Transport characteristics of FR Yugoslavia

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The Federal Republic of Yugoslavia (population about 10.5 million) comprises two federal entities, the Republic of Serbia, and the Republic of Montenegro.

FR Yugoslavia takes up the central part of the Balkan region, and provides for the passage of traffic through corridors linking Europe with the Near East, Asia and northeastern Africa. Yugoslavia has favorable economic and geographical conditions for cargo transportation in inland waterway traffic. Two basic corridors could be separate: Danube-East and Danube-West. In the Danube-East corridor, the cargo flows can move in directions: river-sea (Danube-Black sea), sea-river (Black sea-Danube) and further, Danube-Mediterranean sea and vice versa. Furthermore Yugoslavia is also a coastal country, and there is access to the southern part of the Adriatic Sea with 300km of seashore, making it relevant to transport in the Adriatic and Mediterranean areas. The main sea port is Port of Bar. Much transportation infrastructure, including international E-roads, railroads, navigable routes, river ports and sea harbors, and international airports and telecommunication systems, are already established and represent an integral part of European routes. Unfortunately, the war events on the territory of former Yugoslavia and five year UN sanctions towards FR of Yugoslavia brought to the isolation of Yugoslavia as well as isolation of transport system which further caused now is technical, technological, organization, ownership and managing obsolescence. The consequence is: the lack of investments for maintenance, modernization and development of capacities, which results in inability to adjust to the new conditions in time.

The paper presents the transport characteristics and transport plans in different transport fields in FR Yugoslavia.

Railway transport

Today length of Yugoslav Railways (JŽ) network is 4059 km (figure 1). All lines have the normal gauge (1435 mm). Length of main railway lines is 1936 km. All main lines have been designed and constructed for the speed of 100-120 km/h, equipped with SS and interlocking devices, automatic phones, and on the most part of lines with centralized dispatching monitoring of trains. Length of electrified railway lines is 1373 km or 33.8 %. Electrification has been carried out applying mono-phase system of 25 kV 50 Hz. Yugoslav
Railways have 678 traction vehicles, 1207 passenger cars, 17462 freight wagons. The existing railway network will be necessary to complete by construction of new railway lines such as: Valjevo - Loznica (now under construction), Prahovo - Djerdap II and Peć - Mateveo.

Main railway network of JŽ consist of the PanEuropean railway corridor X and the lines which makes the side branch connections of this Corridor to the Corridors IV and IX, such as: Belgrade – Šid (Croatia), Belgrade – Niš - Preševo (FYROM), Belgrade – Subotica (Hungary), Niš - Dimitrovgrad (Bulgaria), Belgrade – Vršac (Romania) and Belgrade – Bar. These railway lines should be constructed in future as high-speed lines, with the exception of Belgrade – Bar line. The planned measures on the Corridor X up to 2010, have the following objectives:

- The line from Hungarian border to Belgrade to be modernized and to be constructed as double track line with the elements on the route for 250 km/h and equipment for the speed of 160 km/h.
- Railway line for Croatian border to Belgrade to be modernized and to be constructed as double track line for the speed of 160 km/h.
- Railway line from Belgrade to Niš to be modernized and to be constructed as double track line along the total length by reconstruction of the single track sections in double track sections with the route elements for 250 km/h and equipment for 160 km/h, so to get it ready for the speed of 120-160 km/h.
- Railway line from Niš to FYROM border to be overhauled and to be ready for the speed from 70-km/h, and
- The line from Niš to Bulgarian border to be electrified, to provide necessary overall size and by main overhauling to be ready for the speed from 70-120 km/h.

The condition of rolling stock fleet, telecommunication system and network, signaling and safety devices, fixed electric traction equipment is high level depreciation because passed two thirds of its exploitation life cycle.

Partiality and relatively poor equipping characterize current situation of the information systems. Further development of the information systems must be in accordance with the modern trends, with a stress on the concept of distributive and integral information system.

Within the railway traffic in FR Yugoslavia, both in passenger and freight traffic the classical traffic technologies have been applied. Within the international passenger traffic the routes of the trains from Istanbul and Thessaloniki end in Budapest. Routes of the trains from Belgrade end in Wien. By opening of Belgrade – Zagreb line exist one train from Belgrade to the Munich/Frankfurt and one from Belgrade to the Zurich. All those international trains are composed of the classical sets. Beside the trains planned by timetable, in the course of tourist season there are a certain number of tourist agency trains from European countries up to Greece and Turkey including the automobile wagons.

Within the domestic traffic, the longest routes are Subotica – Novi Sad/Belgrade – Bar, Belgrade – Lapovo – Kosovo Polje – Peć/Prizren, Belgrade – Niš. Also there are some regional and local trains. The great number of all trains is of a classical composition; i.e. there are few diesel and electric-motor trains. There is a special need for revitalization and modernization of a city, suburban and regional railway traffic in the most of the cities (especially in Belgrade urban area), i.e. in local and regional railway traffic in small cities on the side lines, mostly not electrified lines.

Freight traffic technology is the classic one, with marshaling the wagons during the transport process. A great number of stations are open for the freight transport, where we have frequent stoppage of trains, big delays etc. Therefore, the transportation is long with small speeds.

At the European level it has not been yet defined a new technology of the railway freight transport. Therefore, it is necessary to undertake the measures for its more extensive utilization within JŽ as well. So, to do that, in first instance, in the most south-east Europe countries and Yugoslavia as well, it is necessary to carry out technical reconstruction of the important routes (to make necessary infrastructure) and to carry out codification of those routes according to the European standards and regulations.

Figure 1 Yugoslavia - Main railway and roads corridors
Inland waterway traffic

The cargo flows can use complex directions as the river-sea-river, for instance, Danube-Black sea-Dnepr, Danube-Black sea-Danube-Bulgaria. The usage of these directions depends on legal status of navigation, which is valid in Ukraine and Russia.

In the Danube-East corridor, the river-sea traffic can make the connection directly between the Yugoslavian river ports in Danube: Abaton, Novi Sad, Pančevo, Smederevo, Pražovo and Beograd and ports Constanta (Romania), Varna and Burgas (Bulgaria), Iljichevsk, Nikolaev, Herson (Ukraine), Novorosysk, Tuapse (Russia), Trabzon, Samsun, Sinop (Turkey).

In the Danube-West corridor, after opening of Rhine-Main-Danube waterway, the cargo flows can move in direction: river-channel-river-sea (Danube-Maine-Danube channel-Main-Rhine-North sea) and vice versa, as in whole corridor: sea-river-channel-river-sea (Black sea-Danube-Danube-Main channel-Main-Rhine-North sea) and vice versa. In this case, two river basins, which empty in opposite sea basins, have been connected first time. These waterways present the spinal column of European inland waterways.

The network of inland waterways in Yugoslavia contains the natural and artificial waterways (Danube-Tisza-Danube channel system). The length of this network is presented in Table 1 and Figure 2.

River fleet

In modern fleet operation and management in inland waterways three basic systems exist according to the kind of vessels which perform cargo transport. They are pulling and pushing barge tow systems and the self-propelled barge system. All mentioned systems exist on Yugoslavian inland waterways. However, the pulling barge tow system slowly dies out the operating and only existing fleet of tugs and pulled barges are operated. These units replace with pushing barge tows and in lower volume of self-propelled barges in depending on the kind of inland waterways characteristics, quality of service the kind of cargo etc.

Operating results with the pushed barge tow system justified the application of this system on Yugoslav inland waterways, particularly on the Danube. The clear advantages of this system in comparison with the pulled barge tow system have had important impact in development of river traffic in Europe, also in Yugoslavia. However, the pushed barge tow system doesn't give the solutions for all problems in inland waterways transport. The advantages of this system can only realize if the push tug hasn't great time losses (waiting time) in loading/unloading ports understanding high degree of technical reliability. The second condition that turn-around time has realized with the complete barge tow for which the push tug have been predicted. These conditions are required:

1) Available manpower in ports with specialized equipment for reloading of cargo from barges in port regions.
2) Large and regular supply of cargoes.
3) Inland waterways, which allow the navigation of determined pushed barge, tows.

The self-propelled barges have great advantage in high elasticity and flexibility, particularly in regard of changes of inland waterways. For instance, these ships can come to some far inland port. On canaled rivers and channel networks, as Danube-Tisza-Danube system, the pushing system is practical eliminated because the channel and lock dimensions.

Combined freight transport

Strategy of combined freight transport within F.R. Yugoslavia is in:

- Construction and completion of container, hucke-pack and Ro-Ro terminal network
- Construction and completion of freight transport centers (FTC) and merchandise distribution centers (MDC)

Terminal network development is based on many-years investigations of requirements of national and international freight moves. Terminals are located in big economic and transport centers in F.R.Y. on the main traffic and transportation routes. F.R. YUGOSLAVIA has three fully developed container terminals in The Port of Bar, The Port of Belgrade and ZIT Belgrade container terminal.
Other terminals partially developed or planned to be constructed are located in thirteen economic and traffic centers: Novi Sad, Pancovo, Subotica, Senta, Sombor_Apatin, Srem'ska Mitrovica, Smederevo, Sabac, Nis, Užice, Podgorica, Presevo and Dimitrovgrad (Figure 3). Prospective container movements within the network are estimated to 100000 TEU p.a.

Container stock consists of about 500 various types of units owned by ZIT Belgrade (250 TEU), YUGOCONTAINER (150 TEU) and BETRA (100 TEU). There are 576 railroad cars of R series for moving loading units of intermodal transportation.

Subsystems for huckle-pack transport technology are located next to container terminals in Belgrade, Nis, Subotica, Dimitrovgrad and Pancovo. Terminals can handle hucke-pack transportation units of C techniques and A and B techniques are scheduled to be introduced in future. 5000 to 10000 transportation units prospectively gravitate yearly to these technologies.

At least one Ro-Ro terminal is presently planned to be constructed in one of the Danube ports from the list: Nov Sad, Belgrade, Pancovo, Smederevo and Prahovo. Expected volume of cargo movements in Ro-Ro transportation technologies is about 10000 unit's p.a.

The network of Yugoslavia freight transportation centers (FTC) was promoted in 1986. Those were centers offering full logistic and other necessary services in commodity movements. FTC is complex systems offering basic, appurtenant, managing and informational, technical and safety functions. The network is composed of twelve centers (Figure 4). FTC network is to be developed through stages with priority onto the commodity transportation centers in Belgrade, Novi Sad, Nis and Subotica. The centers are to be developed on the area of 50-200 ha with annual commodity circulation from 200000 to 200000 tons.

Merchandise distribution centers are predicted for logistic distributional regional requirements, which are to include transportation, trading, industrial and forwarding companies with their own logistic systems. By their macro and micro locations these centers are additions to FTC and intermodal transportation terminals. Those centers are of regional and local character and most cases with preferential city logistic function. Merchandise distribution centers cover the area up to 20 ha with annual commodity circulation from 100000 to 5000000 tons.

The container terminal of Port of Bar covers an area of 60000 m² and could be extended to 80000 m². The operative length of the coast is 330 m and depth 12 m. The port provide handling of containers straight from the railroad cars, road vehicles and vessels. Container terminal offers complete washing, charging and discharging, repair and other service on customer request. They also provide service connections for 40 frigo containers. Transloading subsystems include 400 KN container loading crane for operation on the quayside with 23 m jib reach toward the sea. Then there are 42 t forklift trucks with spreaders and two 25 t forklift trucks. Temporary storage of containers is within the operational zone of transtrainer crane. Besides that terminal has 6 more multipurpose lots for machinery and equipment movement. Terminal has well-developed road and railroad infrastructure with parking apron for road trailers.

The Port of Bar has also Ro-Ro terminal equipped for all kind of Ro-Ro units. It covers 270 m length of quayside operative area with 10 m aquatorii depth. Terminal has open-air storage covering 60000 m² with asphalt and concrete base and ramps for Ro-Ro units transloading.

Container terminal of the Port of Belgrade is located on the southern side of central part of aquatorii on vertical quay which is used in the length of 610 m. At the present conditions the volume of operation is 1000 containers and capacity 10000 TEU. The existing infrastructure allows direct and indirect transloading of containers from ship to railcar or road trailers.

Container terminal of the Port of Belgrade is equipped with units used also for other purposes, among which are container loading crane/bridge, bearing capacity 500 KN equipped with spreader for handling 20 ft and 40 ft containers, 270 KN forklift trucks with spreader and 320 KN without spreader for handling empty containers ramp for trucks to enter into container, platform for road trailers covering 2800 m², open air container storage covering 5000 m², container maintenance and repair service center of 780 m² and three railway tracks of 609 m useful length.

Container terminal storage subsystem is planned to be extended, transloading equipment to be modernized in accordance with international standards. Also new information system is to be implemented to enable full monitoring and control over the whole terminal area at any time. The construction of hucke-pack and Ro-Ro terminals are planned also for reasonable period of time as there are technical and technological conditions for such project i.e. required area, railway sidings, parking lots, custom zone, public bonded warehouse and other appurtenant elements. Starting up such terminals means preconditions for rational cooperation between road and railway traffic as well as with river traffic.

Container terminal ZIT Belgrade (Railway Integral Transport) is located within Belgrade Railway Station area, between passenger railway station and bank of the Sava river, on the area of 18000 sq.m. Its main activity is organization of goods transport in containers. Its container stock consists of 350 units included into itinerary container trains transport on local and international routes.

Two information systems are in operation: one autonomous for monitoring containers on very terminal and other one connected to railway computing system providing information on trains and goods movements at any time i.e. arrivals and departures to/from the container terminal, and due time interventions as arrivals and departures whenever required. It also provides transloading of hucke-pack units under C technique (transport of interchangeable transportation vessels).
Conclusions
Some basic characteristics of Transport Systems of Yugoslavia have been presented in article. Isolation of country influenced on volume of freight especially transit one. The data about freight flows are available but in this moment are not compatible by previous period.

LITERATURE