

Valuation of Road Infrastructure in Urban and Traffic Study of the City of Split

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Functional reciprocity of all transport sectors with their infrastructure support is most evident in ports. The port of Split, integrated in Split's traffic intersection, is a striking example of uniqueness of Split-Dalmatia County as a traffic and economic centre of Central Dalmatia. The development of City's harbour for passenger traffic and the North Port for cargo traffic has determined already set constellation of relations of maritime, road and rail traffic, and their mutual interference. The road transport and activities with regard to hinterland services generate economic development in which Split is no exception. This estimate is based on changes that can be expected in terms of redistribution of traffic flow in the central and southern Adriatic and the greater role of road transport, with Split having an increasingly important role.

KEY WORDS

- ~ Port of Split
- ~ Cargo and passenger flows
- ~ Road infrastructure
- ~ Logistics

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1. INTRODUCTION

Reciprocity operation of all transport sectors with their infrastructure support is most evident in ports. The port of Split integrated in Split's traffic intersection is a striking example of uniqueness of Split-Dalmatia County, as a traffic and economic centre of Central Dalmatia. At this relatively confined and high quality space overlap agglomeration of Split, Solin and Kaštela, and the related port systems. As a very important future longitudinal segment of The Adriatic-Ionian Corridor, Split has the role of transit, as well as the starting point of landing in the circulation of all types of transport substrate. For this reason, the urban functions of the largest agglomeration on the Croatian part of The Adriatic Sea are very demanding and complex. Split's connection with the hinterland is more difficult because of extended Kozjak Mountain, and organization of traffic flows in the central area is particularly problematic. Periods of saturation are most pronounced in summer during the high tourist season. The development of City's harbour for passenger traffic and the North Port for cargo traffic has determined already set constellation of relations of maritime, road and rail traffic, and their mutual interference.

2. BASIC TRANSPORT-TECHNOLOGICAL PARAMETERS

When accepting the European traffic flows from West, Central and East Europe, and distributing them in the city of Split and mentioned port-basins, Split's traffic junction is determined by its transverse disposition between the branches «b» and «c», Pan-European corridor V, and the longitudinal direction of the Adriatic-Ionian corridor. Relevant characteristics and determinants of future development are decided by the Regional

Plan of the city of Split, the General Urban Plan of the city of Split (no special traffic plan), a traffic study of the wider area of Split (IGH), a state-level Transport Development Strategy of Croatia since 1999, and other supporting documents which are focused on port facilities and supporting facilities for the road and rail infrastructure.

The layout of the City Port and the North Port is emphasized as it is of particular importance and having in mind all transport sectors and the capacity of their infrastructure. Practically, infrastructure facilities of the road and rail traffic face the inner city area, at the lowest elevations near the sea. Therefore, they are in a very specific and high quality coastal area in the centre of Split-Dalmatia County, and the city's urban structure in which the City and Port operate as two complex systems, with their complementary activities.

However, the inherited County's transportation network, particularly right in the city centre of Split cannot meet increasing traffic demands of the development of both, the Port and City, and has no other alternative but, only possible solution to build integrated, intermodal transport hubs that would operate on the principle of sustainable development with the aim of increasing long-term effectiveness of the transport system as a whole. In the field of infrastructure and superstructure, major buildings and complex structures should be planned and implemented, which will mitigate the effects of inconsistent long-term transport policies.

The area of the city of Split with the corresponding ring of settlements may experience the economic revival of activating uncontested logistical resources, both in passenger and in freight traffic.

3. BASIC INFRASTRUCTURE

On the narrow catchment area of the city of Split, road traffic is characterized by inadequate road network density with relatively fair traffic and technical characteristics, inadequate quality of roads, signs and safety features. As regards the road transport, the construction of motorways and expressways along the state lines has recently retained the dominance in the Republic of Croatia, what is justified by the spatial indented network and enabling «door to door» system. With construction of the high capacity road, A1 highway, Split-Dalmatia County permanently solved the problem of connection with the capital.

The relatively large distance (approximately 20 km) from the node Dugopolje to the city reduced its level of availability, and alternative Adriatic tourist road (JTC) partially retained the role of road links to Šibenik and Zadar.

Underlying Adriatic highway cannot adequately serve the primary flow connection with the littoral cities and villages of Central and South Dalmatia for traffic and exploitation, safety, environmental, economic exploitation and other reasons.

So the question of interregional connections and a need to

build a parallel four-lane highway remained opened.

With regard to the road transport, links with the hinterland of Split's harbour, there is a significant capital project Trans-European North – South (TEM) Motorway, which runs from Szczecina to Prague, Bratislava, Hungary, Zagreb and Rijeka to Dubrovnik and further on to Greece. Present status and development of road transport infrastructure in the logistics of the considered traffic direction, and the EU transport system determine the basic road corridors connecting The Republic of Croatia with Europe. These will form the basis for the conclusions on the state road network when it comes to linking the harbour of Split to its catchment area, as an important determinant for the evaluation of geotrafical position.

Apart from the standpoint of supply, competitiveness of existing road infrastructure should be considered, as already stated, in relation to traffic demand, the demands placed before it, set the current and potential market (users of transport services) transport route Zagreb-Split and given the continued motorway A1 towards Dubrovnik. Traffic demand in the road traffic is observed on the basis of data on traffic flows on road network obtained by counting the traffic on the roads, which is calculated using the average annual daily traffic (AADT) and the number of vehicles per day. Nota bene, with respect to the traffic from other countries, Split harbour has its greatest tourist transit traffic, it is expected that parts of the road in the Croatian territory which connect the port of Rijeka to Austria, the Check Republic, Slovakia and Hungary will be the most loaded in terms of traffic demand. This fact is confirmed by the data on the most burdened road corridors by the Adriatic Sea. The year 2010 highlights the following trends:

- Goričan – Zagreb – Rijeka – Pula ,
8.717 vehicle / day
- Macelj – Zagreb – Knin – Split,
7.334 vehicle / day
- Pasjak – Rijeka – Zadar – Split – Dubrovnik,
5.122 vehicle / day

Most burdened roads to forecast the AADT in 2010, coincide with currently busiest roads and forecast amount of traffic as follows:

- Goričan – Zagreb – Rijeka – Pula
6.536 vehicle / day
- Macelj – Zagreb – Knin – Split
6.583 vehicle / day
- Pasjak – Rijeka – Zadar – Split – Dubrovnik – Karasovići
11.581 vehicle / day
- Kneževo – Osijek – Slavonski Šamac; Metković – Opuzen
11.921 vehicle / day

These data show that on the major European routes, so called E-roads, some improvements are needed when it comes to throughput and traffic safety. According to traffic forecasts, in order to reach a high level of service by 2015, the priorities should be to improve the range of existing transport networks and the quality of construction of new road sections.

The transport route from Zagreb to Split and the sea port of Split as a starting point (and as a transit point in relation to the island archipelago of Central and South Dalmatia) have marked a higher priority for connecting the road to the source points in the hinterland in relation to the distance of the train. It means that the size of the hinterland area of Split sea port, in relation to other sea ports is more competitive due to road distances, which certainly should be put in relation with all parameters that determine the transport service. These statements are based on actual data that impose different issues, of which some refer to it – is it really that the state (density and development) of roads between seaport Split – Zagreb – Central Europe, is much better compared to rail connections?

These results are affected by the fact that road transport logistics is preferred, particularly the use of high quality types of roads in the transport of high-tariff goods. Sometimes the freight is not always necessary to place this kind of roads for high level service. For this reason, it is often considered that the transport route used by inland road without charge consumes a lower level of service (the «old» road Zagreb-Split).

Road freight transport as compared with rail transport can be characterized as less economical mode of transport service. The reason for this is primarily limited by the static capacity and high service costs, and high cost of fuel. Limited availability of

road transport is especially true in container freight transport, given the limited dimensions and gross weight vehicles. The capacity of cargo of commercial vehicles is limited to 2 TEU, while also it is not possible to accept any container largely deviating from the standard. Regarding the relatively high costs of road traffic, determining exactly the same place of truck transport of containers in three major segments of the gravitational field of the maritime port of Split:

- urgent transport to the remote system (Split-Zagreb-Central Europe);
- land transportation of the narrow catchment area of the port of Split, or between production and consumer sites in the region (container terminal at the port of Ploče Pan-European Corridor Vc);
- internal transport from the sea port to the processing industrial centres in the port of Split (Industry Zone Dugopolje etc.).

The biggest advantage that can be attributed to road transports relates to the elasticity of transportation, which is reflected in the fact that the road vehicle can get to any place that could be reached by road infrastructure, and transport is not time limited. Elasticity contributes to the growing number of private road transport services (such as natural and legal persons), which often specialize in a particular coverage, the narrow part of the transport market, which then supports and improves transport services. Taking into consideration all the advantages of road transport, rail transport is the mode of transport which could be used for all these reasons and should be particularly encouraged.



Figure 1.
Traffic counting on the roads of Croatia.
Source: group of authors, 2011.

So the rail transportation should have a larger share in the carriage of cargo on the route of the future container terminal in the North Port to various destinations in the Central European hinterland. Regarding the economic relations and geo traffic predispositions in relation to the gravitating area of Bosnia and Herzegovina, there is no dispute in the marketing importance of these wining market potentials.

Nevertheless, it is important to point out that in Croatia, because of pronounced increase in the number of road carriers, and therefore the road transport capacity, the share of road transport is growing on the transport market. On the one hand, it is because of abolition of strict administrative ban on the import of vehicles, particularly the reduction of import and other duties, which are open to opportunities for uncontrollable massive import of used commercial transport vehicles. At the same time, this enables individuals performing road transport activities, even in international traffic, so there are many individuals inspired by the possibility for entering into this category of private enterprise.

As a rule, the economy of Split-Dalmatia County is not an exception, road transport capacity exceeds demand, and in most cases competes with rail transport. However, no matter what road carriers, on domestic and international markets, load in non-transparent ways, such as unfair competition by lowering prices below the threshold of economic feasibility, we should expect stronger regulatory function of competition. An example is the limited number of licenses for the transfer to other European countries with regard to the issue of road vehicles that do not meet the requirements for getting a carnet (TIR, CEMT, CMR, ATA etc.) that provide the cheapest and fastest crossing of state borders, the conditions of the insurance of carrier's liability, etc. Although road transport has played a leading role in the transport supply for certain types of cargo between the port of Split and the hinterland (e.g. the title of valuable general cargo) we should not ignore the view that for the advantages of rail logistics it could be difficult to replace the services with high levels of road courtesy, especially so called Dalmatina (highway A1). However, rail transport of mass and heavy loads, large amounts of cargo (e.g. cement) and long distances, with all major satisfactory environmental conditions and low transportation costs, have advantage over the road transport.

The remote road linking with the gravitational surrounding area of the Port of Split, the available capacity of motorway to the border with Hungary to AADT among 18000 – 20000 vehicles per day. The value of turnover in the previous operation was not reached even in peak loads during the tourist season, so the highway Zagreb-Split can be considered «a road perspective» that will be at its high level of service to generate and stimulate a new traffic demand. Sufficiency of capacity is not questionable for the projected volumes of traffic from Split's port, i.e. the predicted 7 million tons of cargo and approximately 6 million passengers by 2040. There may be certain periodic lowering, so

called, scale general eligibility (level of serviceability from B to E, according to the High Capacity Manual). The expected increase in transportation / waste containers and other general cargo terminal from the North Port sustainable in the case of bridging the Bay of Kaštela by a new bridge, three variants of connecting Split and Kaštela, according to a IGH study (Figure 2). The shortest



Figure 2.
The Kaštela Bay Bridge.
Source: IGH, 2011.

connection bridging The Kaštela Bay can be achieved in the variant No.1. The planned bridge touches the western side of RO-RO/container terminal and has a clearance for the passage of larger ships. Another, cheaper option No.2 has a shift towards the eastern part of the bay that touches the eastern side of this terminal. Variant No 3. is represented by the shortest and the lowest (cheapest) bridge at the extreme eastern part of Kaštela, but at least it is technologically justified.

Regarding the organization of traffic flows in the central part of the city network, it can be concluded that the capacitance limits of the road transport infrastructure in the Split node is in the absence of a consistent policy of planning and construction of capital infrastructure.

The expected trend of part loading will cause the saturated traffic and lowering of the courtesy level, it is necessary to build a

new road bridge across Kaštela Bay, and to construct a new road (Split-Kaštel Stari; Kaštel Stari-Trogir; Split-Dujmovača).

Since the capital facilities should initiate the construction of new bus station for remote and local traffic in Kopilice, which will, among other projects and upgrading of street network subsequently affect regime change operations in the central part of Split.

Future connection road between the City port – Kopilica constructed as a highway tunnel, is the «conditio sine qua non» of sustainability providing a new concept of the transport regimes of the City.

4. CONCLUSION

The traffic of Split area is determined by the importance of all branches of transport within that county as the centre of Split and the central Dalmatian islands are structurally related. Road traffic and activities that are related to the servicing of mountainous hinterland at the same time generating economic development in which Split is no exception. The port of Split by its significance belongs to the group of the top passenger destinations on the Mediterranean. Its importance is reflected in facilitating the mobility of local population and connecting the islands with the mainland, and in the transfer of a large number of tourists, be it to their transit or final destination.

Because of such characteristics of the port where the passenger traffic is dominated by domestic sales with a 90% share, of which over 40% of the total turnover is achieved during the summer, we come to its essential feature, which is sensitive to seasonal changes as a result of tourism oscillations. This is tied to certain problems that are manifested through large crowds at peak loads, and the spatial constraints of road infrastructure. In

such circumstances it is necessary to find short term solutions, but also to determine the long-term development concept for the next 30-odd years, based on projections of traffic demand. Croatian accession to the European Union could make a real scenario possible, in which the passenger transport segment realize an average growth of 2% per year.

The function of Split harbour as a cargo port, also needs to be accepted even though the current traffic is almost entirely a function of the local industry. Projections of demand for freight traffic serving the particular industry should be taken with caution because the expectations are solely related to the operating policies of the entity that uses the port. However, there are realistic expectations that the future development of freight traffic in the port of Split will depend on the adjustments in the port for the reception of intermodal transport units (containers and ro-ro cargo) for various clients in a broad economic hinterland. It is estimated that this type of cargo transport will reach 40 000 TEUs (container sales) and 15 000 vehicles a year by 2040. This estimate is based on changes that can be expected in terms of redistribution of traffic flows in central and southern Adriatic and the greater role of road transport where Split could have an increasingly important role.

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