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**Location of river cargo ports on the Odra Waterway - the results of the analyzes  
Szczecin and Świnoujście Seaports Authority**

**Abstract:** Studies on the location of river ports along the Odra Waterway (ODW), the Silesian Canal and the Polish section of the Danube-Odra-Elbe Canal (DOL) have been completed. The multi-criteria analysis of the transport and economic potential of the ODW allowed to determine the location of transport nodes and river ports and to define their categories. The indicated river ports should constitute future concentration points for transport and logistics services. This is especially important in the context of the update of the European TEN-T network, which is planned for 2023. Hence, the key recommendations relate to nine new international transport nodes and trimodal ports located therein.

**Keywords:** River ports; Transport nodes; Cargo port

**Introduction**

Works on the project of the Odra Water Road Development Program are close to completion. Its purpose is to adapt the Odra Waterway (ODW) to the Va navigability class, following the AGN Agreement (AGN Agreement - European Agreement on the Main Inland Waterways of International Importance (Journal of Laws of 2017, item 1137)), ratified by Poland in 2017 and the construction of its connections with other waterways. In operational practice, this means the possibility of transport in self-propelled inland waterway vessels with a maximum length of 110 m, a maximum width of 11.40 m, and a maximum draft of 2.80 m. The load capacity of such a vessel is from 1500 to 3000 tons, which can be transported at one time in inland relations. Although the

prospect that such large barges will sail from Ostrava or Kraków to Świnoujście seems distant in time, it should already be taken into account in the developed programs and development strategies. Transport infrastructure development plans are being prepared at the European, national, regional and local levels, in which it seems necessary to take into account the potential of the modernized Odra Waterway. Hence the need to indicate possible port locations that will be served by river units.

Established in the Szczecin and Świnoujście Seaports Authority (ZMPSiŚ) in 2017, the Odra Waterway Office prepares analyzes and technical concepts for the modernization of the OHH and the construction of the Silesian Canal and the Polish section of the Danube-Odra-Łaba Canal (DOL). The planned Silesian Canal will allow access to the inland waterway of international importance (category E) to those areas of the country that have not had such access so far. It will also connect the canalised section of the upper Vistula with the Odra Waterway. In turn, the DOL canal will constitute a new connection of the OHH with the European network of inland waterways. The documentation prepared at ZMPSiŚ will be the basis of the Odra Waterway Development Program. The completed works include analyzes of the location of river ports along the Odra River and the planned canals [7, 8, 9]. Based on the transport and economic potential of the OHH, i.e. the international E30 waterway, the places where the river cargo ports should be located, taking into account their categories, have been identified. In the context of the update of the European TEN-T network, which is planned for 2023 and preparations for the new EU financial horizon 2021-2027, it is worth presenting the results of these analyzes in more detail.

### **Methodological assumptions**

Due to the separate hydrological and technical conditions and transport characteristics, the analysis was divided into:

- a section of the freely flowing Odra on which the construction of barrages is planned, from the Malczyce barrage to Bielinek;
- the canalised section of the Odra River from Kędzierzyn Koźle to the Malczyce barrage;
- The Silesian Channel and the Polish section of the DOL Channel - according to the course of the preliminary route variants.

The following four assumptions were made.

- 1) The selected sections of the OHH will achieve the parameters of an international waterway in the class Va for navigability, while the Silesian Canal and the DOL canal are to be of the Vb class.
- 2) The main hydrotechnical structures for the river will be modernized or planned water steps.
- 3) The new navigational conditions at OHH will differ so significantly from the current and historical navigational conditions that all potential port locations have been taken into account, including existing port locations, historical locations, and locations related to the construction of dams.
- 4) Account is taken of the current and forecast demographic and economic conditions affecting the functioning of the river port as a transport node, which is understood as the point of intersection of at least three transport routes.

The comparative analysis was carried out first for all potential port locations and then for locations grouped according to their spatial assignment to a specific common transport base. The purpose of grouping was to select locations with the greatest regional potential. As a result, the selected ports-transport nodes, evenly distributed along the OHH, will not compete with each other.

The assessment of the location of the ports was multi-criteria and was made based on [1, 2, 6]:

- technical criteria related to the assessment of the technical potential of the port area (port basins, quays, storage yards and warehouses, the most important transshipment facilities) and the assessment of the potential access infrastructure to the port (circular roads, railway lines);
- economic criteria related to the assessment of economic and demographic potential in the so-called areas of gravity;
- environmental criteria related to the tourist attractiveness of the port and its surroundings as well as the assessment of the port's environmental impact;
- organizational and legal criteria resulting from the assessment of the conditions of port infrastructure management and operating activities.

Data necessary to perform the analyzes came from many sources. They consisted of legal acts, transport policy documents, statistical data, results of own surveys of municipalities, and data obtained directly from the market from waterway managers, roadway managers, railway infrastructure managers, logistic operators, and freight forwarders [3, 4, 5]. Spatial analyzes were performed with the use of GIS IT tools with the use of dedicated computational models.

For the analyzes, the following categories of cargo ports were adopted:

- **Trimodal river ports** serving the means of water, rail, and road transport, which should be located in international transport nodes;
- **bimodal river ports** serving the means of water and road transport, which should be located in national transport nodes;
- **reloading points**, which should be located in local transport nodes.

The location of river cargo ports was determined in the following stages:

- 1) inventory of transport and industrial infrastructure, taking into account development plans,
- 2) identification of potential locations of river cargo ports,
- 3) assignment of potential port locations of transport nodes together with the definition of their category,
- 4) designation of the location and definition of the category of river cargo ports.

In cases where different categories of transport nodes have been identified for neighboring ports, it was assumed for this article that ultimately there will be a node with the highest of the identified categories.

### **Analysis results**

Based on the analysis, it is recommended to create:

- on the free-flowing Odra section from the Malczyce barrage to Bielinek - 17 new ones and extension of the 3 existing cargo ports (Fig. 1);
- on the canalised section of the Odra River from Kędzierzyn Koźle to the Malczyce barrage - 13 new ones and the expansion of 6 existing cargo ports (Fig. 2);
- on the Silesian Channel and the Danube-Odra-Laba Channel - 8 new river cargo ports (Fig. 3).

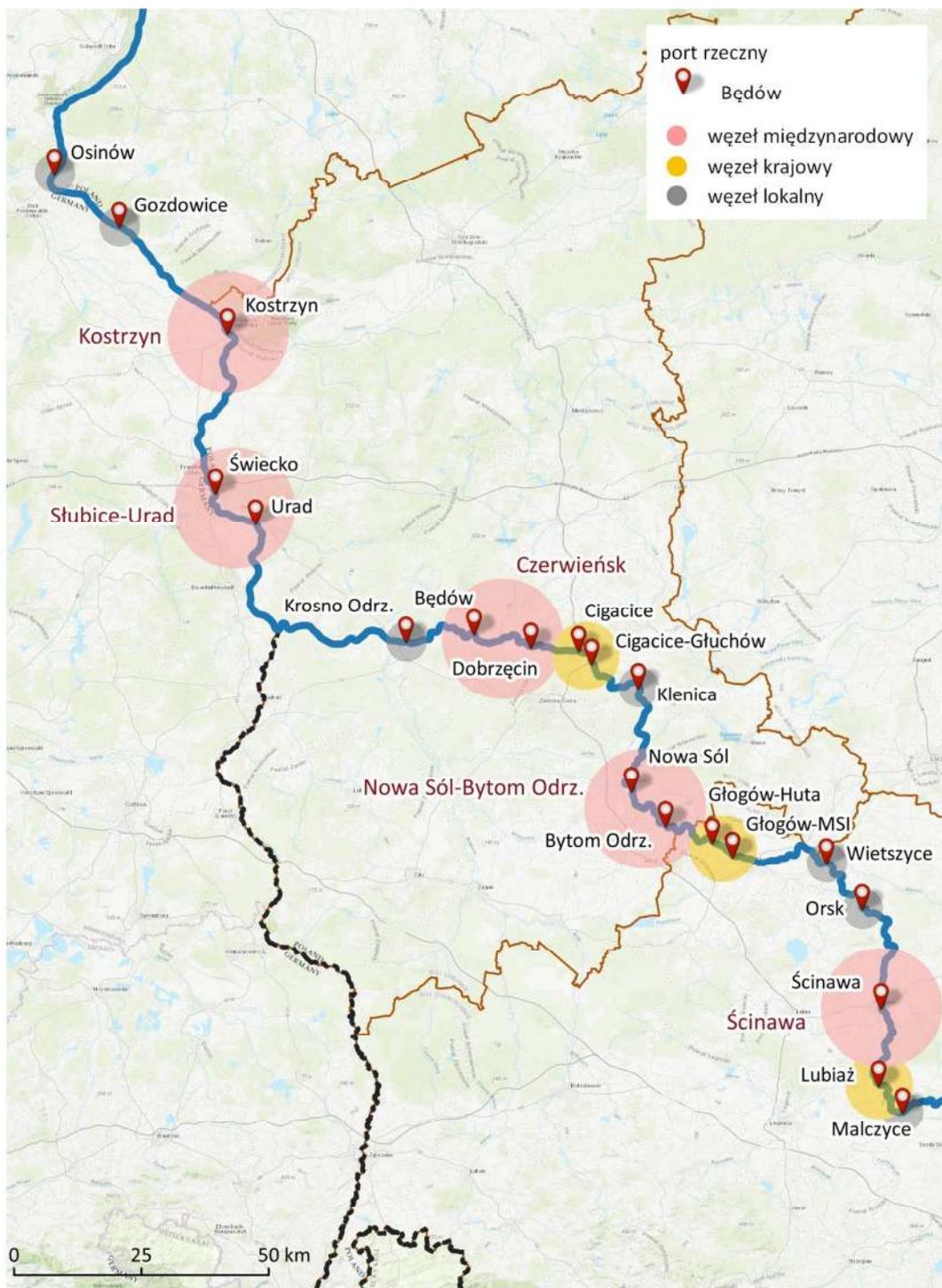
These ports are listed in Table 1.

**Tab. 1.** Recommended cargo river ports on the Odra Waterway

| No  | River port name    | development /new | ODW km      | Port category           | Transport node |
|---|--------------------|------------------|-------------|-------------------------|----------------|
| <b>The Odra River flows freely from the Malczyce barrage to Bielinek</b>      |                    |                  |             |                         |                |
| 1   | Malczyce           | development      | 304,7       | tri-modal               | local          |
| 2   | Lubiąż             | new              | 313,7-316,5 | bimodal                 | national       |
| 3   | Ścinawa            | new              | 330,2-332,0 | tri-modal               | international  |
| 4   | Orsk               | new              | 358,0       | transshipment point     | local          |
| 5   | Wietszyce          | new              | 373,8       | transshipment point     | local          |
| 6   | Głogów MSI         | new              | 397,4       | trimodal (main in node) | national       |
| 7   | Głogów Huta        | new              | 402,3       | tri-modal               |                |
| 8   | Bytom Odrzański    | new              | 415,0-423,0 | tri-modal               | international  |
| 9   | Nowa Sól           | new              | 423,0-428,0 | tri-modal               |                |
| 10  | Klenica            | new              | 450,2-453,1 | transshipment point     | local          |
| 11  | Cigacice-Głuchów   | new              | 466,8-472,2 | bimodal (main in node)  | national       |
| 12  | Cigacice           | development      | 471,8       | bimodal                 |                |
| 13  | Dobrzęcin          | new              | 481,4       | trimodal (main in node) | international  |
| 14  | Będów              | new              | 495,0       | transshipment point     |                |
| 15  | Krosno Odrzańskie  | new              | 512,8-516,1 | tri-modal               | local          |
| 16  | Urad               | new              | 567,2       | trimodal (main in node) | international  |
| 17  | Świecko            | new              | 578,9       | bimodal                 |                |
| 18  | Kostrzyn           | development      | 617,6       | tri-modal               | międzynarodowy |
| 19  | Gozdowice          | new              | 645,3       | transshipment point     | local          |
| 20  | Osinów Dolny       | new              | 662,8       | transshipment point     | local          |
| <b>The Odra River canalised from Kędzierzyn Koźle to the Malczyce barrage</b> |                    |                  |             |                         |                |
| 1   | Kędzierzyn Koźle - | development      | 98,1        | trimodal (main in node) | local          |

|  |                                     |             |   |                            |               |
|--|-------------------------------------|-------------|---|----------------------------|---------------|
|  | Kłodnica                            |             |   |                            |               |
| 2  | Kędzierzyn<br>Kozle -<br>Blachownia | new         | 98,1 (9,5<br>The<br>Gliwicki<br>Canal)    | transhipment<br>point      |               |
| 3  | Kędzierzyn<br>Kozle - Azoty         | development | 98,1<br>(5,6 The<br>Kędzierzyn<br>Canal)  | transhipment<br>point      |               |
| 4  | Krapkowice                          | new         | 125,3                                     | trimodal (main<br>in node) | international |
| 5  | Chorula                             | development | 133,0                                     | bimodal                    |               |
| 6  | Opole -<br>Metalchem                | development | 143,0                                     | transhipment<br>point      | national      |
| 7  | Opole –<br>Półwieś                  | new         | 154,5                                     | trimodal (main<br>in node) |               |
| 8  | Opole -<br>Zakrzów                  | development | 154,7                                     | transhipment<br>point      |               |
| 9  | Opole -<br>Elektrownia              | new         | 161,6                                     | tri-modal                  |               |
| 10   | Mikolin                             | new         | 175,5                                     | transhipment<br>point      | local         |
| 11   | Brzeg - Pawłów                      | new         | 196,2                                     | trimodal (main<br>in node) | national      |
| 12   | Brzeg Wyspa                         | new         | 197,6<br>(1,9 The<br>Odra River<br>canal) | transhipment<br>point      |               |
| 13   | Brzeg -<br>Stocznia                 | new         | 197,7                                     | transhipment<br>point      |               |
| 14   | Oława -<br>Ścinawa                  | new         | 212,9                                     | bimodal (main<br>in node)  | local         |
| 15   | Oława - Kanał                       | development | 213,0 (1,1<br>Canal to<br>the Lock)       | transhipment<br>point      |               |
| 16   | Czernica                            | new         | 229,0                                     | tri-modal                  | national      |
| 17   | Wrocław –<br>Kowale                 | new         | 244,2 (3,4<br>Shipping<br>Channel)        | transhipment<br>point      | international |
| 18   | Wrocław –<br>Rędzin                 | new         | 256,6                                     | trimodal (main<br>in node) |               |
| 19   | Brzeg Dolny                         | new         | 282,6                                     | transhipment<br>point      | local         |
| <b>The Silesian Canal and the Danube-Odra River-Laba canal</b> |                                     |             |   |                            |               |
| 1  | Rybnik Stodoły                      | new         | The                                       | tri-modal                  | local         |

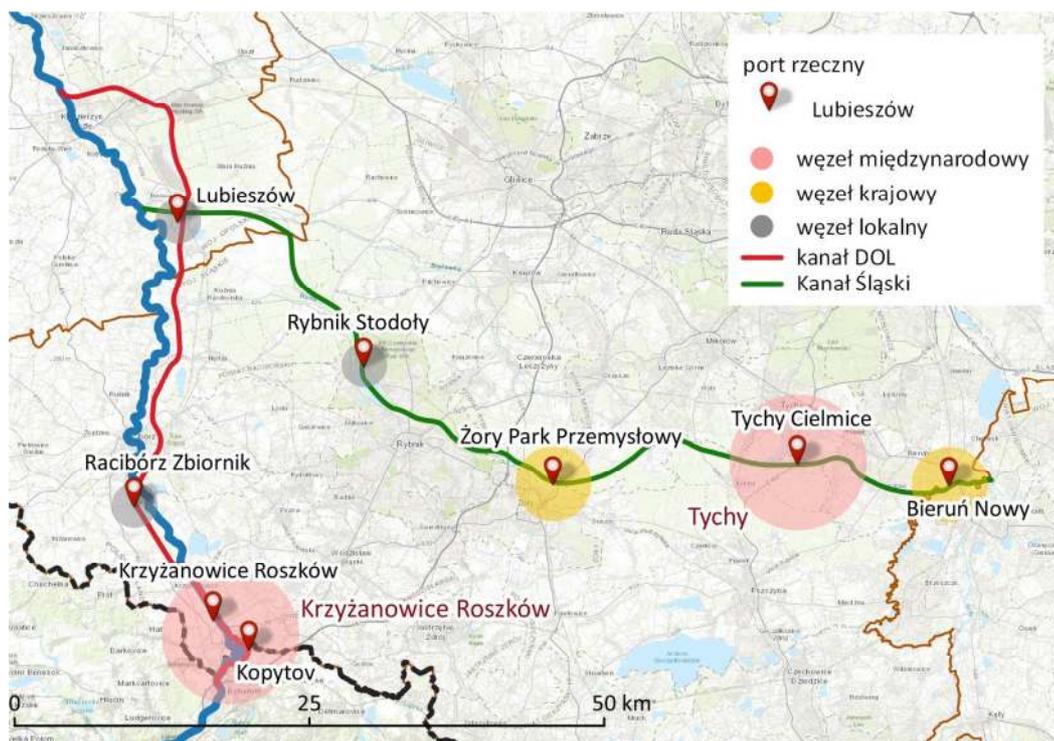
|   |                       |     |  |                         |               |
|---|-----------------------|-----|--|-------------------------|---------------|
|   |                       |     | Silesian Canal 26,3 km   |                         |               |
| 2 | Żory Park Przemysłowy | new | The Silesian Canal 46,3 km   | tri-modal               | national      |
| 3 | Tychy Cielmice        | new | The Silesian Canal 68,2 km   | tri-modal               | international |
| 4 | Bieruń Nowy           | new | The Silesian Canal 82,4 km   | tri-modal               | national      |
| 5 | Lubieszów             | new | DOL Channel - south of the intersection of the DOL Channel with the Silesian Channel | tri-modal               | local         |
| 6 | Racibórz Zbiornik     | new | DOL Channel - the north-west bank of the Racibórz Dolny Reservoir                    | tri-modal               | local         |
| 7 | Krzyżanowice Roszków  | new | DOL channel - below the railway bridge (line 158)                                    | tri-modal               | international |
| 8 | Kopytov               | new | DOL Channel - east of the "Graniczne Meandry Odry" in the Czech Republic             | trimodal (main in node) |               |



1. Cargo river ports on the free-flowing section of the Odra River from the Malczyce barrage to Bielinek



2. River cargo ports on the canalised section of the Odra River from Kędzierzyn Koźle to the Malczyce barrage



3. River cargo ports on the Silesian Channel and the DOL Channel

For the needs of the current update of the European TEN-T network, the most important are the recommendations for international nodes and the tri-modal ports located in these nodes. The analyzes revealed nine such ports:

*The Odra River flows freely from the Malczyce barrage to Bielinek*

- 1) the port of **Ścinawa** in the Ścinawa junction;
- 2) the port of **Nowa Sól** or **Bytom Odrzański** at the Nowa Sól-Bytom Odrzański junction;
- 3) **Dobrzęcin** port in the Czerwiensk junction;
- 4) **Urad** port at the Słubice-Urad junction;
- 5) **Kostrzyn** port in the Kostrzyn junction;

*The Oder canalised from Kędzierzyn Koźle to the Malczyce barrage*

- 6) the port of **Krapkowice** in the Krapkowice junction;
- 7) port of **Wrocław Rędzin** at the Wrocław junction;

*The Silesian Canal and the Danube-Oder-Laba canal*

- 8) the port of **Tychy Cielmice** in the Tychy junction;
- 9) **Kopytov** port at the Krzyżanowice-Kopytov junction.

All the above ports should be points of concentration of transport and logistics services in the indicated nodes of the TEN-T network. It is worth noting that the vast majority of the indicated locations are new international nodes and should complement the existing TEN-T nodes integrating road and rail transport.

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