

# Concept of connection between the Mukhavets and the Bug river as an element of International Waterway E40 development on the Polish-Belarusian border

## Koncepcja połączenia rzeki Muchawiec z rzeką Bug jako element rozwoju Międzynarodowej Drogi Wodnej E40 na granicy Polsko-Białoruskiej

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**Abstract:** International waterway E40 is part of the European inland waterway network of transnational importance. It is a specific link between two seas: the Baltic and the Black Sea. The route runs through three countries, Poland, Belarus, and Ukraine.

The article presents the problem of the missing link on E40 IWW, particularly, the lack of adequate quality connection between the Bug and Mukhavets rivers. This missing link is on the Polish-Belarusian border in the high historical value - the fortress of Brest. The article shows three variants of connection. The concepts should not be taken as final projects recommended by the countries through which the concerned section of E40 runs. The article will be useful to create a strategy for the revitalization of international waterway E40 in Poland and will facilitate the decision on the accession and signing of the AGN Convention. The article can also be initial material supporting policies and companies' development conducting their business, based on infrastructure along the E40 waterway.

**Keywords:** Bypass water channel, AGN convention, E40 Inland Waterway, revitalization, inland navigation

**Streszczenie:** Międzynarodowa droga wodna E40 wpisana jest w sieć dróg wodnych śródlądowych o znaczeniu ponadnarodowym. Stanowi swoisty łącznik dwóch akwenów: Morza Bałtyckiego i Morza Czarnego. Jej trasa przebiega przez trzy kraje Polskę, Białoruś i Ukrainę.

W artykule przedstawiono problem brakującego ogniwa MDW E40 w postaci braku odpowiedniej jakości połączenia rzeki Bug z rzeką Muchawiec. To brakujące ogniwo znajduje się na granicy Polsko-Białoruskiej w bezpośrednim sąsiedztwie obszaru o dużych walorach historycznych - twierdzy Brześć. Przedstawione w artykule trzy warianty połączenia mają charakter koncepcji i nie mogą być odbierane jako ostateczne projekty rekomendowane przez kraje przez które przebiega rozpatrywany odcinek drogi wodnej E40. Artykuł będzie przydatny do stworzenia strategii rewitalizacji międzynarodowej drogi wodnej E40 w Polsce oraz ułatwi podjęcie decyzji dotyczącej przystąpienia i podpisania przez Polskę konwencji AGN. Artykuł może również stanowić wstępny materiał wspomagający politykę i rozwój firm prowadzących swoją działalność w oparciu o infrastrukturę zlokalizowaną wzdłuż drogi wodnej E40.

**Słowa kluczowe:** Kanał obejściowy, AGN, droga wodna E40, rewitalizacja, żegluga śródlądowa

## Introduction

Inland waterways shipping is part of the national economy's system and an element of transport subsystem. Inland waterways companies in the framework of their activity fulfil the transport needs of other sectors of the national and European economy by exporting transport services. Following the transition period of the national economy system in Poland, the demand for transport services picked up in line with the rise in economic development, and the opportunity for exports also raised.

The inland waterway link of the Vistula River with the Prypec River via the Bug River, or more precisely via the planned lateral channel (called Eastern Channel in some documents) is a vital element of the European transport policy aimed at revitalisation and development of the integrated inland waterways network. The international waterway E40 linking the Baltic Sea with Black Sea will enable development (or rather restoration) of the transport of goods between Poland, Belarus, and Ukraine and activate the inland waterways tourism. Dniepr and Prypec are navigable, but require wise modernisation and improvement of the existing infrastructure, when the Polish segment is considered. Special attention should be considered for the border section of E40 waterway on the Polish-Belarusian border. On the Polish-Belarusian border, between Mukhavets and the Bug, is a fortress of Brest with high historic and cultural value. The location of the fortress is directly in line with the route of E40.

The article uses data collected as part of the Maritime Institute in Gdansk project: "Restoration of E-40 waterway on the stretch Dnieper – Vistula: from strategy to planning" financed by EU Cross-border Cooperation Programme Poland - Belarus – Ukraine 2007-2013.

## Belarusian section of IWW E40

The length of the Belarusian part of international waterway E40, running along the Mukhavets river, Dnieper – Bug channel, Pina and Pripyat rivers (Brest and Gomel regions) is 651 km (Belarusian section of IWW E40 is presented in figure 1). The E40 Waterway in Belarus meets the parameters of a class IV waterway, with restrictions on deadweight of vessels. From the Polish - Belarusian border to Belarusian – Ukrainian border, there are four inland river ports of Brest, Pinsk, Mikashevichy, and Pchow (Mazyr). From Brest along the Mukhavets river and the Dnieper – Bug channel there are nine locks, and between Pinsk and Mikaszewicze, there are two locks. Clearances under bridges are over 7 m and meet the requirements of a class Vb waterway. Depending on the weather conditions, navigation season on a given section of IWW E40 is between 245 and 270 days a year.

The navigable section of the E40 waterway in the Republic of Belarus starts in Brest, where the closed dam section of the Mukhavets river flows into the Bug river. At a distance of 61.99 km, a river port (Brest) and three navigable locks are situated,

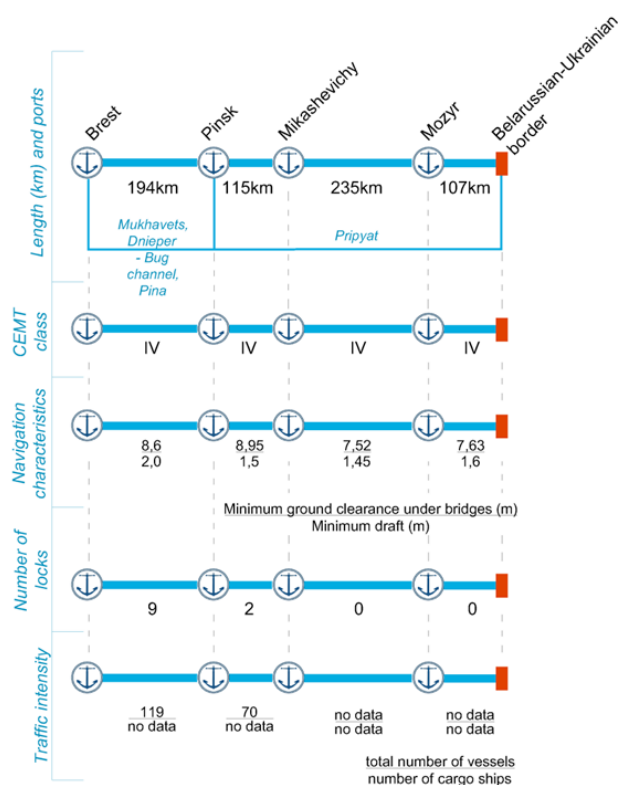


Fig. 1. Scheme of the Belarusian part of international waterway E40. Source: Own elaboration of Maritime Institute in Gdansk - Department of Economics and Law.

on the water nodes: no. 10 Triszyn (Brest), no. 9 Nowosady and no. 8 Zaluzie (both in the Zabinecki region). Because of recent reconstruction of these locks, they meet the requirements of European standard class Va.

In the years 1775-1783, between Pina and Mukhavets rivers, a channel was dug, which was named the Royal Canal. In the nineteenth century, another straightening channel was dug with improved parameters of shipping - Dnieper-Bug Channel (DBC), and the Royal Canal served only as a means to evacuate flood waters and supply water to the navigation channel. DBC joins with the Mukhavets river in Kobrin, and runs along the sparsely populated agricultural areas. The length of the section from the Mukhavets junction with DBC to water junction no. 2 Pererub (Janowski area) is 92.42 km.

A section of the Pina river from the water junction no. 2 Pererub to the Pripyat river mouth is channelled. Waterway passes to the south through Pinsk city, and the length of this section is 40.8 km. Pina River after 74 km flows into the Pripyat River, which connects to the Dnieper River in Ukraine. The total length of Pripyat is 755 km. The source of Pripyat is in the north-western part of Ukraine; the river flows northeast over the border with Belarus, from Mazyr further southeast back to Ukraine before the city of Pripyat, and after a few kilometres flows into the Dnieper.

According to the "List of the most important barriers and missing links in the network of waterways category E" (Resolution No.

49 dated October 24th 2002 of Working Group on Inland Water Transport of UN European Economic Commission) section of E40 route Brest - Dnieper-Bug channel - Pinsk - Pripyat to the border with Ukraine belongs to the “strategic barriers”, i.e., sections where parameters comply with the basic requirements of class IV but should be modernized to improve the structure of the network<sup>1</sup>.

### Border section as a missing link of E40 waterway on the Polish-Belarusian border

The study of the Belarusian part of an international waterway E40 paid attention to the connection of the Mukhavets - Bug. On the Polish-Belarusian border between Mukhavets and the Bug is a fortress of Brest with high historic and cultural value to the most outstanding fortification objects of the XIX/XX century. The route of the section connecting the Polish part of the waterway with the Mukhavets river must be done so as not to violate the fortifications.

Because of the objections to modernisation of the Bug river on Polish territory, it was decided to opt out of this for environ-

mental reasons; the section should be treated as a link of the new channel (Vistula - Terespol) with Mukhavets. This section is navigable only in Belarus - a port of Brest.

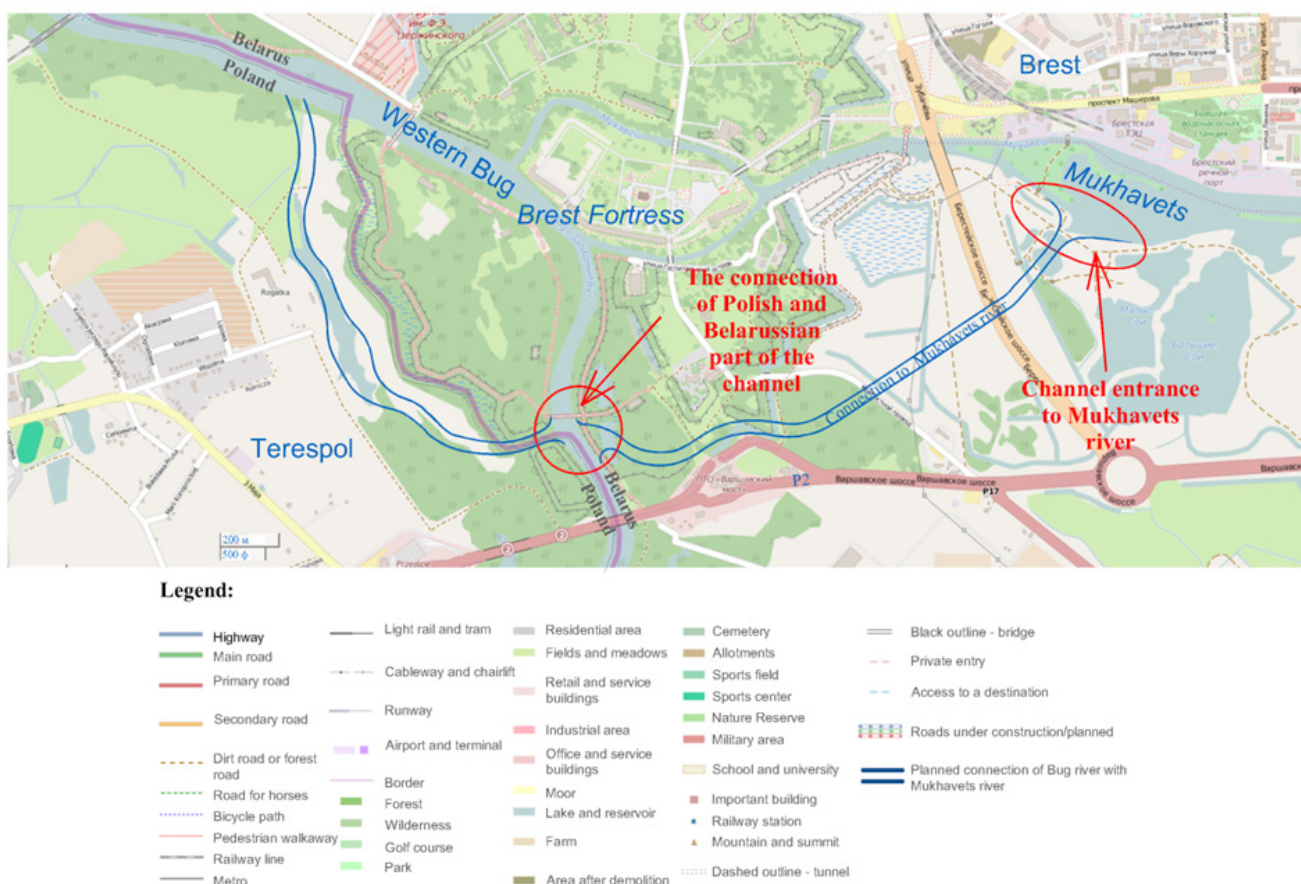
Construction of the waterway with the required parameters along the whole length of the route is possible by implementing one of the three technologies:

- ◆ Construction of a new bypass channel around Brest,
- ◆ Construction of a new channel through Brest,
- ◆ Carrying out repair work on the existing channel.

The specific location of the link to the given section with the new channel (Vistula - Terespol) on Polish territory would be determined at the stage of project documentation, after the final route of the new channel is determined.

Despite the final variant, the analysed section should have dimensions corresponding to the minimum values for the new channel Vistula - Terespol: depth - 4 m; width - 50 m, the radius of curvature – 650 m. This is due to the possibility of creating a multimodal logistics center in Brest: river vessels with a draft of 2.8 m along the restored waterway would reach Brest from Warsaw, where handling operations would take place, cargo would be shifted on to the trucks, wagons or

<sup>1</sup> Blue Book. (2006). Inventory of Main Standards and Parameters of the E Waterway Network “Blue Book” First Revised Edition, Economic Commission For Europe, Inland Transport Committee (ECE/TRANS/SC.3/144/Rev.)



**Fig. 2.** First variant of Vistula – Mukhavets channel connection.  
Source: Maritime Institute in Gdansk - Department of Economics and Law, own elaboration based on OpenStreetMap and materials of the National Academy of Sciences of Belarus

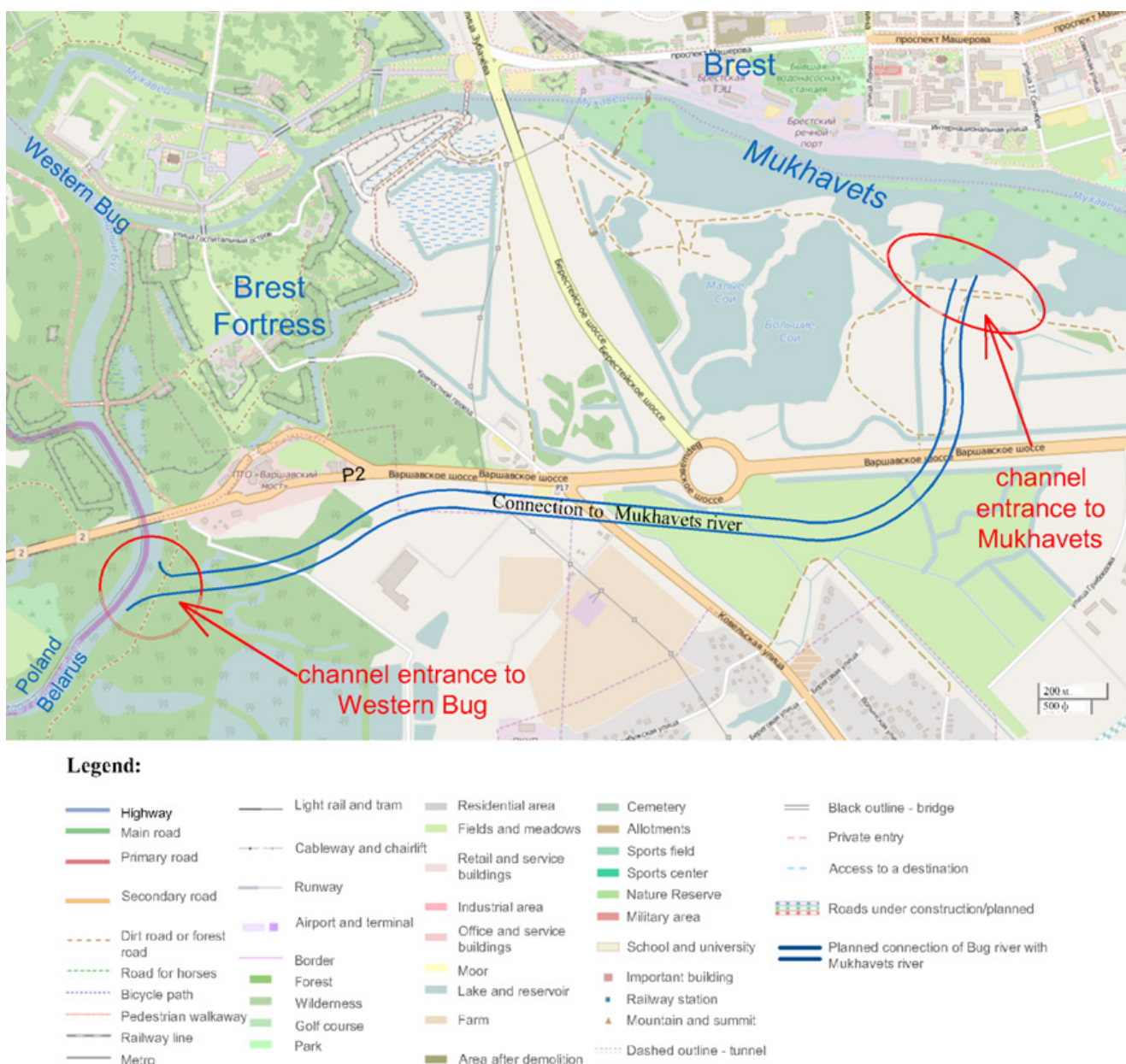


Fig. 3. Second variant of Bug–Mukhavets channel connection.  
Source: Own elaboration of Maritime Institute in Gdansk - Department of Economics and Law.

smaller vessels - up to 2 m draft to be taken by water toward Kiev and Kherson.

Construction of a new bypass channel around Brest would be pointless, since:

- ◆ This would require a wide range of investments, such as:
- ◆ construction of an additional shipping channel with min. length of 20-30 km,
- ◆ reclassification of large land areas, including agricultural land,
- ◆ construction of at least 3-5 bridges,
- ◆ construction of various types of hydrotechnical infrastructure.
- ◆ existing infrastructure that may allow for future organisation of multimodal transport would not be used effectively:

- ◆ Brest is a big transportation hub, connecting road and railway transport (normal and wide-gauge tracks), through which large cargo volumes are handled,
- ◆ Brest water infrastructure is well-developed (navigable route on Mukhavets river, port of Brest, lock on water junction no. 10 Triszyn reconstructed in 2012 with the most lockages on the Dnieper-Bug channel).

Construction of a new water channel through Brest admittedly requires lower expenditures, but in this case, it is necessary to significantly change the general plan of city infrastructure development. The most realistic variants seem to be two connections extending outside the complex of Brest Fortress.



**Fig. 4.** Scheme of Bug river and Mukhavets river connection through historical area of Brest – Brest Fortress  
Source: Materials from second proceedings of the E40 Commission Meeting in Brest, November 17, 2015

### First variant of Bug – Mukhavets connection

The first variant envisages that the channel will be connected to the Bug River in the vicinity at 284 km, about 350 meters north of the national road no. 2 (NR 2). Further, the channel will run between Brest Fortress and NR 2 and turn to the Mukhavets river near the Brest river port. If the first variant of the route channel Vistula – Terespol is chosen, to bypass the Brest Fortress, there will be a need to perform an additional bypass on the Polish side. The first variant is presented on fig. 2.

### Second variant of Bug – Mukhavets connection

The route of the second variant begins at the entrance to the Bug river, about 200 meters south to the NR 2. It runs between buildings and NR 2, which intersects and creates the need for construction of a hydrotechnical building, i.e., bridge for NR2 or water bridge for channel. It ultimately joins the Mukhavets river approximately 1 km east to the first connection variant. The second variant is presented on fig. 3.

### Third variant of Bug – Mukhavets connection

During the second meeting of the Commission for development of the E40 waterway on Dniepr-Vistula Section in

Brest on November 17, 2015, a new variant of the connection of the Bug River with the Mukhavets river was presented (Fig. 4)<sup>2</sup>. The Commission includes 76 experts and four working groups:

Working Group 1. Development of water transport and cross-border economic development.

Working Group 2. E-40 waterway in the context of spatial development of cross-border regions.

Working Group 3. Cross-border water resources and environment.

Working Group 4. Promotion of restoration of the Dnieper-Vistula waterway connection at the European national and regional levels.

The concept assumes to carry out the required hydrotechnical works to revive shipping on the E40 waterway passing through the Brest area on the historically formed waterway: from the Mukhavets river – with existing riverbed - to Bug river. According to the Commission, the proposed variant is optimal in terms of planning and in terms of necessary investment expenditures.

<sup>2</sup> The concept was recommended for further investigation, according to the minutes of the meeting of representatives of organizations concerned and with the participation of Deputy Chairman of the Brest Regional Executive Committee W. Je. Sakowski held in Brest on November 6, 2015.

The decision on the route variant of the connection between the Vistula-Bug channel with Mukhavets river requires further analysis. In the opinion of the experts, the final decision should be taken at the preparation stage of investment implementation.

## Role of Dnieper – Bug channel in Bug river and Mukhavets river

Dnieper-Bug channel (D-BC), crossing the watershed between the two rivers, is divided into three distinct parts:

- ◆ western section with a length of 64 km from Brest to Kobryn,
- ◆ watershed section with a length of 58 km from Kobryn to Lachowicze in the Drohiczynski area,
- ◆ eastern section with a length of 47 km from Lachowicze to Duboj village.

The main part of the channel has a length of 156 km and a catchment area of 8,500 km<sup>2</sup>. A channel width of 40 m, at a depth of 2.4 m in normal operation, changes the cross-section into half trench - half embankment.

There is no direct connection by inland waterway between Dnieper-Bug channel and Western Europe. The reason for this is the location of a fixed lock on the Mukhavets river in Brest. For the successful implementation of the revitalization project along E40 waterway, it is necessary to solve the problems of reconstruction of D-BC and necessary hydrotechnical structures and provide adequate water supply.

The need to improve water relations in D-BC is due to problems of technical and ecological nature. Periodic shortages of water on the watershed are strictly connected with water collection in dry years from the upper Pripjat river in Ukraine by the Power System of White Lake (PSWL).

## Assessment of possible impact of an improved E40 waterway

Infrastructure of inland waterways has several important functions related to flood protection, retention of water, energy, tourism, recreation, public utilities, etc. Inland waterway transport is one of the cheapest and most environmentally friendly modes of transport. It is characterized by: a) lowest energy consumption, b) low emission of air and water pollutants, c) low external costs, and d) low accident rate<sup>3</sup>.

Revitalization of inland waterway E40 by connection between the Mukhavets and the Bug, apart from those indicated above measurable socioeconomic benefits and costs, will evoke costs and benefits that cannot be expressed in numerical values, including:

- ◆ Improving flood protection,
- ◆ Improving the water supply of the population and business,
- ◆ Retaining water and possibility to tackle drought,

- ◆ Developing the regions, in particular, as a result of the investment,
- ◆ Increasing the investment attractiveness of regions,
- ◆ Creating new jobs,
- ◆ Improving transport accessibility,
- ◆ Improving the transport density of the area influenced by the investment,
- ◆ Strengthening international cooperation,
- ◆ Promoting a sustainable development idea,
- ◆ Extending the service offer of economic centers, etc.

The analysis of impact of connection between the Mukhavets and the Bug river as an element of International Waterway E40 considers both positive and negative externalities:

Impact on the transport system - the cost of transport, routing, mode selection, the choice of time of departure and arrival - made by the users of the part of the network covered by the project of revitalization E40.

Effects on behaviour choices within the transport system carried onto other network users who are not users of the network, (e.g., possible modal shift at the area of the waterway investment).

Effects outside the transport network as a result of the project of connection between the Mukhavets and the Bug river on transport infrastructure, including general changes in productivity, employment, and population of residents in specific locations (e.g., households moved into the city due to better connection with job market thanks to the new connection).

The impact on the selection of the transport mode in other markets (real estate markets, labour market, product markets, and capital) because of changes in the total costs<sup>4</sup>.

## Conclusions

Undoubtedly, inland waterways and other transport routes are among the factors integrating economic space. Transport and tourist use of E40 IWW will contribute to the economic integration of Eastern Europe with EU countries and will improve the competitive position of Poland and other countries and regions along this route. It is especially important to increase the attractiveness of the regions economically lagging behind and generate development impulses for improving economic efficiency. Transport infrastructure, including the infrastructure of inland waterway transport, plays a key role in developing economic ties and creating growth poles. Taking these factors into account, it is important to streamline E40 IWW over its entire length through the liquidation of barriers and alleviation of bottlenecks. The article presents consequences of "bottlenecks" and the steps that should be taken to remedy the situation.

<sup>3</sup> Program rozwoju infrastruktury transportu wodnego śródlądowego w Polsce, Część 1. Analiza funkcjonowania transportu wodnego śródlądowego oraz turystyki wodnej w Polsce. Ecorys. Warszawa, Rotterdam 2011.

<sup>4</sup> Kalinowski M., Koba R., Kowalczyk U., (2016). Using cost-benefit analysis as a method of more efficient allocation of inland waterway E40 resources. Bulletin of the Maritime Institute in Gdańsk Volume 31 No. 1

Most of the E40 IWW has large capacities, but its full use is hindered by several “bottlenecks” caused by small transit parameters, small bridge span, and lock dimensions, which limit its competitiveness in relation to other modes of transport, including road and rail. A development plan should be implemented for the improvement and maintenance of waterway infrastructure and transshipment points to improve pan-European inland waterway transport, while respecting the requirements in environmental protection. The network of waterways according to the assessment of the EU can handle 425 million tons of cargo annually. At the same time, current investment

policies of some governments were criticised, observing it gives priority to other branches of transport and does not put enough stress on maintenance of waterways and eliminating “bottlenecks” in the network. The European Commission forecasts that, of all modes of transport, inland waterways will be recorded until 2020, with the largest increase in freight traffic in Europe.

The above article presents consequences of “bottlenecks”, and necessary steps should be taken by the governments of the countries along IWW E40.

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