1. Introduction

An approximate duration of the navigation from the port of Bratislava towards the North and Black Sea is based on the standard nautical terms, i.e. on water and weather conditions permitting safe navigation (Table 1). In autumn and winter may the period of the navigation be longer because of the early morning fog, ice drifts, which are necessary to take into account when planning the transportation. It is also important to consider the possible high water levels on the Main, which do not allow the navigation of pushed vessels [1].

Slovak Shipping and Ports (major shipping operator in Slovakia) has three vessels which enable the transportation of wheeled technologies. The standard DE IIb vessel type has the container transport capacity of 63 TEUs, 21 truck trailers or 70 cars can be transported by the Ro-Ro vessel. The formation of two or three pushing convoys of Ro-Ro vessels transport a maximum of 200 cars.

One possibility of increasing the transportation capacity is to extend the Ro-Ro fleet of multi-storey Ro-Ro vessels or of pushing convoys enabling the transportation of more than 500 cars. An example may be 2-3 storeys Bulgarian Ro-Ro ships called INTERSHIPPING-1, INTERSHIPPING-2, INTERSHIPPING-3 and INTERSHIPPING-4 pushed by the tugboat Naiden Kirov (Fig. 1) [2].

## Table 1

| Distance km | Number of Locks | Table 1 |
|-------------|-----------------|---------|
| Port        | MCV 1.350 t     |         |
| Ghent       | 196              |         |
| Antwerp     | 192              |         |
| Amsterdam   | 185              |         |
| Rotterdam   | 182              |         |
| Brussels    | 175              |         |
| Hamburg     | 173              |         |
| MCV 2.000 t | 170              |         |
| MCV 1.350 t | 167              |         |
| MCV 2.000 t | 164              |         |
| MCV 1.350 t | 161              |         |
| MCV 2.000 t | 158              |         |
| MCV 1.350 t | 155              |         |
| MCV 2.000 t | 152              |         |
| MCV 1.350 t | 149              |         |
| MCV 2.000 t | 146              |         |
| MCV 1.350 t | 143              |         |
| MCV 2.000 t | 140              |         |
| MCV 1.350 t | 137              |         |
| MCV 2.000 t | 134              |         |
| MCV 1.350 t | 131              |         |
| MCV 2.000 t | 128              |         |
| MCV 1.350 t | 125              |         |
| MCV 2.000 t | 122              |         |
| MCV 1.350 t | 119              |         |

1 - connection for maritime transport, 2 - in the case of low water level 100 km detour through the shoulder Borcea, * Motor Cargo Vessel

Source: Authors
SWOT analysis of the use of the port of Bratislava for transportation of automobiles and containers from Slovakia

SWOT analysis is a strategic planning tool used for the evaluation of the strengths, weaknesses, opportunities and threats that lie in a given project in an effort to undertake a certain goal. It involves monitoring internal and external marketing environment.

The following Table 2 presents the SWOT analysis which focuses on potential of the port of Bratislava in the transportation of cars and containers in export and import [3].

| SWOT analysis | Table 2 |
|---------------|---------|
| **Strengths** | **Weaknesses** |
| • strategic geographical position in relation to the localization of potential customers, | • long transport time in water transport, |
| • connection to the inland waterways of international importance (Danube-Main-Rhine) | • low transport capacity of the existing fleet, |
| • cost of transportation, | • obsolescence of fleets |
| • environmental aspects, | • navigation restrictions on the waterway, |
| • direct connection to the rail network, | • poor awareness of the possibilities of using waterway by carriers and logistics operators in Slovakia, |
| • support of water transport by the EU, | • technical condition of port infrastructure, |
| • direct connection of the port of Bratislava to the ports of Rotterdam and Zeebrugge. | • the need for multiple reloading, |
| **Opportunities** | **Threats** |
| • the improvement of the road network by completing the Bratislava ring road, | • direct competition of rail transport |
| • possibility of expanding capacity and activities of the port. | • dependency on weather and hydrological conditions, |
| • a growing trend in the field of logistics and international transport of goods, | • increased used of rail and road transport, |
| • increase production of cars and consumer goods in Slovakia, | • development of Koper port as a major logistics hub for Slovak automakers. |
| • orientation of the Slovak economy mainly for export. | **Source:** Authors |

3. Evaluation of requirements and needs of logistics operators in automotive industry

There is a difference between the transportation of completed vehicles and transportation of components and parts for automobile production. The components are supplied to the factories by Just-In-Time or Just-In-Sequence. This means to deliver the components to the appropriate production line in the correct order, in the required amount and in the given time. Trucks of different sizes and different types of semi-trailer may be used for these operations according to the quantity and nature of the cargo. As every automobile company tries to keep the lowest stock, they have the components only for 1 or 2 days or in some cases just for a few hours. The car manufacturers (PSA and VW), where the engine production is carried out of the Slovakia,
average stock lasts only about 8 hours. Their import is done from France only by the truck transport as it presents a high degree of flexibility. Shippers and logistics suppliers have to follow strict requirements. The vehicle transportation has its specifics because special transporters (especially trucks and trains), intended exclusively for the transportation of vehicles, are required for the implementation. And the vehicles transported by carriages require special instruments to provide loading and unloading. Moreover, the conditions of transportation on the open carriages are completely different from the transportation in the closed carriages. In practice, the carriages and vessels for the intermodal transportation of trucks fully loaded by cars or specially modified aircraft are also used [4, 5 and 6].

Delivery time, within the transportation of completed cars, plays an important role when choosing the transport mode. The attention of commercial policy of almost every company is primarily focused on the final customer, i.e. to satisfy their requirements on time and at the required level. An average delivery time, from setting the order by customer to taking the vehicle, is approximately 18 days. Logistics schemes of operators are adapted to this priority.

Modernization of the railway transport network and the transport policy of the European Union aimed at finding the alternatives to the road transport are important factors that affect the constant increase of the environmental transport modes portion when transporting the goods all over the world. The EU orientation to alternative transport modes (in relation to the road transport) represents a high potential of the involvement in the “rare” usage of the inland waterway transport not only when transporting the vehicles [8].

However, if the water transport wants to be a competitive partner to the rail and road transport (Fig. 4), it is necessary to draw attention to its main advantages (environmental aspects, price of transport, capacity) and weaknesses (transport time, location and availability of trimodal logistics centres and their connection to the manufacturing companies, multiple transhipment) [9].

The capacity of a truck, when transporting the vehicles from PSA, is 6 personal cars, the capacity of the double-deck carriage of the Lggs type is 14 personal cars, of the BLG carriage type (used by KIA) only 6 personal cars. A train, depending on the transportation road, can take about 220-250 personal cars from PSA. Inland vessels have a capacity up to 500 cars, which is more than twice compared to capacities of the railway transport. However, it is important to consider the shipping area, its possibilities and limitations [4, 5 and 6].

Slovakia has an important position in the automotive industry in Europe. Annual production of cars, approaching the million, confirms this fact. A huge amount of the car production is for the European market. France, Germany, Italy, the United Kingdom
and Belgium are the countries with the highest import of vehicles produced in Slovakia. However, the export is realized only by the road or rail transport. Exports of cars from Slovakia according to their final destinations are expressed in Fig. 5 [10 and 11].

4. Conclusion

Europe has over 30,000 km of canals and rivers, which link together hundreds of key industrial towns and areas. The core of the network, approximately 10,000 km, connects the Netherlands, Belgium, Luxembourg, France, Germany, Poland, the Czech Republic, Austria, Slovakia and Hungary, Switzerland, Croatia, Serbia, Montenegro, Romania, Bulgaria, Moldova and Ukraine. The main part of this network consists of the main rivers such as the Rhine and the Danube, many tributary rivers and canals connect a network of smaller towns and industrial zones. A considerable number of ports in the network enables to use various types of the transport modes. Connection of Slovakia and the inland waterway network using the Danube River is a way how to unburden the transportation flows, especially from the road networks and also to reduce costs of this transport. It is necessary to meet the delivery time and consider navigation restrictions.

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