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## POSSIBILITIES OF INTERMODAL PASSENGER TRANSPORT BETWEEN SPLIT AIRPORT AND ISLANDS

### ABSTRACT

*A substantial number of passengers landing at Split Airport during the tourist season continue their journey to the destinations on the central Dalmatian islands. Today the transfer is done mainly through the ferry port in Split. The insufficient capacities of roads from the airport to the city centre which accommodates the ferry port and waiting for the embarkation on the ferries and the transport itself to the islands and the final destinations take much longer than the air transport itself to Split. The paper studies the possible improvements of the existing condition as well as the construction completion and opening to traffic of the passenger sea port next to Split Airport which would provide a much better solution of passenger transfer to the islands.*

### KEY WORDS

*airport, catchment zone, intermodal transport, mainland-island connections*

### 1. INTRODUCTION

During the tourist season a large number of tourists arrive to the central Dalmatian islands by air through Split Airport. The only airfield on the island of Brač can accommodate due to its size the aircraft up to 50 (70) seats, adjusted for flying on short and mid-ranges, which partially satisfied the needs of the island of Brač. The transfer of passengers from the airport to the ferry port in Split is by road vehicles, with obligatory waiting for the embarkation on the ferry which operates in accordance with the schedule and not according to the time of passengers' arrivals. After the ferry arrives to

the island, the final destination has to be reached by road. The total transfer time amounts to several hours, and the journey is very inconvenient and tiring.

There are two ways of improving the transfer from the airport to a certain destination on one of the central-Dalmatian islands:

- by integrating the services in the road and sea transport chain: road vehicle – ferry – road vehicle [1];
- by organizing intermodal transport using sea port in the very vicinity of the airport, with the schedule of fast boats being adjusted to the aircraft schedule: “gate-to-gate” transport [2].

Since maximum quality of service is conditioned by maximum harmonization and coordination of all the traffic subsystems confirmed by positive experiences of airports in Zurich and Kuala Lumpur where air and rail transport have been integrated, this paper analyses the implementation of “gate-to-gate” transport with the aim of integrating air, road and sea transport, and improving the transport system in general, as well as the total quality of services provided by Split Airport.

### 2. INFRASTRUCTURE FOR CONNECTING SPLIT AIRPORT AND CENTRAL DALMATIAN ISLANDS

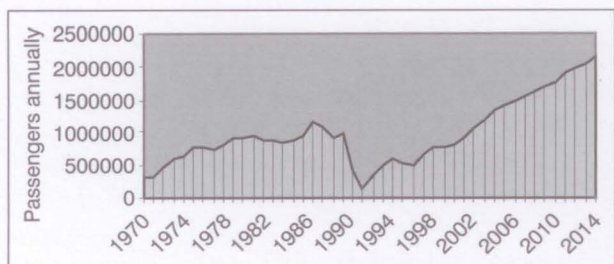
#### 2.1 Split Airport

The services of Split Airport during 2005 were used by more than 560,000 international passengers and out of this number about 30-40% completed their



journey on one of the Central Dalmatian islands, which means approximately 180-230,000 passengers.

Graph 1 and Table 1 present the realized and planned traffic of passengers until 2015.



Graph 1 - Realized and planned annual traffic of passengers at Split Airport in the period from 1970 to 2015 [3,4]

Table 1 - Realized and planned passenger traffic at Split Airport for the selected years [3, 4]

Year	Passenger Traffic		
	Non-Tourists	Tourists	Total
1998	273,829	198,450	581,737
2004	292,411	541,248	833,659
2009	452,668	999,508	1,524,785
2015	636,950	1,406,408	2,043,357

In order to accept such a number of passengers, the passenger terminal at Split Airport was reconstructed and expanded in 2003, and the handling of buses and road vehicles has been reorganized.

Although the capacities of single facilities and airport surfaces have been increased recently, and the technology of work in the handling processes improved, great increase in traffic, especially in peak loads indicates the need for further increase in the overall capacities of the airport.

## 2.2 Passenger sea terminal next to Split Airport

In order to improve passenger transfer to the Central Dalmatian islands, a sea passenger terminal was partly constructed in 2000 next to Split Airport [5]. This is the precondition for the development of intermodal transport that would start at the airport.

This future passenger sea terminal has been planned for the following comparative advantages:

- favourable meteorological conditions (protected from the wind),
- existence of good navigable route and the possibility of simple vessel manoeuvring,
- closeness of the already constructed road traffic infrastructure on land,

- possibilities of seamless technological process of passenger and luggage embarkation and disembarkation, as well as customs clearance and their protection control,
- close vicinity of the airport,
- no buildings on the surrounding grounds, and
- possibilities of constructing the facilities on the sea-shore, without any additional interventions on the surrounding privately owned land.

The usage of this terminal is minimal, only sometimes in cases of large delays of transfer from the islands, as it happened in the summers of 2000 and 2001. Greater utilization is restricted by the lack of adequate auxiliary facilities, as well as insufficient promotion and entrepreneurial initiative directed to the realization of intermodal transport.

Since passenger sea terminal is out of function, in the meantime it is necessary to organize a better connection of Split Airport and the passenger port in Split, based on the experiences and evaluations of the users (passengers, travel agencies, etc.).

## 2.3 Passenger port at Split

The passenger ferry port in Split (Figure 1) which regarding passenger traffic volume with over 3 million passengers in 2004 occupies the third place on the

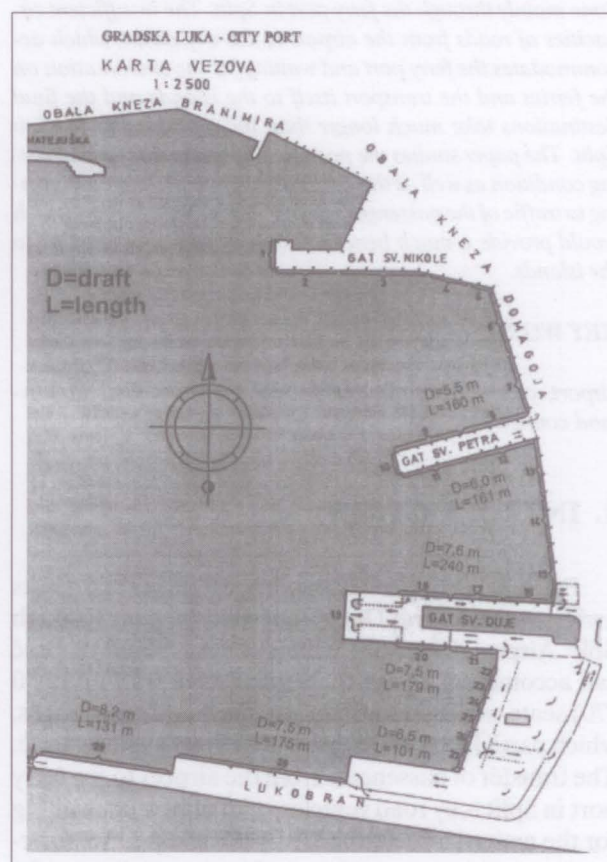


Figure 1 - Passenger port in Split



Mediterranean is used for berthing of ferries and ships, including also large cruisers in international transport. The passenger port is located in the very city centre. The railway and bus station for intercity and international lines are located in the close vicinity of the port. With the lack of parking spaces, the access to the passenger port is made extremely difficult, and the total space capacity which accommodates a number of concentrated facilities of the three traffic systems is also restricted.

With about 28 berths in the port, out of which 10 are intended for passenger cruisers and with the berth length: from 63–173m, that can accommodate ships in the length of up to 250m, the Port of Split features all the necessary potentials for the accommodation of ships, and the expansion of the services in coordination with Split Airport would certainly increase the potential and the quality of services.

#### 2.4 Road connections of Split Airport and passenger port

There are two roads leading from Split Airport to the passenger port in Split: the Adriatic Highway and the so-called old Kaštela Road. Both are under-capacitated regarding the very intensive local traffic. It is increasing, both because of the greater number of vehicles per inhabitant and because of the extremely high population growth in Kaštela and Solin over the recent ten years. A large number of people commute to Split. The under-capacity of these two roads is especially marked during the summer months when the intensity of traffic is doubled because of the tourists, and the average vehicle speed is reduced to 30–40km/h because of the great number



Figure 2 - Road connections of airport and passenger port in Split

of facilities and secondary ways constructed without permits along both roads.

The expansion of the Adriatic Highway on Trogir-Split relation with two new lanes should improve the current situation.

### 3. PASSENGERS FROM SPLIT AIRPORT TO CENTRAL DALMATIAN ISLANDS

#### 3.1 Time necessary for transfer from Split Airport to islands

Since the sea terminal next to the airport is currently not in use, and because of the fact that the transport to the islands includes travelling by road to the Split ferry port, the average transfer time of individual passengers from the moment they exit the passenger terminal building to the embarkation onto the ferry to the islands during the summer months takes a minimum of two hours and it is the sum of the following parameters and activities:

- waiting and boarding the bus or passenger car/taxi take up to 30min.,
- travelling by bus or passenger car to the Bus Terminal in Split (about 25km distance) takes from 40min. to 80min.,
- walking from the terminal to the ferry port: about 1km, because there is no bus connection, takes 10-15min.,
- for the purchase of the ticket in the ferry port or on the coast, it takes about 10-15min.,
- waiting for the ferry depends on the time of arrival to the ferry port in relation to the time of departure for the islands,
- embarkation on the ferry takes about 10-15 minutes, depending on the berth at which the vessel is located,
- transport to the islands (Brač and Šolta about 1 hour, Hvar and Vis 2-3 hours...).

Thus, the time spent on additional activities (apart from travelling to the ferry port) amounts to 30-75min, which is a lot and shows that there is possibility of optimizing the transfer service in general.

#### 3.2 Number of passengers towards islands

There is no precise statistics of the number of passengers, who, after having landed at the airport, continue their journey to the destinations on one of the Central Dalmatian islands. The orientation data which have been used for this analysis are the result of empirical estimate of the employees who have been employed for many years in the companies Dalmacijaturist and Atlas, and the workers at Split Airport.



According to these data, the most visited places on the Central Dalmatian islands during the tourist seasons, in the period before the Croatian War of Independence, had been Supetar and Bol on the island of Brač, and Hvar, Jelsa, Starigrad and Vrboska on the island of Hvar. Apart from these places, in the post-war period the frequent destinations are Vis and Komiza on the island of Vis, and somewhat less the islands of Šolta and Korčula.

According to the analyses from Split Airport (2001) the number of foreign passengers, during the summer schedule, who continue their journey after having landed at the airport, to the destinations on one of the Central Dalmatian islands, amounts to approximately 50% passengers on charter flights, and according to estimates the values are similar for individual passengers (40-50%).

Regarding time, the largest number of tourists (international passengers) is during the summer season (01 May-31 Oct.). This has been also confirmed by Tables and Diagrams 5 and 6, developed on the basis of statistical data about the number of passengers per months at Split Airport: for 2007.

**Table 2 - Number of international passengers per months at Split Airport in 2007**

Jan.	Feb.	March	April	May	June
23,493	21,503	29,842	62,606	108,890	171,284
July	Aug.	Sept.	Oct.	Nov.	Dec.
205,474	216,932	195,589	89,548	34,009	31,381

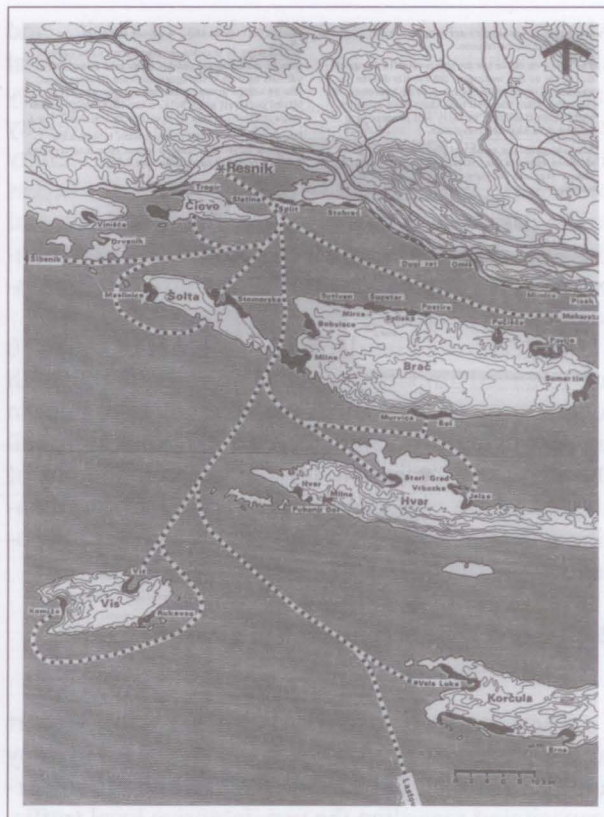
Out of a total of 1,190,551 passengers in 2007 (1,030,368 international and 160,180 domestic passengers), as many as 896,420 international passengers (87% out of the total number of foreign passengers) and 86,497 domestic passengers (54% out of the total number of domestic passengers) passed through Split Airport in the period from 01 May to 30 October.

According to statistical data, passenger traffic of as much as 50% has been realized on Saturdays over the recent years, and the number of passengers on Saturdays and Sundays amounts to more than 60% of weekly traffic.

The weekends during the summer season would be targeted days of the start of the application of "gate-to-gate" transport, from the airport to the destinations on the islands.

### 3.3 Comparison of time necessary for arrival of tourists to Split by car and by air

The largest number of tourists in Croatia, and thus also in the Split-Dalmatia County arrive from Germany, Austria, Slovenia, Italy, the Czech Republic and Slovakia.



**Figure 3 - Destinations of tourist passengers in transfer from Split Airport [3]**

The text further shows the journey time, using passenger car and aircraft. Only certain destinations with direct flights to Split have been taken into consideration. The average travel speed of 110km/h has been adopted as well as one hour stopping at every 500km of travel ( $550\text{km}/6\text{h} = \text{actually } 92\text{km/h}$ ). The trip length has been obtained from the Route Planner. The air traffic encompasses the duration of travel from house to the departure airport, passenger handling and air transport to Split.

#### *Example 1: Cologne, Germany – Split and back*

Passenger car:  $1,453 \text{ km} \times 2 = 2,906 \text{ km}$ ; travel time:  $2,906 / 92 = \underline{31.5 \text{ hours of travel}}$  (15.75 hours in each direction).

Air transport: travel time about 8 hours (4 hours in each direction).

#### *Example 2: Stuttgart, Germany – Split and back*

Passenger car:  $1,171 \text{ km} \times 2 = 2,342 \text{ km}$ ; travel time:  $2,342 / 92 = \underline{25.5 \text{ hours of travel}}$  (12.75 hours in each direction).

Air transport: travel time about 7 hours (3.5 hours in each direction).



**Example 3: Prague, Czech Republic – Split and back**

Passenger car:  $1,038 \text{ km} \times 2 = 2,076 \text{ km}$ ; travel time:  $2,076 / 92 = 22.6$  hours of travel (12.3 hours in each direction).

Air transport: travel time about 7 hours (3.5 hours in each direction).

**Example 4: Bratislava, Slovakia or Vienna, Austria – Split and back**

Passenger car:  $742 \text{ km} \times 2 = 1,484 \text{ km}$ ; travel time:  $1,484 / 92 = 16.2$  hours of travel (8.1 hours in each direction)

Air transport: travel time about 6.5 hours (3, 25 hours in each direction).

**Example 5: Milan, Italy – Split and back**

Passenger car:  $839 \text{ km} \times 2 = 1,678 \text{ km}$ , travel time:  $1,678 / 92 = 18.2$  hours of travel (9.1 hours in each direction)

Air transport: travel time about 7 hours (3.5 hours in each direction).

**Example 6: Graz, Austria – Split and back**

Passenger car:  $562 \text{ km} \times 2 = 1,124 \text{ km}$ , travel time:  $1,124 / 92 = 12.21$  hours of travel (6.1 hours in each direction)

Air transport: travel time about 6 hours (3 hours in each direction).

**Example 7: Ljubljana, Slovenia – Split and back**

Passenger car:  $448 \text{ km} \times 2 = 896 \text{ km}$ ; travel time:  $896 / 92 = 9.7$  hours of travel (4.85 hours in each direction)

Air transport: travel time about 6 hours (3 hours in each direction).

The examples show the advantage of using air transport provided by speed and comfort of travel with adequate price of service.

The saving in travel time can amount even up to 24 hours upon return journey, and the difference in costs of using air transport over road transport is of special significance on greater distances, using the charter of low-cost carrier services.

#### 4. PROPOSALS FOR IMPROVEMENT OF PASSENGER TRANSFER SERVICE FROM AIRPORT TO PASSENGER PORT SPLIT

The development of tourism and continuous growth in the number of passengers in air traffic of the Split-Dalmatia County indicate that in the near future even more than 50% of all passengers travelling by air to Split will continue their journey to the islands, and

that about 90% will travel during the summer schedule (May-October). The statistical data presented in this work indicate that there is a justified reason and need to maximally simplify the technological process of passenger and luggage transfer on the way from the airport to the island.

In this sense, and since:

- passengers who arrive by air lose much more time in the transfer airport – island, than in air travel to the airport, and that
  - all other islands except Brač are accessible only by boat,
- it is necessary with the aim of integrating the traffic subsystems to allow the following:
- booking and purchase of air and ship ticket via the Internet,
  - purchase of bus and ship tickets at Split Airport (e.g. at a special kiosk),
  - bus ride from the airport to the ferry port, and not as previously, only to the bus station in front of the ferry port,
  - more frequent departures (of smaller) buses from the airport on a cheaper shuttle transport, not only to Split, but also to Makarska and Šibenik,
  - in the near future, the claiming of the checked-in luggage at the ferry port instead of the airport terminal building, upon integration of the Republic of Croatia in EU, i.e.
  - luggage claim upon arrival to the destination on the island.

The proposed organization would insure shorter transfer time and provision of several services on one spot, which would be not only a saving of 30-45min for the passenger, but would also simplify the handling of checked-in luggage.

It is important to emphasise that the transfer of checked luggage from airport to ferry port necessarily means not only organization of the sorting area with conveyor belts for delivering luggage in the ferry port, but also a much more detailed designation of the luggage destination with marked destinations in the ferry port on the mainland and/or island, and/or on the bus station and/or at the hotel, etc.

In the future it is necessary to foresee the possibility of connecting the airport – port administration – shippers – tourist agencies – hotels into a single chain of an integral "gate-to-gate" service.

#### 5. CONCLUSION

The existing transfer, especially of the individual passengers from Split Airport to the islands, is extremely long and uncomfortable. The implementation of integral transport would render the journey to the



islands (Brač, Hvar, Vis, Šolta, Korčula, Lastovo etc.) much faster and more comfortable.

Detailed research, surveys and interviews need to determine the exact needs of the passengers, and through cooperation with the air carriers, airport, shippers, tourist agencies, hotels and private renters it is necessary to present the possibilities of such passenger transport.

The passenger sea terminal in close vicinity of the airport allows organizing of the shortest and fastest transfer from the airport to one of the islands. Therefore, it is necessary to provide additional investments into the construction of all the necessary facilities and completion of this infrastructure facility.

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## SAŽETAK

### **Mogućnosti intermodalnog putničkog transporta između zračne luke Split i otoka**

Značajan dio putnika koji slijeću u Zračnu luku Split tijekom turističke sezone nastavlja putovanje do odredišta na srednjedalmatinskim otocima. Danas se transfer obavlja uglavnom preko trajektne luke u Splitu. Nedostatni kapaciteti cestovnih prometnica od zračne luke do centra grada gdje se nalazi trajektna luka i čekanje na red plovidbe trajekata te sam prijevoz do otoka i konačnog odredišta vremenski značajno premašuje putovanje zrakom do Splita. U radu su istražena moguća poboljšanja postojećeg stanja kao i završetak izgradnje i puštanje u funkciju putničke pomorske luke uz Zračnu luku Split na koji bi se način daleko kvalitetnije riješio transfer putnika na otoke.

## KLJUČNE RIJEČI

zračna luka, gravitacijsko područje, intermodalni transport, povezivanje kopnani otoka

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