac - Dubrovnik Airport • Slano - Dubrovnik Airport • Ston - Dubrovnik Airport • Prapratno - Dubrovnik Airport • Trpanj - Dubrovnik Airport • Orebić - Dubrovnik Airport • Korčula - Dubrovnik Airport • Lumbarda - Dubrovnik Airport • Brna - Dubrovnik Airport • Vela Luka – Dubrovnik Airport <i>during the tourist season</i>	90 – 300 HRK / 12 – 40 € one-way ticket	3 – 8 times/day 4 times/day on the average

Source: Prepared by author

Transfer of passengers by bus is organized from the City of Dubrovnik to the airport. Buses depart from the Main Bus Terminal in Dubrovnik one and a half hours before departure of regular, scheduled flights. This form of transport depends on Croatia Airlines flights which connect the Dubrovnik Airport with other airports and to other Croatia Airlines flights. Passengers arriving by charter flights or other airlines are transported by organized transfers from and to their respective hotels, or by taxi.

Transfer from the airport to the City of Dubrovnik (Pile, Main Bus Terminal) by organized carrier takes place after every regular, scheduled flight arrival. The bus stop is in front of the passenger terminal – building B⁶.

There are a total of 211 bus stops on the territory of the Dubrovnik-Neretva County.

Transport connection of municipalities and towns in the DNC area by bus lines does not meet the needs. Due to terrain configuration and spread out and scattered agglomerations, the local government units or the County cannot provide adequate inter-municipal connectivity.⁷

⁶ Urban Development Plan, 2016, Trames Consultants, str.

⁷ www.edubrovnik.org/wp-content/uploads/2017/01/Z%CC%8CRS-DNZ.pdf (January, 2018)

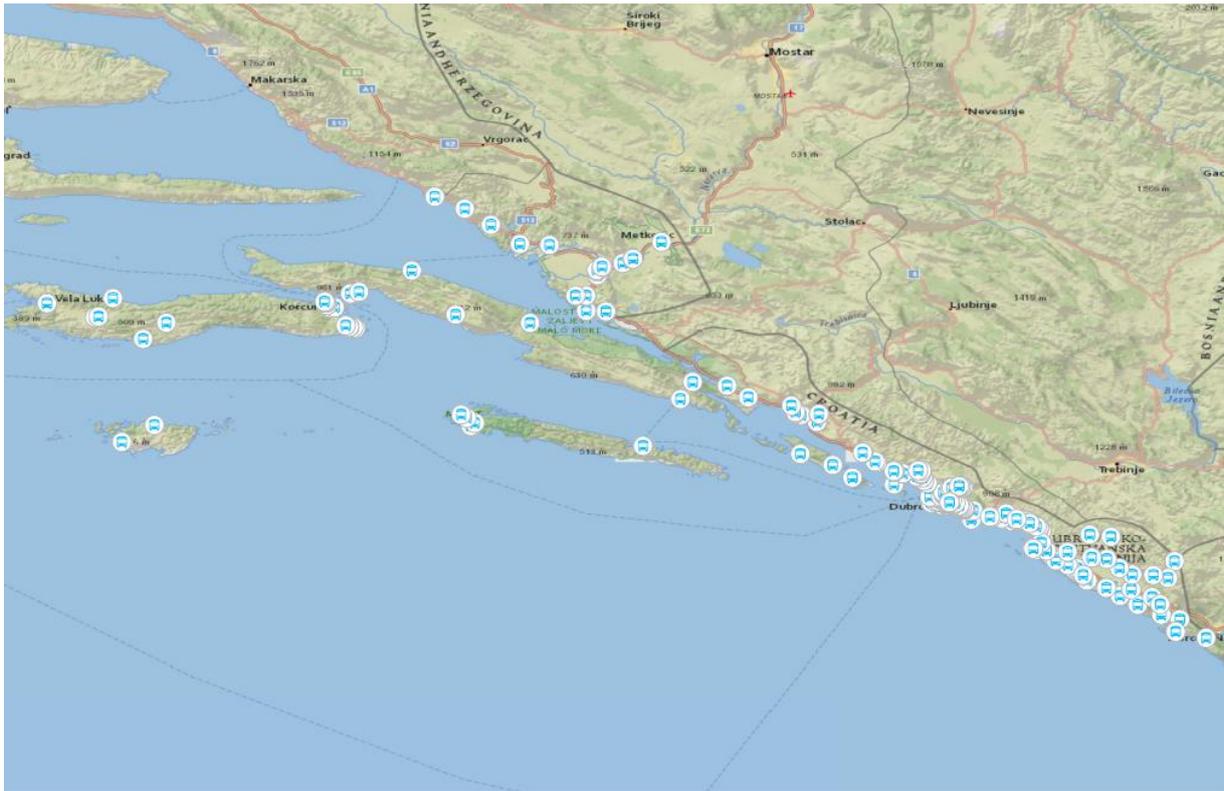


Figure 27: Map showing all bus stations in the DNC
 Source: Prepared by author



Figure 28: Map showing the coverage of every bus station up to the Dubrovnik airport, 300, 500, 800m and 1km
 Source: Prepared by author

5.1. SHUTTLE BUS ATLAS

Shuttle busses ATLAS transfer passengers from Dubrovnik to the Dubrovnik Airport and vice versa. These shuttle busses depart from their stops at the Main Bus Terminal, at the address, Obala Ivana Pavla II, 20000 Gruž, Dubrovnik, usually 120 minutes before every international flight, and 90 minutes before every domestic flight. The route from Dubrovnik to the Dubrovnik Airport includes the following bus stops in the order as given: Main Bus Terminal Gruž, bus station near the „Grawe“ building, bus station near the Dubrovnik Cableway and bus stop in front the passenger terminal, building „B“.

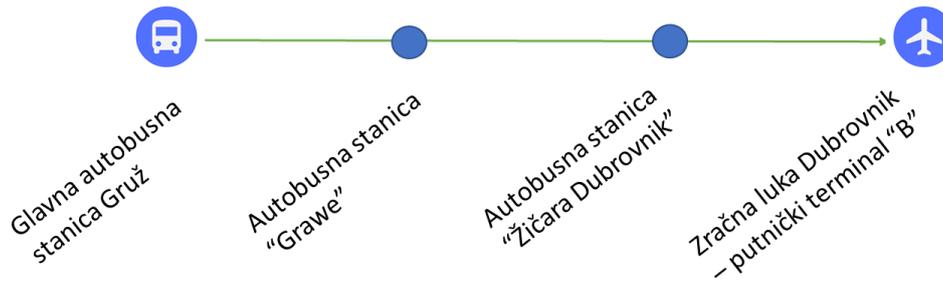


Figure 29: Atlas Shuttle bus stops, 2018

Source: Prepared by author

Transfers are scheduled from the airport to Dubrovnik (main bus terminal Gruž) after every scheduled flight, 20 – 30 minutes after every aircraft landing. The bus stop is in front of the passenger terminal – building B. It is a 30 minutes drive in each direction, and the ticket is 40 HRK. Price of a round trip ticket is 70 HRK.



Figure 30: ATLAS shuttle bus route, town of Dubrovnik – Dubrovnik Airport
Source: Prepared by author

The number of departures of shuttle busses from the Main Bus Terminal Gruž is proportional to the number of outbound flights. Most frequent shuttle bus departures are on Mondays, Tuesdays and Thursdays (5), while the least number of departures is on Fridays (3) due to the least number of outbound flights. The flights may be cancelled at times due to adverse weather conditions (strong winds), and the alternative offered to the passengers might be a drive by Shuttle bus from the Dubrovnik Airport to Split Airport, i.e. to the next available outbound flight from the Split Airport.

Table 19: ATLAS shuttle bus schedule (January 2018)

DAY	DEPARTURES	NUMBER OF DEPARTURES
Monday 8/1/2018 Dubrovnik – Airport	5:10h, 6:55h, 10:35h, 11:50h, 14:55h	5
Tuesday 9/1/2018 Dubrovnik – Airport	5:10h, 11:35h, 12:25h, 13:50h, 14:55h	5
Wednesday 10/1/2018 Dubrovnik – Airport	5:10h, 06:55h, 11:50h, 14:55h	4
Thursday 11/1/2018 Dubrovnik – Airport	5:10h, 11:35h, 12:25h, 14:55h, 17:15h	5
Friday 12/1/2018 Dubrovnik – Airport	5:10h, 11:50h, 14:55h	3

Source: www.atlas-croatia.com (January 2018)

The Table shows the departure pattern in the second week of January 2018, which is the off-season shuttle bus schedule, when there are significantly less flights in the Dubrovnik Airport.

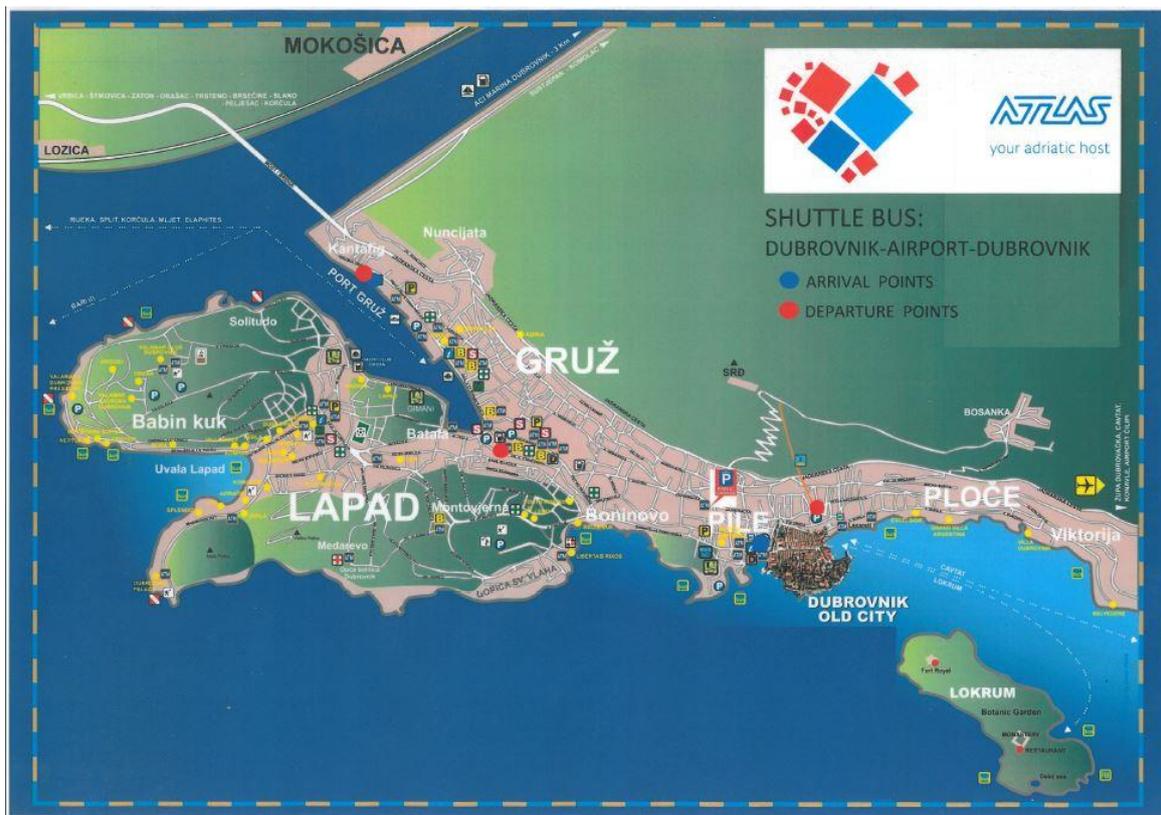
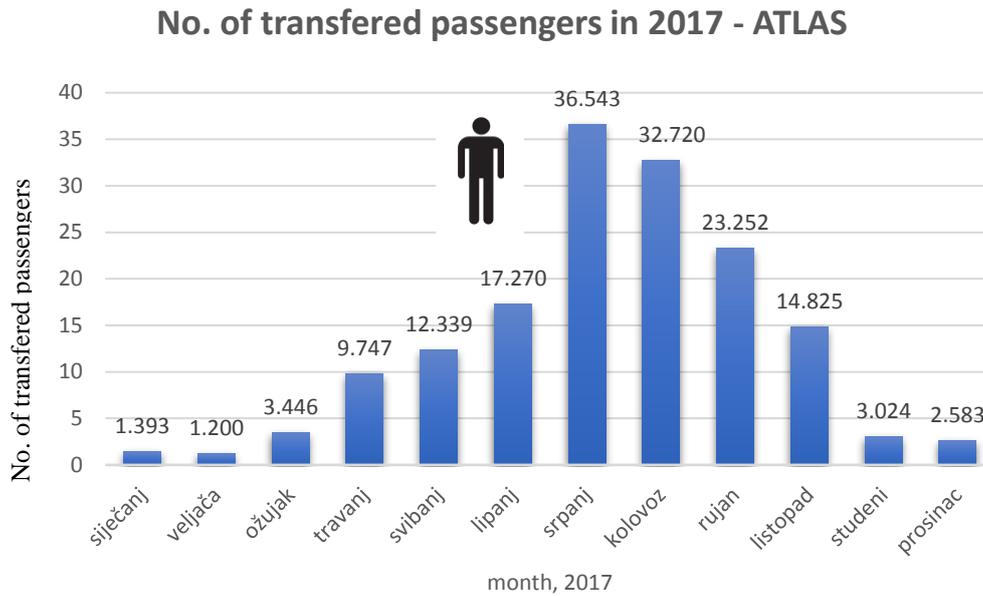


Figure 31: Graphical representation of ATLAS shuttle bus departure and arrival points in the City of Dubrovnik
 Source: www.atlas-croatia.com (January 2018)

Passengers should check the exact departure times two days prior to their trip using the ATLAS contact form, since there might be 15 minutes deviations in the bus departure schedules. Bus departure schedule is posted on the ATLAS sites on a weekly basis.

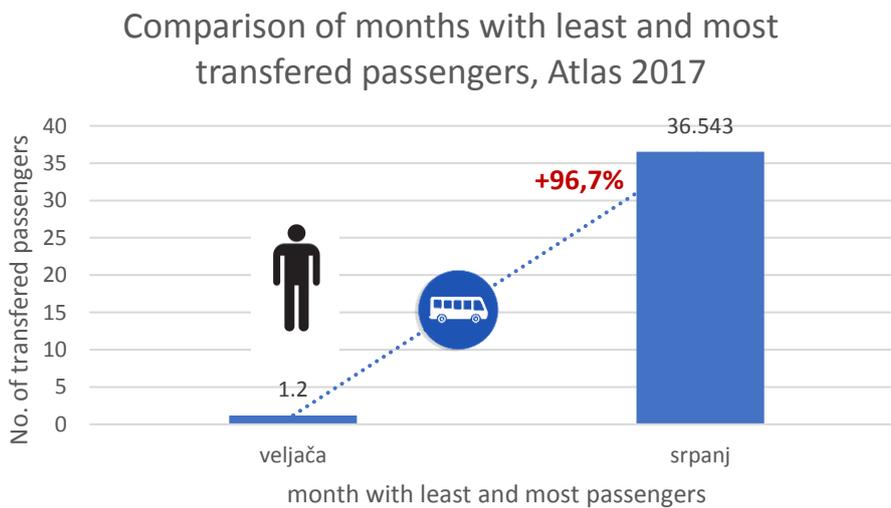
Graph 14: Number of transferred passengers in 2017 by ATLAS shuttle bus



Source: Prepared by author using data obtained from the ATLAS company

The Graph 14 shows the number of users of the Atlas shuttle bus services per month in 2017. Least passengers travelled in February (1 200 passengers) and January (1 393 passengers), while most passengers travelled at the peak of the tourist season, in July (36 543) and August (32 720). The problem of seasonality causes extra loads and capacities during peak months and insufficient number of passengers in the off-season period, as visible in Graph 15.

Graph 15: Seasonality problem – month with least and most transferred passengers



Source: Prepared by author using data obtained from the ATLAS company

Overall number of transferred passengers in the year 2017 by ATLAS shuttle busses amounts to **158 342 passengers**.

5.2. SHUTTLE BUS KORKYRA (seasonal shuttle bus transfer)

The Korkyra Travel Agency organizes passenger shuttle bus transfer since 2006., from and to the Dubrovnik Airport, with the following destinations and ticket prices (one-way trip):

- **Orašac** (stop: *hotel Radisson Blue*) - 90 HRK / 12,00 €
- **Slano** (stop: *hotel Admiral*) - 125 HRK / 17,00 €
- **Ston** (stop: *Main Bus Terminal*)- 165 HRK / 22,00 €
- **Prapratno** (stop: *ferry port*) - 165 HRK / 22,00 €
- **Trpanj** (stop: *hotel Faraon*) - 255 HRK / 34,00 €
- **Orebić** (stop: *Grand hotel Orebić, Studenac*) - 225 HRK / 30,00 €
- **Korčula** (stop: *Korkyra info travel agency*) - 240 HRK / 32,00 €
- **Lumbarda** (stop: *Main Bus Terminal*) - 255 HRK / 34,00 €
- **Brna** (stop: *hotel Amines Lume*) - 300 HRK / 40,00 €
- **Vela Luka** (stop: *hotel Korkyra*) - 300 HRK / 40,00 €

Table 20: Korkyra travel agency shuttle bus schedule Korčula – Dubrovnik Airport, end of season 2017

DAN	DATUM	RELACIJA	BROJ POLAZAKA
MONDAY	30 Oct, 2017	Korčula – Airport Dubrovnik 07:00, 09:00, 14:00	3
TUESDAY	31 Oct, 2017	Korčula - Airport Dubrovnik 05:00, 07:00, 09:00, 15:00	4
WEDNESDAY	01 Nov, 2017	Korčula - Airport Dubrovnik 06:00, 09:30, 11:30, 14:30	4
THURSDAY	02 Nov, 2017	Korčula - Airport Dubrovnik 05:30, 07:30, 09:30, 13:00	4
FRIDAY	03 Nov, 2017	Korčula - Airport Dubrovnik 06:00, 08:00, 10:00, 12:00	4
SATURDAY	04 Nov, 2017	Korčula - Airport Dubrovnik 05:00, 06:00, 07:30, 10:00, 14:00	5
SUNDAY	05 Nov, 2017	Korčula - Airport Dubrovnik 05:00, 06:00, 07:00, 08:00, 09:00, 13:00, 15:00	7

Source: Prepared by author

The shuttle busses connect Dubrovnik Airport and other 10 destinations, with eight departures each day. There are 4 departures on the average per week.

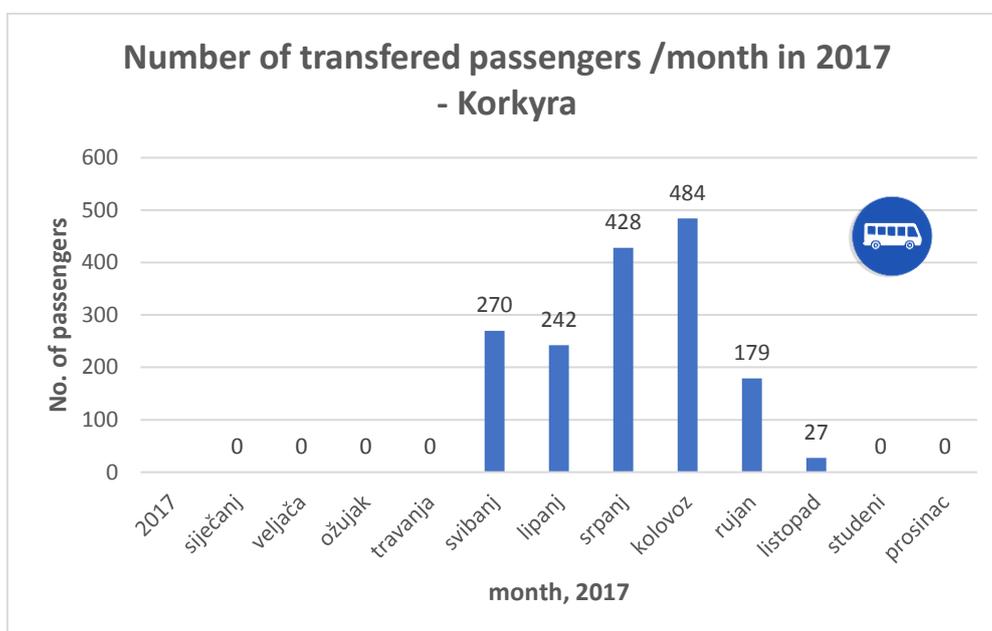


Figure 32: Korkyra shuttle bus

Source: korkyra.info (January, 2018)

Korkyra shuttle busses operate during the tourist season, they do not operate in the off-season period. According to data presented in Graph X most passengers are transferred in July (428 passengers) and August (484), at the peak of the tourist season.

Graph 16: Number of transferred passengers by shuttle bus per month in 2017 - Korkyra



Source: Prepared by author using data obtained from the Korkyra company

The following table shows the summer schedule of departures from the Dubrovnik Airport per arrivals of several flights (group). The time in parentheses in Table X are the expected time of departure of the shuttle bus. Expected shuttle bus departure depends on the arrival of flights and time required for luggage pick-up.

Table 21: Summer schedule of Korkyra shuttle bus departures, in accordance with regular arrivals of flights, 2017

DAY	Departure upon exit of passengers from regular flights that arrived by	BROJ POLAZAKA
MONDAY	11,40 h (12,10 h) / 14,50 h (15,15 h) / 19,20 h (19,50 h)	3
TUESDAY	10,00 h (10,30 h) / 12,45 h (13,15 h) / 14,40 h (15,10 h) / 20,00 h (20,30 h)	4

<i>WEDNESDAY</i>	10,40 h (11,10 h) / 14,50 h (15,15 h) / 16,35 h (17,00 h) / 19,45 h (20,15 h)	4
<i>THURSDAY</i>	10,30 h (11,00 h) / 12,35 h (13,15h) / 13,05 h (15,10 h) / 17,50 h (18,20 h)	4
<i>FRIDAY</i>	10,45 h (11,15 h) / 13,00 h (13,30 h) / 14,30 h (15,00 h) / 17,00 h (17,00 h)	4
<i>SATURDAY</i>	09,20 h (09,50 h) / 11,15 h (11,45 h) / 12,45 h (13,15 h) / 14,50 h (15,20 h) / 20,00 h (20,30 h)	5
<i>SUNDAY</i>	09,00 h (09,30 h) / 10,50 h (11,20 h) / 12,15 h (12,45 h) / 13,20 h (13,50) - (15.6.2017 – 15.9.2017) / 14,40 h (15,10 h) / 18,00 h (18,30 h) / 20,30 h (21,00 h) - (15.6.2017 – 15.9.2017)	7

Source: Prepared by author using data obtained from Korkyra info

5.3. PUBLIC BUS TRANSPORT – Libertas

The Dubrovnik Airport is connected with the City of Dubrovnik and the region by public bus transport.

There are four bus lines currently operating on the motorway and three of these connect the Dubrovnik Airport and the City of Dubrovnik:

- Bus line no. 11 Dubrovnik – Molunat (6 -7 with a total of 6 -7 departures per day in both directions)
- Bus line no. 27 Dubrovnik – Vitaljina (with a total of 8 departures per day in both directions)
- Bus line no. 38 Dubrovnik – Gruda (with a total of 2 departures per day in both directions)
- Bus line no. 31 Vitaljina – Cavtat (with a total of 3 departures per day in both directions).

These lines do not operate on Sundays and holidays. Price of a single, one-way ticket is 28 HRK / 3.78 €.

All lines are organized by the public enterprise JGP Libertas from Dubrovnik. As can be seen from the above given information, the public transport system has very few departures, where 3 bus lines drive to Dubrovnik and line no. 31 requires a stopover or transfer in case a passenger is travelling to Dubrovnik, since the bus line operates only within the Konavle municipality.

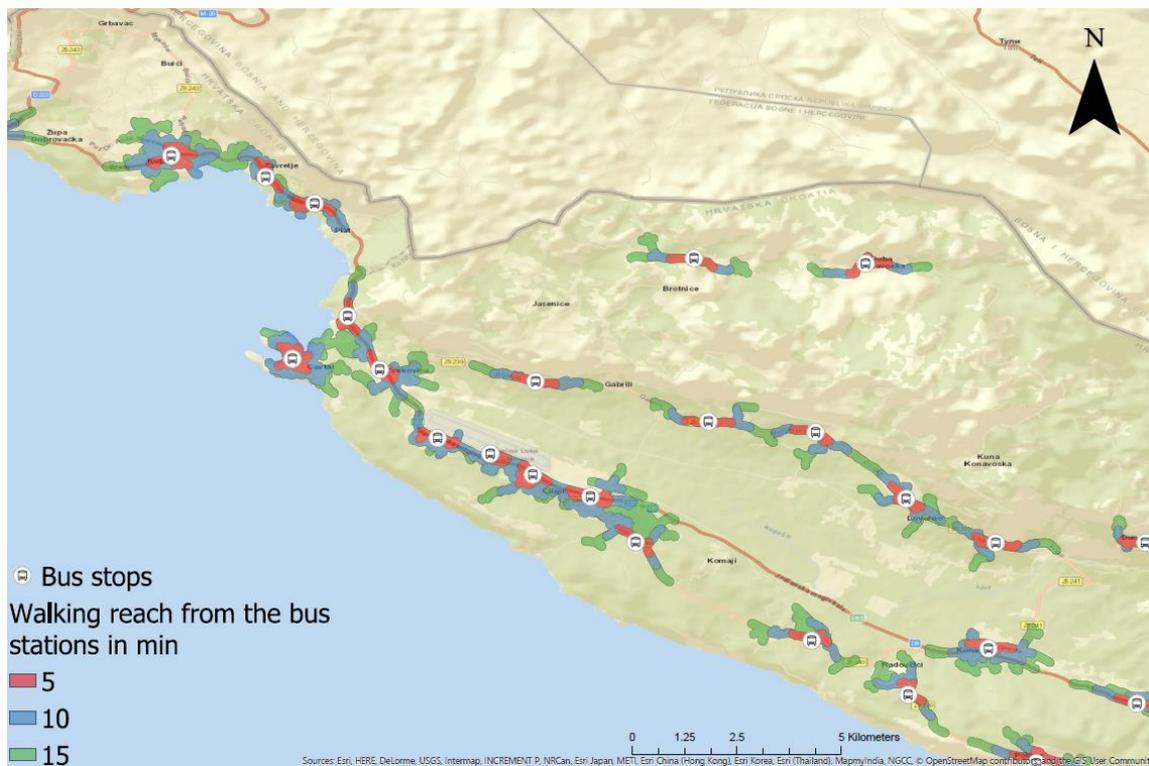


Figure 33: Walking reach from the bus stops around the Dubrovnik Airport

Source: Prepared by Author

The Figure shows a certain discontinuity regarding walking distances between reachable bus stations.



Figure 34: Schedule of departures of Libertas bus line no. 11

Source: Libertas



Figure 35: Schedule of departures of Libertas bus line no. 27

Source: Libertas

Public transport stops, i.e. bus stops are accessible throughout the territory of the functional region South Dalmatia, but they are not in line with European Directives on the minimum distance between stops and place of residence of each inhabitant of the Region.



Figure 36: Graphical presentation of the connectivity of Dubrovnik Airport by Public bus transport JGP Libertas

Source: Libertas d.o.o.

5.4. BUS TRANSPORT WITH AUTOTRANS (DB ARRIVA) COMPANY

Autotrans company has direct bus transfer on the routes Dubrovnik- Dubrovnik Airport and Dubrovnik Airport-Dubrovnik during the summer season , offering:

- 9 departures / day in both directions
- free Wi-Fi in the bus
- 2 stops: Dubrovnik (Main Bus Terminal) and Cable Car Srđ at the town exit
- Price 40,00 HRK
- 5% discount for online ticketing
- online tickets need not be printed
- no charge for luggage

Except transfers from / to the Dubrovnik Airport, Autotrans also connects Dubrovnik with most towns and agglomerations on the Adriatic coast, such as Korčula, Vela Luka, Orebić, Makarska, Split, Šibenik, Zadar, Rijeka, Pula, Rovinj, with some towns in Germany, as well as Trieste, Sarajevo and Mostar.⁸



Figure 37: Autotrans bus

Source: www.autotrans.hr/hr-hr/zracna-luka-dubrovnik (January 2018)



Figure 38: Bus stop in front of the passenger terminal building

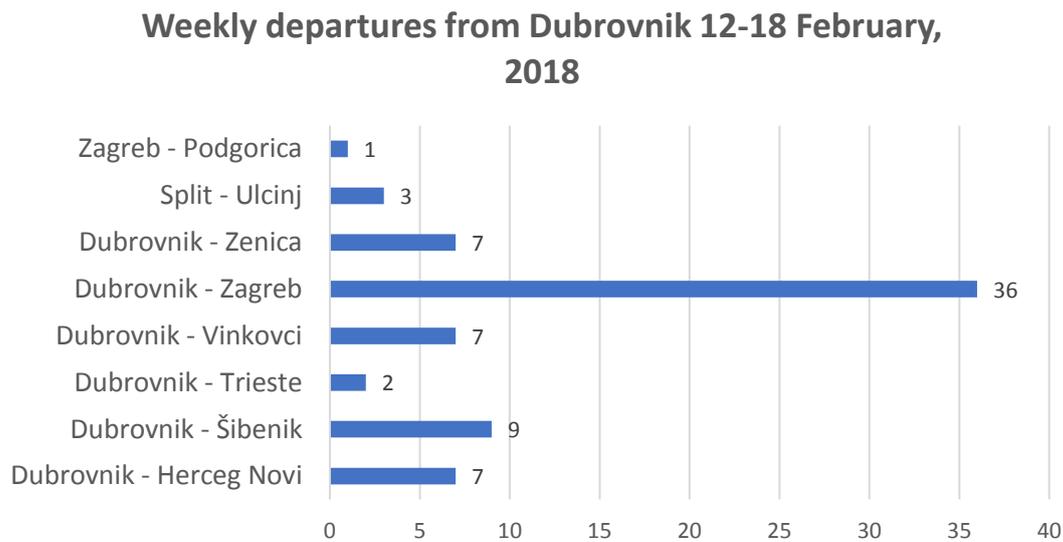
Source: Prepared by author

⁸ www.autotrans.hr/hr-hr/zracna-luka-dubrovnik, (January 2018)

5.5. CONNECTIVITY OF THE MAIN BUS TERMINAL DUBROVNIK

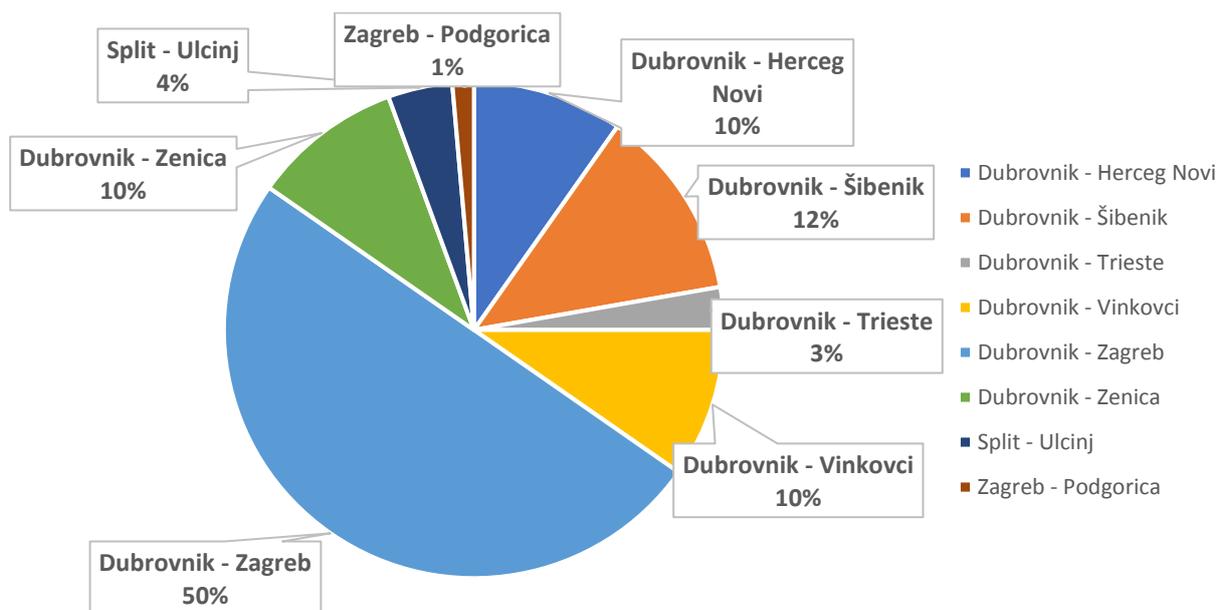
The Main Bus Terminal Gruž is important for Dubrovnik Airport since a large number of passengers arrive to the Main Bus Terminal Gruž by public transport and from there take another line to the Airport. The Dubrovnik Main Bus Terminal is connected with other Croatian regions and the rest of the DNC with bus transport carriers on routes given in the graph below. The bus line Dubrovnik-Zagreb is dominant, and connecting Croatian north and south. Connection with the south region (Montenegro) counts eight departures / week in the off-season period.

Graph 17: Number of bus departures according to destination from the Dubrovnik Main Bus Terminal



Source: Prepared by author using data from the Dubrovnik Main Bus Terminal

Graph 18: Connectivity between Dubrovnik Main Bus terminal with the rest of Croatia's territory and Montenegro, 12-18 February, 2018



Source: Prepared by author using data from the Dubrovnik Main Bus Terminal

5.6. MARITIME TRANSPORT

For the DNC, maritime transport is especially significant because, along with air transport, it has the greatest potential for further development. Well indented coastline and a large number of islands, with relatively low population, require specific measures for a systematic solution to an effective and cost-efficient transport connectivity. Ports of particular significance (international) for the Republic of Croatia are the passenger port Gruž and cargo port Ploče. Except the ferry port connection Dubrovnik – Bari which operates during the season, there are no other international sea links. Modern tourist trends and motorway construction to Ploče require ferry boat connectivity of the North Adriatic ports during the season through Dubrovnik all the way to Greece. Five passenger ports are of particular County significance. These are: Dubrovnik Town Port, Port of Korčula, Port of Trpanj, Vela Luka Port and Port of Orebić, as well as the cargo port Metković. Seventy six ports are of particular local significance. Most ports are not maintained on a regular basis.⁹

Table 22: List of sea lines in the DNC

Line no.	Route	Ship
101 - 107	Rijeka - Split - Starigrad - Korčula - Dubrovnik and vice versa	Ferry boat
9604	Lastovo - Vela Luka – (Hvar) - Split and vice versa	Fast boat line
604	Lastovo - Vela Luka – (Hvar) - Split and vice versa	Ferry boat
604a	Vela Luka - Lastovo and vice versa	Ferry boat
9608	Korčula – (Prigradica) - Hvar - Split and vice versa	Fast boat line
633	Ploče - Trpanj and vice versa	Ferry boat
634	Orebić - Dominče and vice versa	Ferry boat
807	Šipan - Lopud - Koločep - Dubrovnik and vice versa	Regular boat line
831	Dubrovnik - Suđurađ - (Sobra) and vice versa	Ferry boat
831a	Sobra - Prapratno and vice versa	Ferry boat
9807	Dubrovnik - Šipan Luka -Sobra - (Polače - Korčula - Lastovo) and vice versa	Fast boat line
614	Orebić - Korčula and vice versa	Regular boat line
641	Drvenik - Dominče	Ferry boat

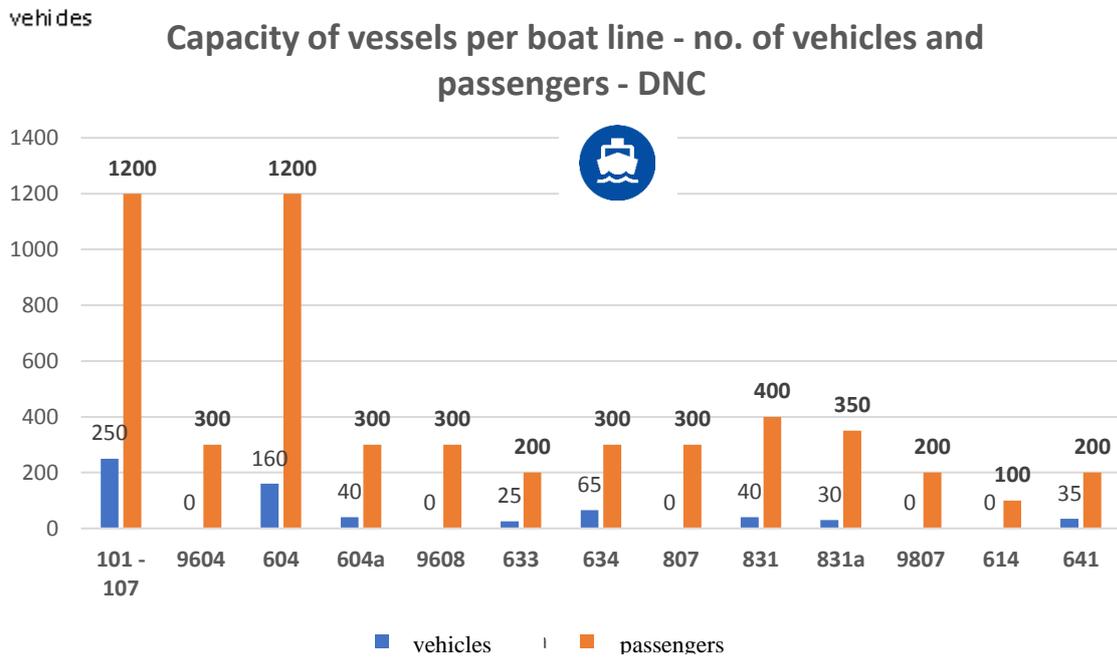
Source. Prepared by author

The lines no. 101 – 107 if extended, can be kept by the ship owner as international lines. On the line 9807 destinations given in parentheses will be established in accordance with the availability of funds from the State budget and the technical requirements.

The quantity of cars and passengers transported per line are given in the Table and graph below.

⁹ www.edubrovnik.org/wp-content/uploads/2017/01/Z%CC%8CRS-DNZ.pdf (January 2018)

Graph 19: Capacities of vessels per sea line in the DNC



Source: Prepared by author

Table 23: Capacities of sea lines, DNC

Boat line no.	Capacity/vehicles	Capacity/passengers
101 - 107	250	1200
9604	passengers only	300
604	160	1200
604a	40	300
9608	passengers only	300
633	25	200
634	65	300
807	passengers only	300
831	40	400
831a	30	350
9807	passengers only	200
614	passengers only	100
641	35	200
	645	5350

Source: Prepared by author

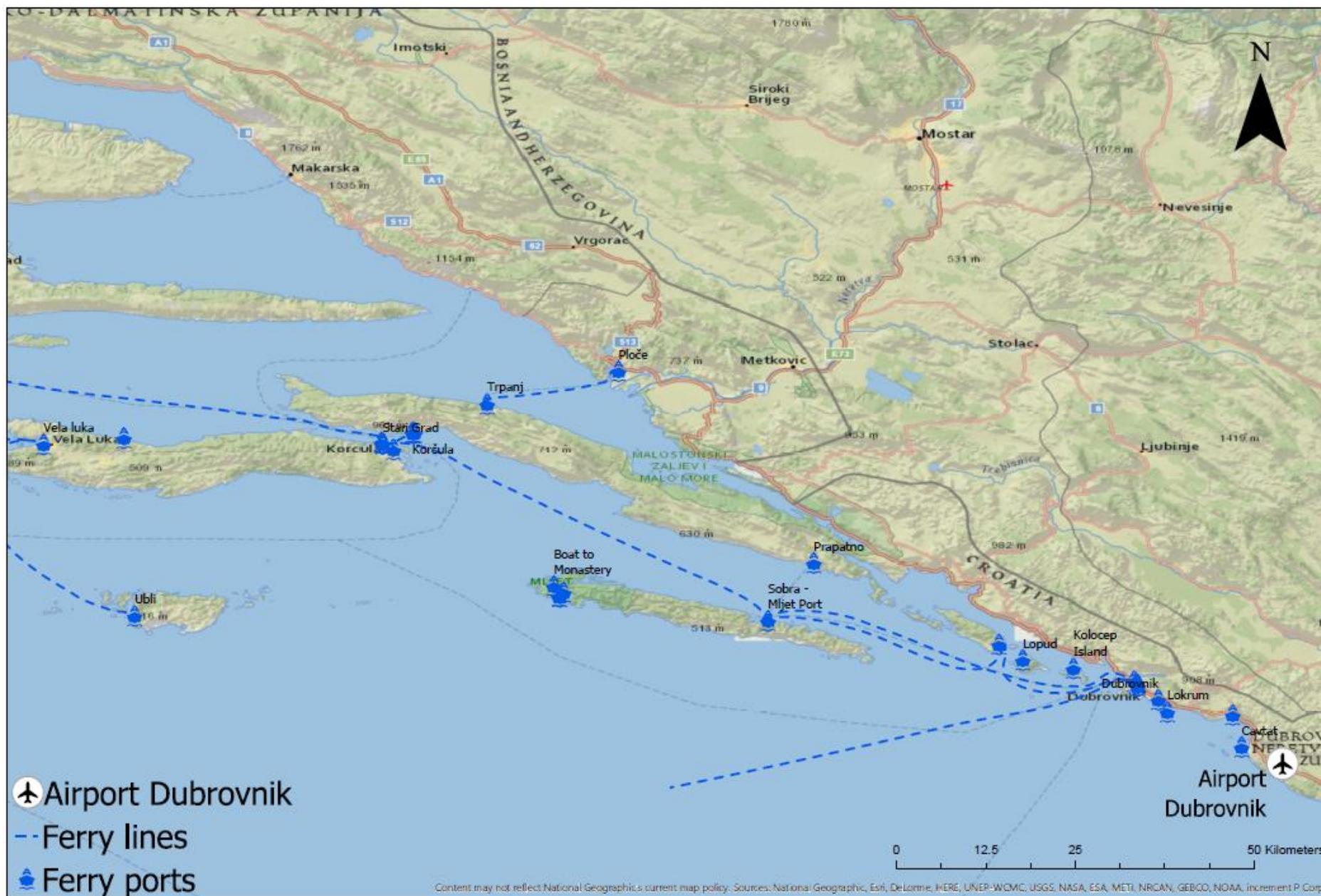


Figure 39: Map of sea lines in the Dubrovnik-Neretva County in relation to the Dubrovnik Airport
 Source: Author

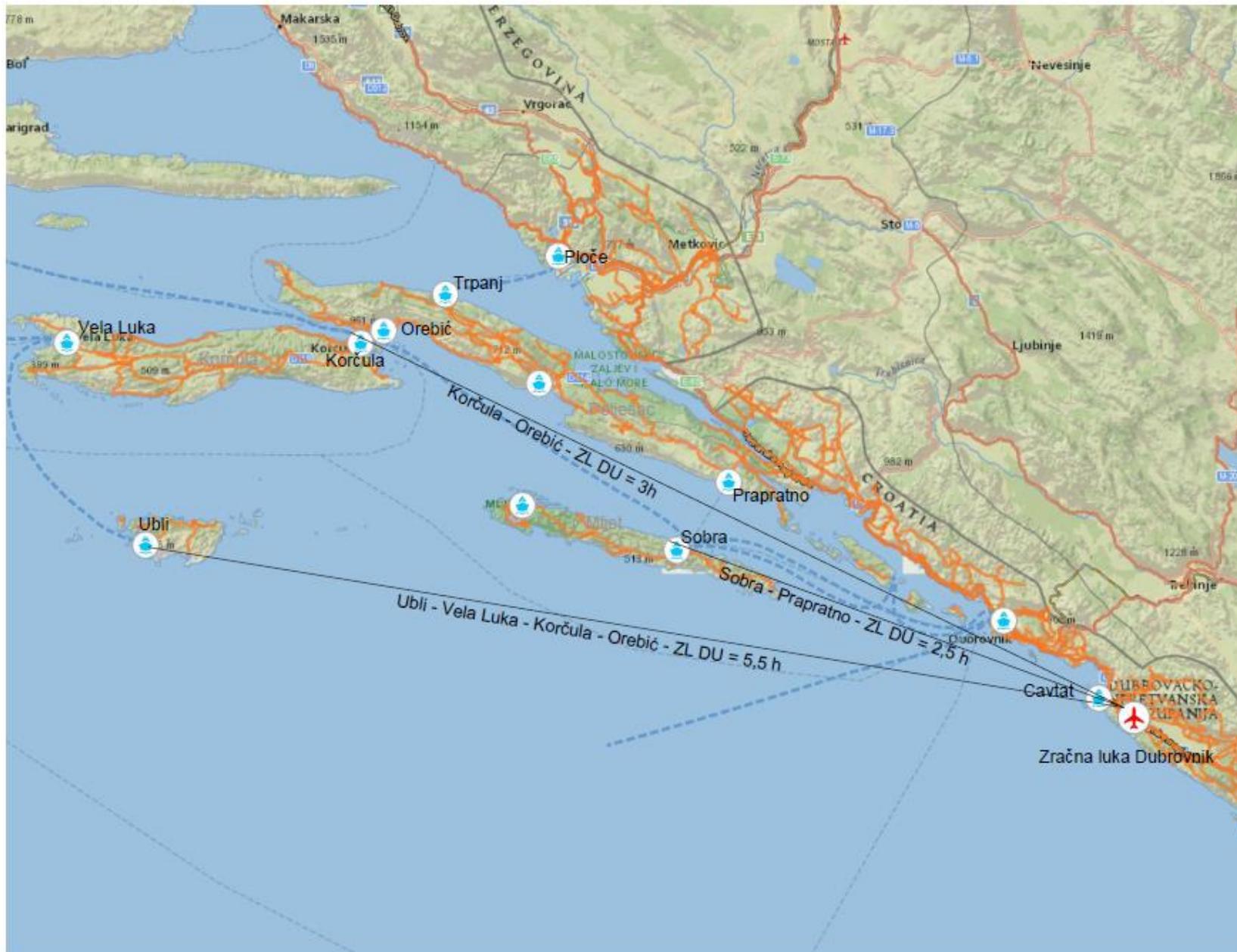


Figure 40: Map showing distances of the DNC ports in relation to the Dubrovnik Airport, expressed in hours
 Source: Prepared by author

6. INFORMATION SYSTEM FOR MOBILITY

There are no effective, valid and innovative passenger information systems in the Dubrovnik-Neretva County for trip planning or transport integration options. Investments into promotion of all transport modes must be undertaken and world-wide application development trends followed, namely trip planning applications and maps showing various benefits. Nearest to this type of system is the Dubrovnik Card, which offers discount prices for sightseeing of some cultural and historical monuments of Dubrovnik, and also offers other benefits, namely regarding use of public transport.

6.1. DUBROVNIK CARD

Dubrovnik Card is a unique card, offering discounts for sightseeing of tourist sites and provides free use of public town and suburban transport.

Dubrovnik Card can be purchased as:

- One day Card – 171 HRK
- Three days Card – 225 HRK
- Weekly Card – 315 HRK
- Daily Dubrovnik Card allows a 24h free use of public transport in the Dubrovnik town area.

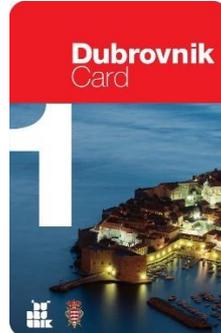


Figure 41: Dubrovnik Card

Source: www.dubrovnikcard.com (February 2018)

Three days card allows six public transport rides in the Dubrovnik town area. With the card the purchaser gets four coupons for four rides on the suburban line no. 10 to Cavtat (in the direction of Dubrovnik Airport). Weekly Card allows 10 rides by public transport in the Dubrovnik town area, with four coupons and four coupons for four rides on the suburban line no. 10 to Cavtat

Bus ticket prices in public transport, town and suburban, without purchasing the Dubrovnik Card:

- **Bus ticket for rides within 24h – 30,00 HRK**
- **Bus ticket for one town ride – 12,00 HRK**
- **Bus ticket for one suburban bus ride – 25 HRK**

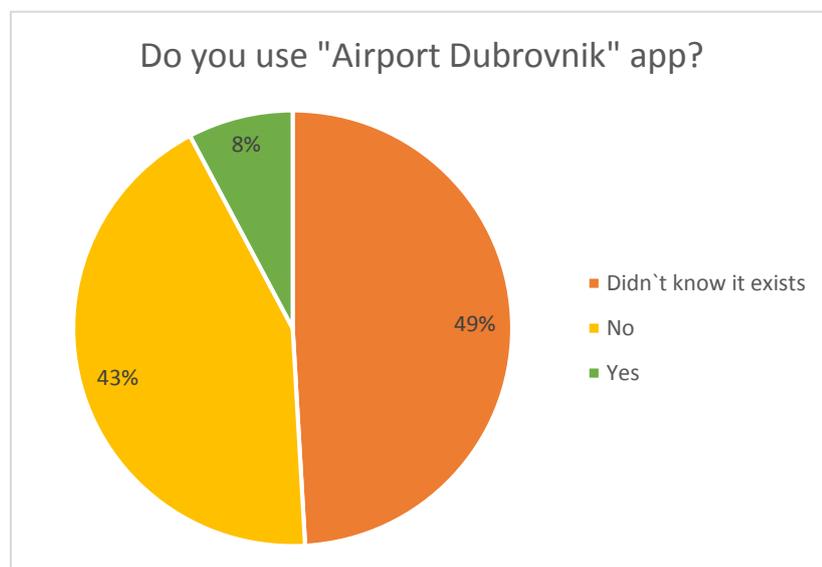
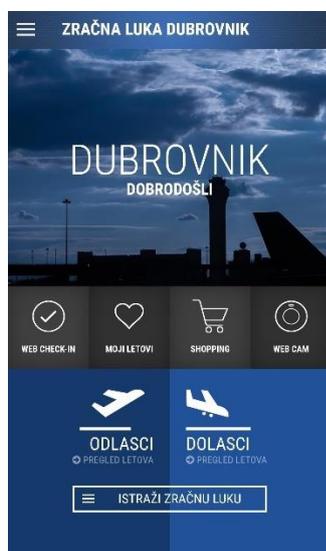
The Dubrovnik Card can be purchased online and picked up in one of the offices of the Dubrovnik Tourist Board or in the Office of the Konavle Municipality Tourist Board.

6.2. DUBROVNIK AIRPORT APPLICATION

The Dubrovnik Airport offers a free application for iOS and android smartphone devices. The application users can prepare for their trip using their mobile devices.

Application contains information on real-time timetable, along with all information for travel including parking, transport, content and services and online check-in.

Graph 20: Application „Airport Dubrovnik” users



Source: Poll results

In addition to the above, application users have the possibility to access airport web cameras, airport map, detailed weather forecast and Duty free offers.

The application will ensure better access for travelling information and easier understanding of airport plan.

Application can be downloaded from Play Store for Android mobile platform and from the App Store for iOS mobile platform..

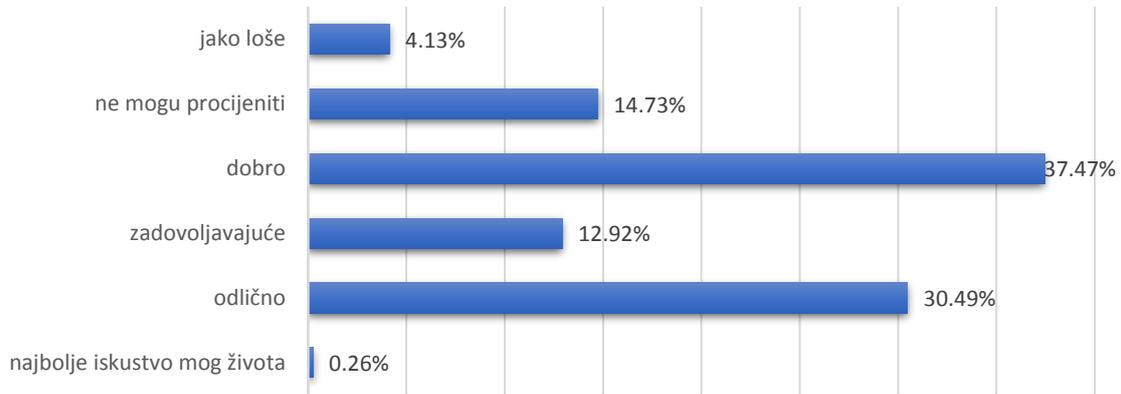
Better application promotion is needed, as can be seen in the Graph, where almost 50% of interviewed passengers has no knowledge of the application, while only 8% of passengers uses or has used the application.

Airport Dubrovnik application offers info on the flights and online check – in which is very convenient, but the awareness of the existence of the app is very low (49 %), and the people using it even lower (8%).

6.3. INFORMING PASSENGERS

Graph 21: Airport road signalization evaluation

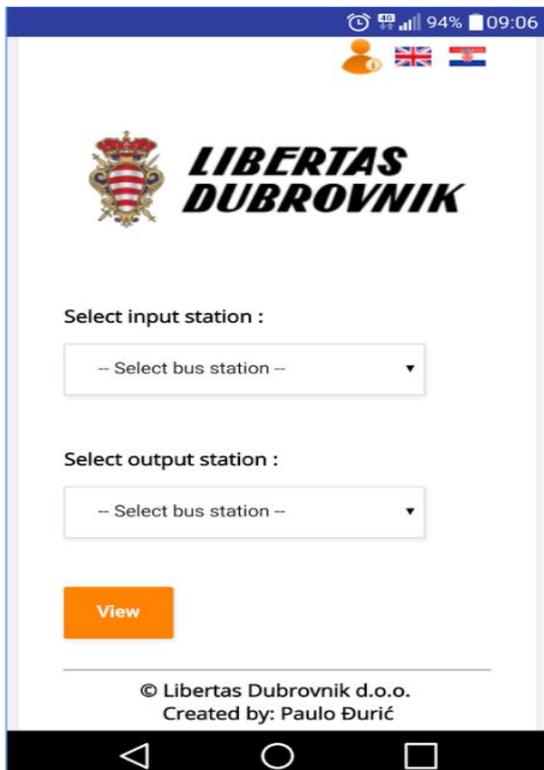
How would you rate airport road signalization



Source: Poll results

Road signals are good enough coming from Dubrovnik and the west. Coming from the east, road signs that signalize how far the airport Dubrovnik is are not satisfying. Many complaints about the road signs from the passengers that were coming from the eastern countries (Montenegro, Macedonia) and Bosnia and Hercegovina were noted.

6.4. TRIP PLANNING

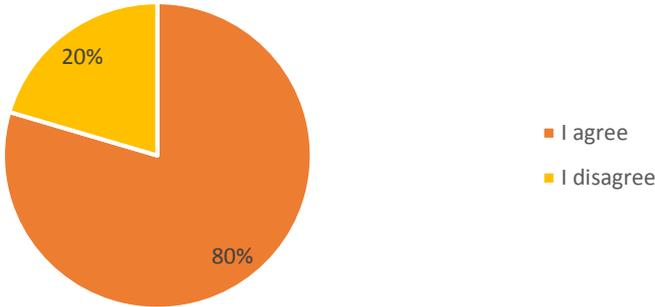


ed valid from 26.10.2015.

Concerning trip planning applications for smart phones there is Libertas' application which contains data of the buses timetables and the possible bus lines from the input station and the output station.
Most of the interviewed people (80%) said they would use the multimodal ticket if there was one.

Graph 22: Possible multimodal ticket

It would be useful if I could use one common ticket for boat and bus to reach/leave Airport Dubrovnik

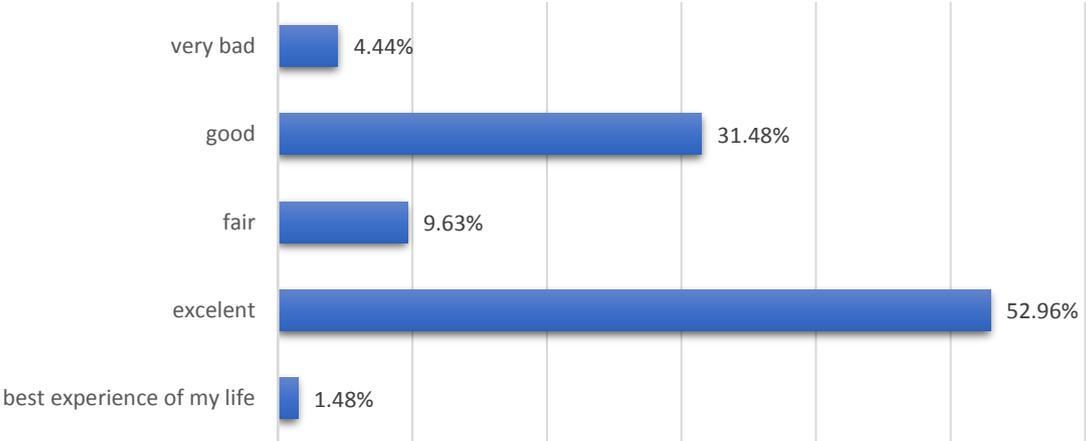


Source: Poll results

6.5. PASSENGER INFORMATION SYSTEM OF THE AIRPORT

Graph 23: Passenger information system of airport

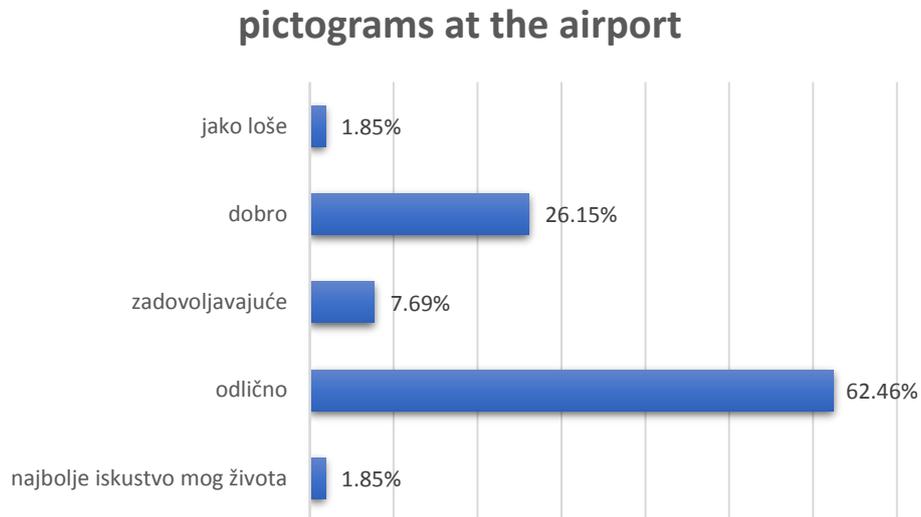
passenger information system of airport



Source: Poll results

Passengers were mostly satisfied with the information system of the airport, few said that the screens that show departures/arrivals aren't in the good positions and that they could hear the voice announcing the flights very rarely. Other comments were pretty decent.

Graph 24: pictograms at the airport



Source: Poll results

People were mostly satisfied with the pictograms of the airport, just that the over 65 people commented that the signs could be bigger. Some people were struggling to find the toilettes and some non Europeans didn't know what WC means. It could be changed to: toilettes.

7. INNOVATIONS IN MOBILITY

The Dubrovnik-Neretva County lacks innovative and sustainable transport solutions, already being applied in Western European Countries. Systems of passenger integration need to be developed, as well as EV mobility, *bike sharing and car sharing* systems. Projects already under development in 2018 have a certain potential.

7.1. CAR SHARING PROJECT AVANT2GO

The Rent-a-car group plans to lease 6 parking spaces to be used in accordance with their car sharing project Avant2Go, using 100 % electric vehicles.

Along with the already existing charging stations on the Dubrovnik Airport parking areas, additional three charging stations would be installed, rated output 2x22 kWh.



Figure 42: Avant2GO car-sharing project for the Dubrovnik Airport
Source: Avant2Go

With this project Avant2Go is introducing an innovative and technologically advanced, energy efficient system, which integrates the use of renewable energy sources and 100% electric drive vehicles, without adverse CO₂ emissions and noise generated pollution, all for a sustainable mobility system. The aim is to decrease the traffic load on the existing transport infrastructure, contribute to environmental protection and overall decrease of emissions, in accordance with EU Directives.

7.3. SMART CITY DUBROVNIK

Project “Smart City Dubrovnik” is a long term project of the City of Dubrovnik Development Agency (DURA) and the city of Dubrovnik, which started with the adoption of the “Smart City Dubrovnik Development Strategy” by the City Council. This Strategy defines the implementation of the “Smart City Dubrovnik” Project through numerous smaller scale projects, interconnected, but also functional as individual, separate units.

The aim is to implement several ICT projects based on the „Smart City Dubrovnik Development Strategy“, and ultimately boost a positive impact on the standard of living of its inhabitants. All projects must be planned implemented with mutual coordination, specially emphasising the Open Data concept, according to which all environmental data collected and gathered are accessible to citizens for their use. This form of action and synergy creates a crucial precondition for the establishment of an IOC (Intelligent Operations Centre) – a centre where all data from different sensor networks (air temperature, ail and soil humidity, vehicle and pedestrian traffic surveillance, free parking spaces, noise level detection, energy consumption, water consumption etc), is gathered, analysed and presented. The transport sector can greatly benefit from this Smart City Dubrovnik platform.

SMART CITY DUBROVNIK 2020

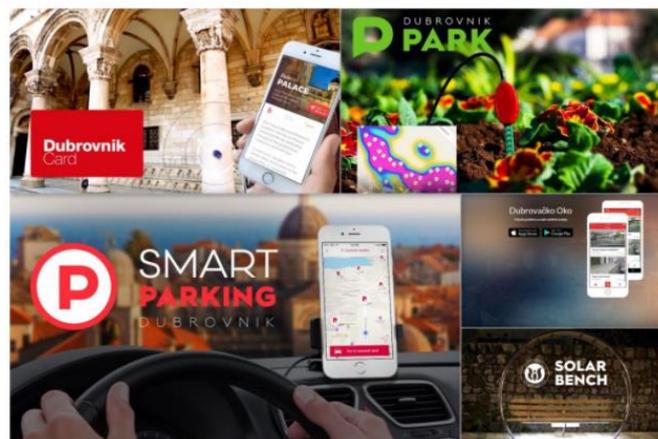


Figure 45: Smart City Dubrovnik project
Source: City of Dubrovnik

8. MULTIMODAL STRUCTURE AND ZONES OF AIRPORT DUBROVNIK

In this chapter zones of airport and modes of transport are graphically described.



Figure 1: Spatial distribution of multimodal transport

Source: author

In year 2012 in Dubrovačko-neretvanska County total of 58 960 vehicles is registered:

- mopeds and motorcycles – 8 383;
- personal cars - 44 889;
- buses – 321;
- cargo vehicles 4 824;
- other vehicles – 543.

In total number at DNC biggest amount is taken by private vehicles (76,13%) followed by mopeds (14,22%).



Figure 47: Spatial distribution of mode: intermodal

Source: Author

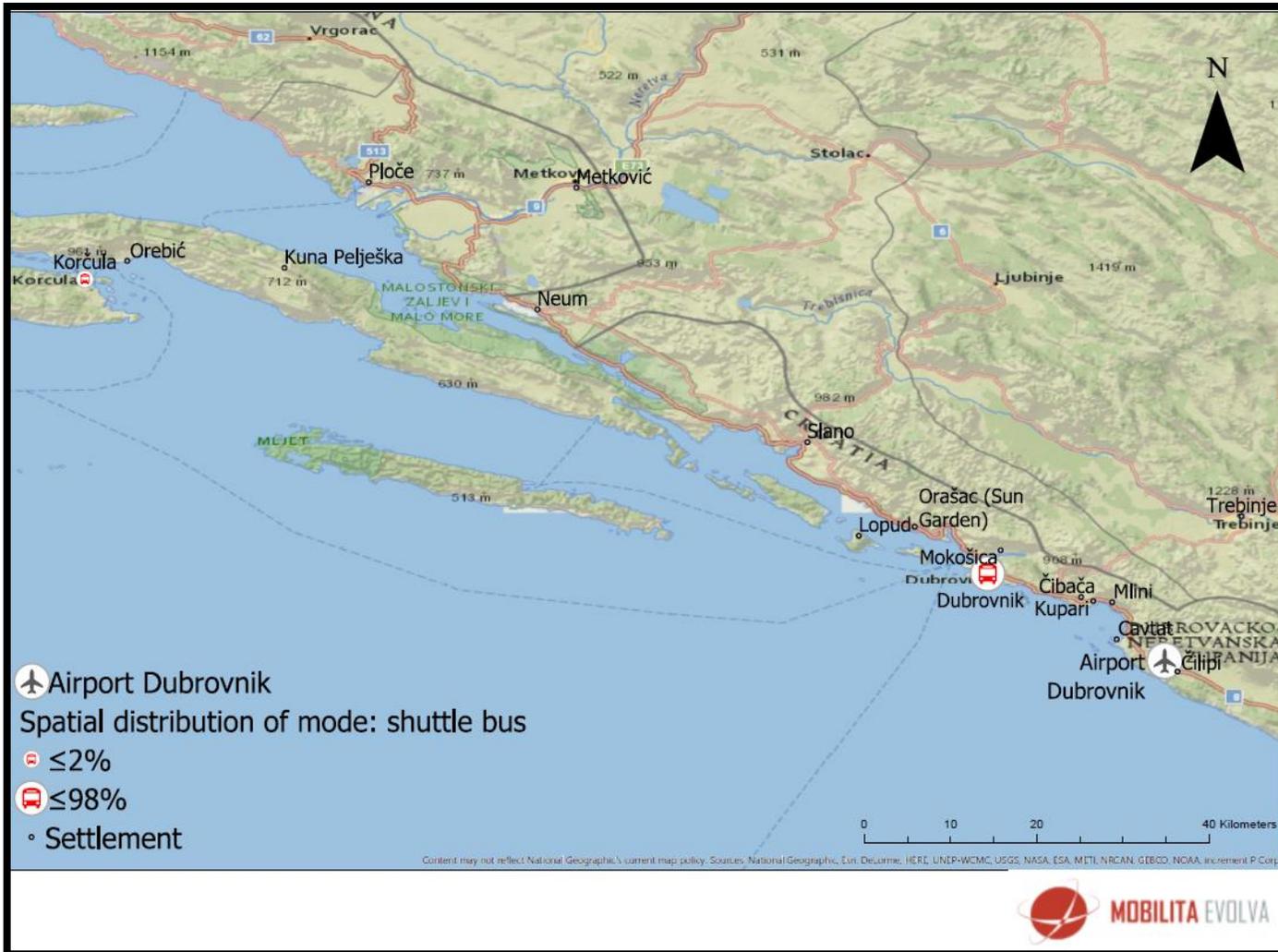


Figure 48: Spatial distribution of mode: shuttle bus

Source: Author

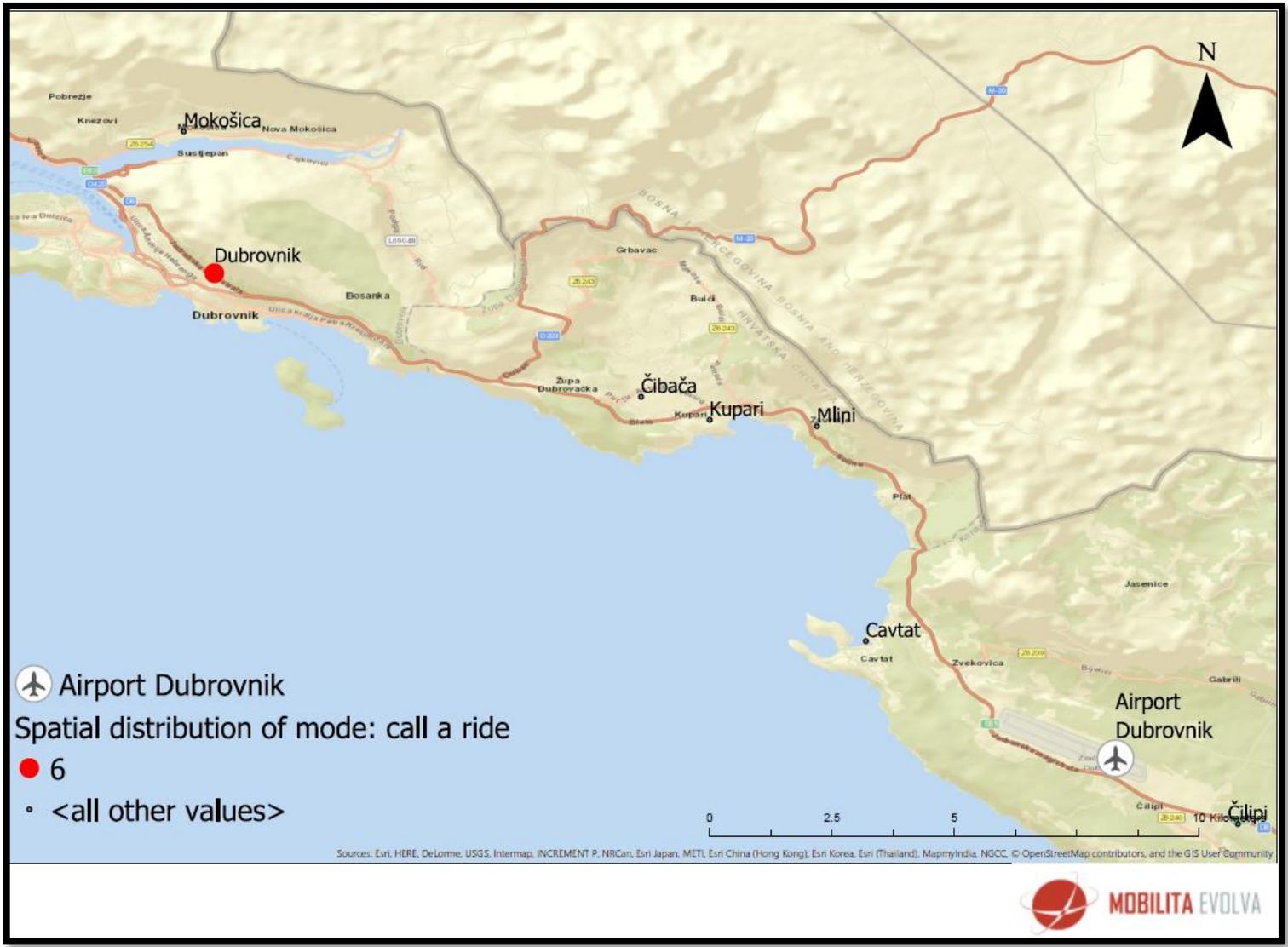


Figure 49: Spatial distribution of mode: call a ride

Source: Author



Figure 50: Spatial distribution of mode: Liberta bus line

Source: Author



Figure 51: Spatial distribution of mode: Uber

Source: Author



Figure 52: Spatial distribution of mode: car as passenger

Source: Author



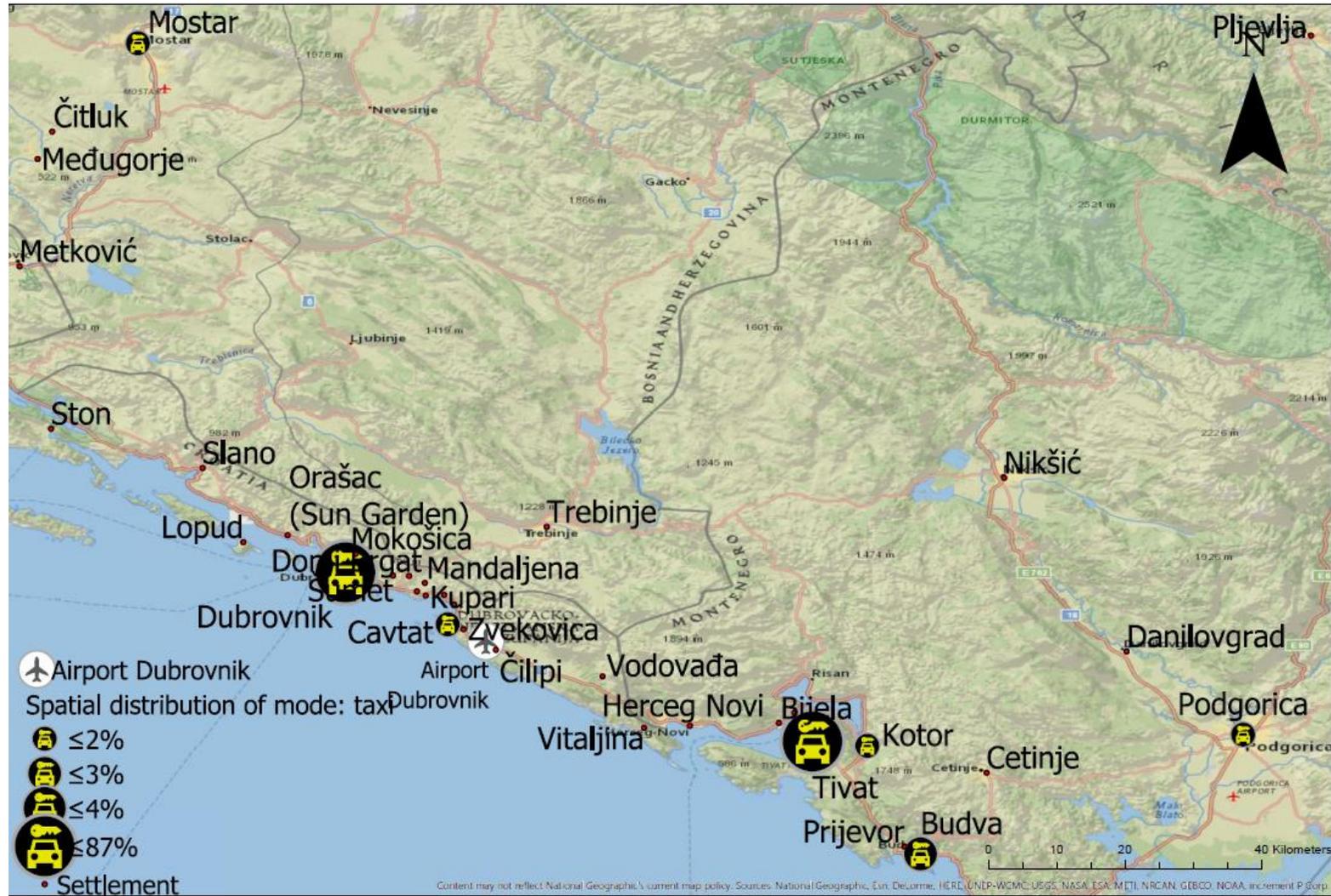
Figure 53: Spatial distribution of mode: car as a driver

Source: Author



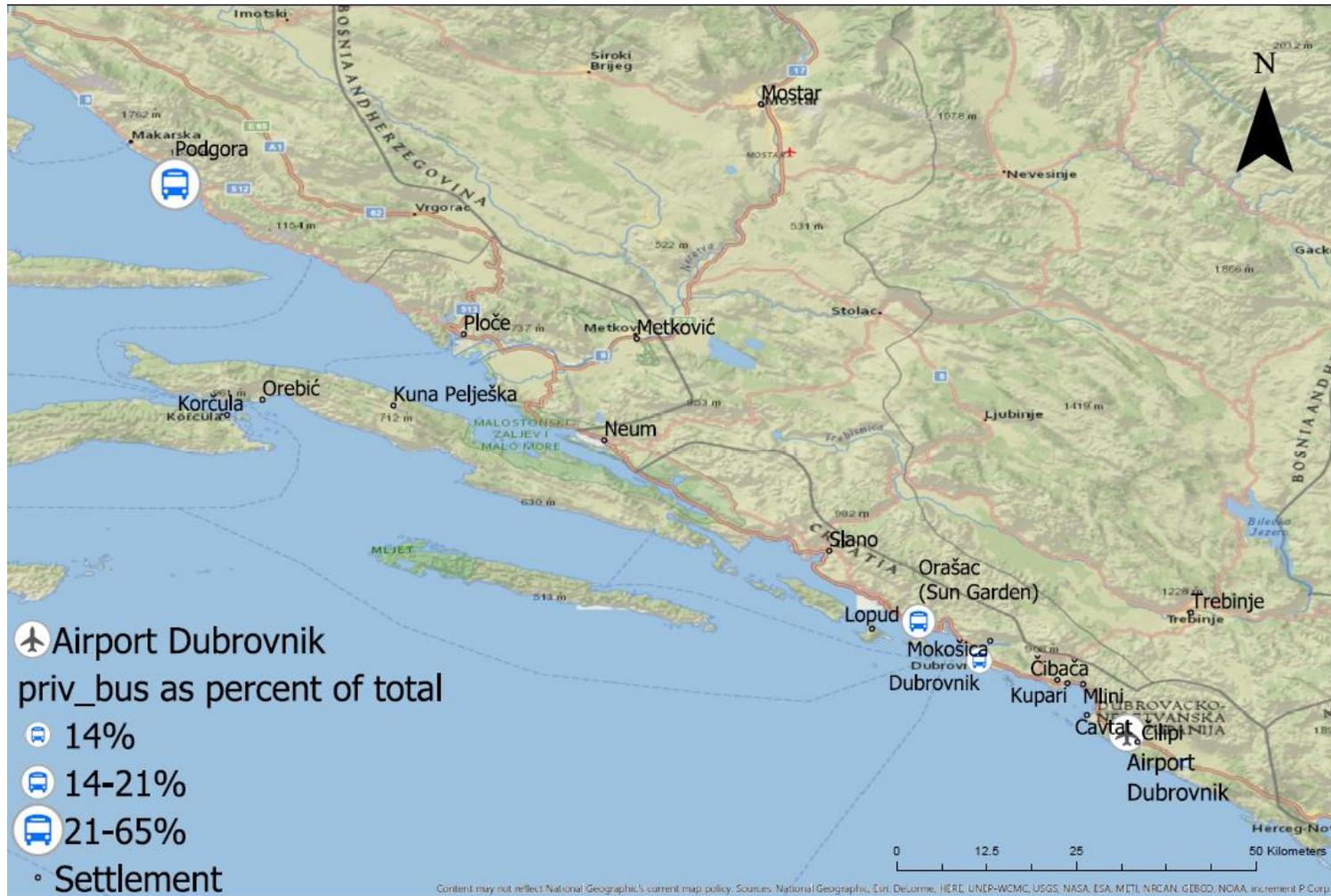
Figure 54: Spatial distribution of mode: intercity coach

Source: Author



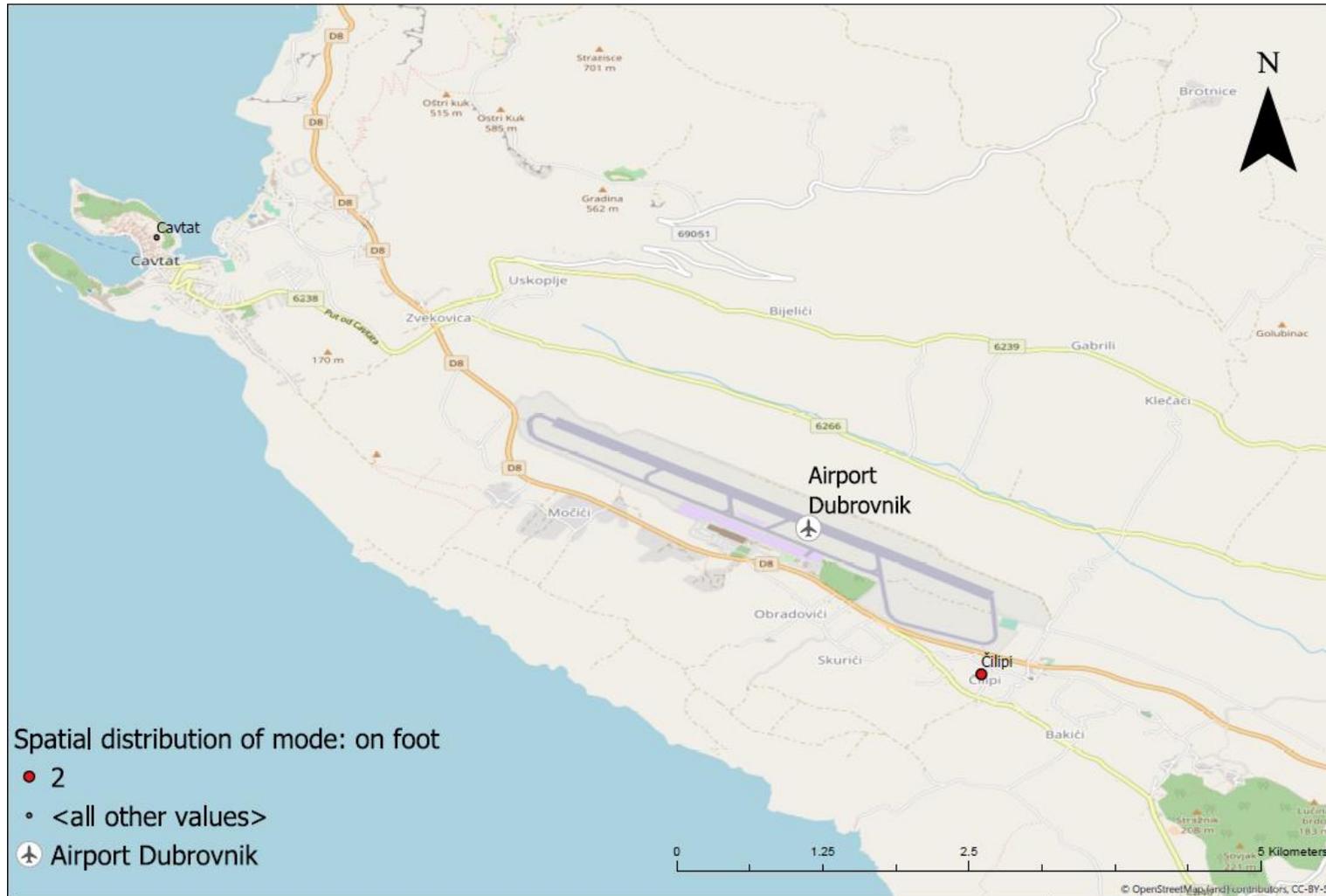
Picture 56: Spatial distribution of mode: taxi

Source: Author



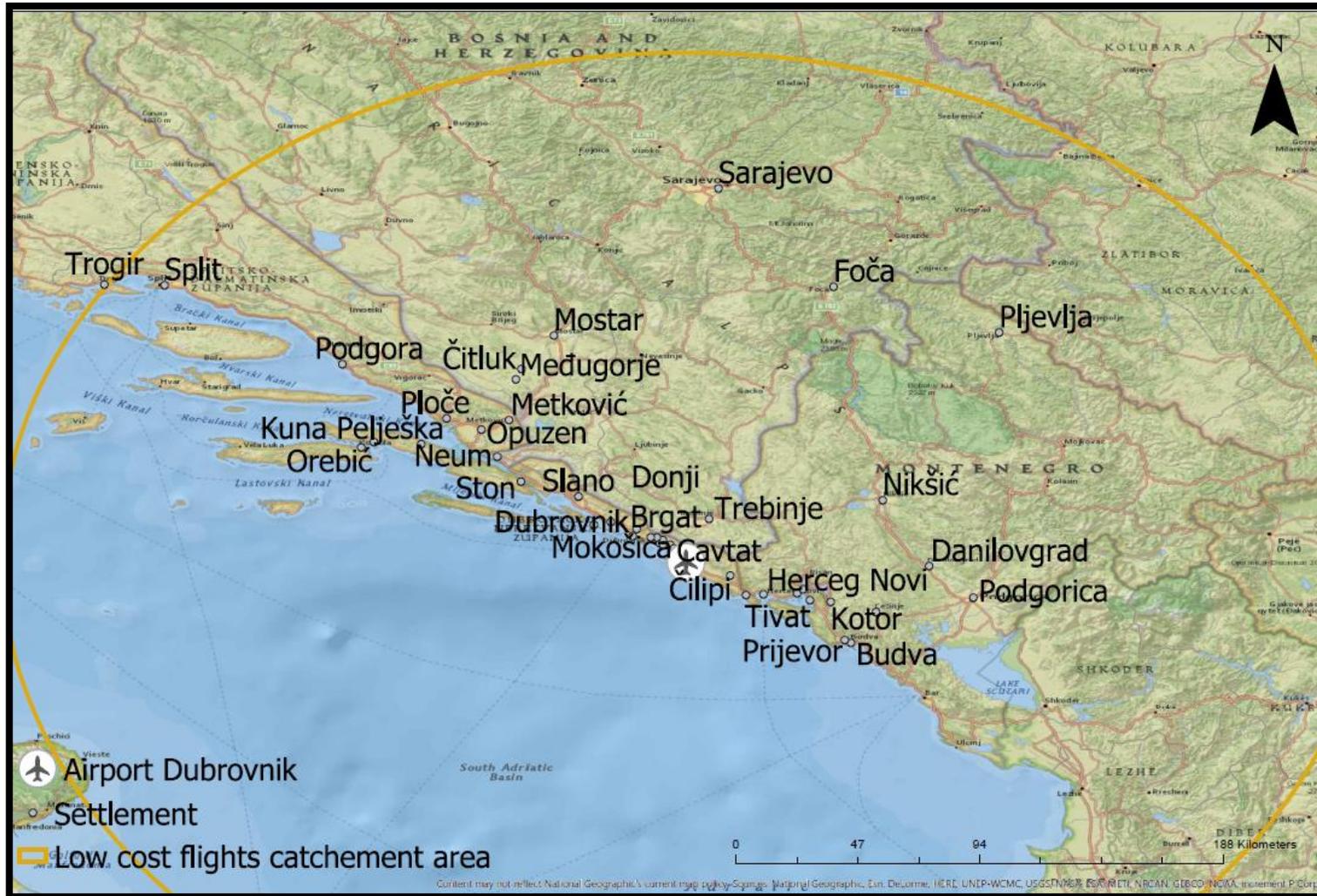
Picture 57: Private bus as percent of total

Source: Author



Picture 58: Spatial distribution of mode: on foot

Source: Author



Picture 59: Low cost flights catchment area

Source: Autho

9. CONCLUSION

The Dubrovnik – Neretva County is isolated from the rest of the region with regards to transport. State road D8 links the Dubrovnik Airport, but with insufficient traffic capacity to enable efficient accessibility. Along with level of road accessibility, there is also a lack of railway links with the rest of the region.

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.

Current connections between Dubrovnik and Dubrovačko-Neretvanska County take place via bus lines, shuttle bus, regional bus, taxi service and rent-a-car. From the analysis it is evident that the most dominant form of transport is one that takes place by bus.

There is no integrated passenger transport in the Dubrovnik-Neretva County, but through conducting surveys, 80% of respondents stated that they would motivate them when one ticket could use more modes of transport.

There is a lack of innovative and sustainable transportation solutions in the area of Dubrovnik-Neretva County, which are present in Western European countries. For this reason, it is necessary to implement new innovation solutions such as applications and mobile services such as car-sharing and bike-sharing. Also, it is necessary to encourage electric mobility through the strategic implementation of pilot projects and to include all those involved in the transport system that have a political impact on the spread of ideas of sustainable mobility.

Potential projects may include the rent-a-car Avantcar group that plans to lease parking lots to comply with the carsharing project, Avant2Go has implemented 100% electric-powered vehicles. With this project, Avant2Go is an innovative and technologically advanced energy-efficient system that combines the use of renewable energy sources without harmful CO2 emissions, all in order to achieve sustainable mobility.

The integration of passenger transport and the introduction of innovative solutions to mobility would significantly affect the reduction of the number of car users in the overall modal ratio, and would thus increase the benefit to sustainable modes of transport such as public transport or car-sharing.

By developing an Integrated Transport Study of Passengers in the Dubrovnik-Neretva County area, the current intermodality would be analyzed in detail to determine the optimal possibilities for integrating public transport of passengers.

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