

## The concept of inland shipping service to the Container Terminal Świnoujście

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### Abstract

In the paper the concept of the system of inland shipping connections to the proposed deep-water Container Terminal Świnoujście is presented. In the introduction argumentation for the container terminal in the port of Świnoujście investment is given. The terminal is briefly described in terms of its infrastructure and operating assumptions. In the next part, the determinants that affect connections between sea container terminal and its hinterland are discussed. The most important part of the work is devoted to the characteristics of the planned inland shipping connections, including: a description of the units, routes and organizational-economic assumptions. The work ends with conclusions that contain a description of the potential sea-land transport chains passing through the Container Terminal Świnoujście.

### Introduction

Containerisation should be understood nowadays not only as the technology, but the transport system. That system dominated the world trade and it's hard to find among the large ports one without a container terminal. Port that does not handle containers usually specializes in handling bulk or liquid cargoes and does not have any general cargo terminals. The process of transformation from a specialised terminal into the universal port that handles all possible cargoes forces the implementation of the container technology. The process of investing in container terminals is very common in Europe, especially in the eastern part of the continent, which is relatively technologically underdeveloped. Examples of such activities are investments in container terminals in the ports of the mouth of the Oder River. These investments include the expansion of the Container Terminal in Szczecin, and the construction of the deep-water container terminal in Świnoujście.

The Szczecin-Świnoujście port complex despite the container-handling potential, which exists in the port of Szczecin since the mid-70s, is connoted as bulk cargo port. Currently the only container terminal is operated by the company of DB Port

Szczecin and belongs to the small terminals with local coverage and this translates into a significant container turnover. Cargo turnover does not exceed 0.1 million TEU and there is no upward trend (Fig. 1). Containers come to Szczecin from the ports of West European container hubs: Hamburg, Bremerhaven, Rotterdam and Antwerp. Terminal DB Port Szczecin specializes in minor cargo consignments and smaller shippers / consignees. The core terminal hinterland is within a radius of ca. 150 km, and is serviced with the use of road transport. There are no regular rail services and no inland shipping services connecting port terminal with its distant hinterland.

Further considerations concern the particular operational aspect of the projected deep-water Container Terminal Świnoujście, the system of inland shipping container connections. The port of Świnoujście has a natural ability to use the Oder River, as a transport corridor leading to the port. Obvious benefits resulting from the use of environmental-friendly and relatively cheap inland shipping transport argue in favour of that sea port-hinterland system. The paper postulates it should be from the beginning of the main operational assumptions for the Container Terminal Świnoujście.

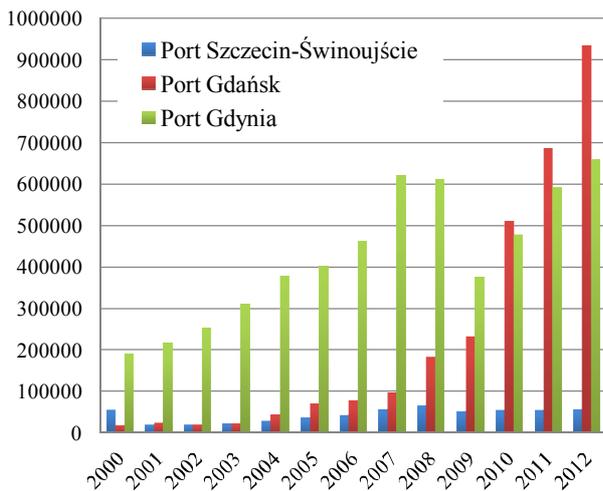


Fig. 1. Volume of container throughput in Polish ports in 2000–2012 [own study on the basis of GUS data]

### Description of the Container Terminal Świnoujście

The study commissioned by the port of Świnoujście, worked out in 2009, assumes situating the container terminal at the Hutników Quay [1]. The terminal would have at its disposal a 410 meters' quay, created by the extension of the Hutników Quay by filling up the Trymerski Basin. At present, at the quay there can berth the biggest ships handled in Świnoujście Port, i.e. with the length of 270 m and draught of 13.2 m, which corresponds to a container ship with a capacity of 4200 TEU. The planned terminal will be situated on the area of 20 ha, including among others: the covered warehouse of 5800 m<sup>2</sup> and the adjacent terrain of about 4 ha at the back of the Chemików Quay (Fig. 2).

By design, the terminal will offer two ship berths situated at the 410 m long quay. One equipped with one and the second equipped with two ship-to-shore gantry cranes. The total handling capacity of a thus equipped quay was described at about 200 thousand TEU per year (transshipment capacity has been determined for a three shift labour during 300 days in a year, with the use of the technical capacity coefficient of 0.6 and the ship call unevenness coefficient of 1.2). Actual turnover of the planned terminal is, of course, a function of many variables. The most important one seems to be adaptation of the terminal's offer to the needs of the sea-land transport chains that run through Eastern Europe. Container Terminal Świnoujście should become a port hub connecting container shipping lines with efficient connections port-hinterland. The criteria of the total time and the cost of the door-to-door carriage determine the shippers' choice referred to the transport chain. Considerations of the development of the container terminal-hinterland transport network will be discussed in the following section.

### Analysis of possibilities for port-hinterland intermodal connections

The geographical location of the ports of Szczecin and Świnoujście is very favourable towards areas of the crossing with transportation routes from Scandinavia in the direction of Southern and Western Europe, as well as the East-to-West ones. The Western location of the city of Szczecin itself determines great proximity to European capitals, such as Berlin, Stockholm or Copenhagen. Western

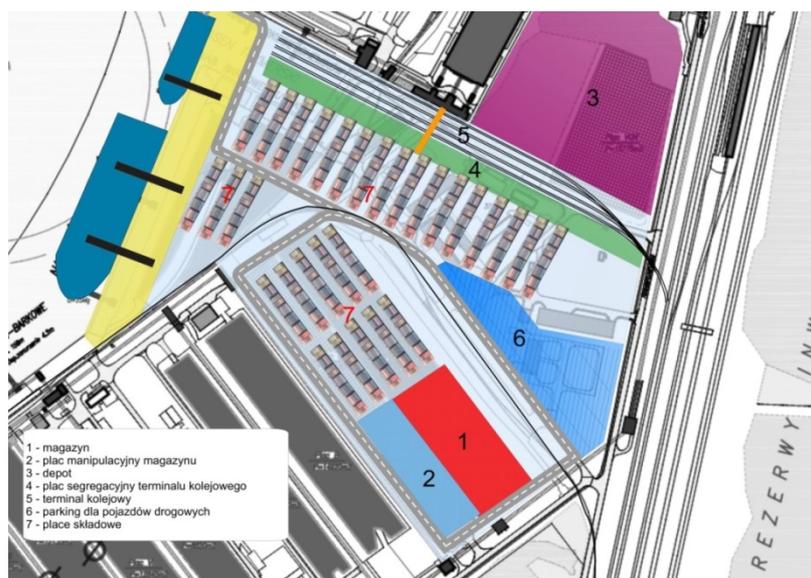


Fig. 2. Project of development of the Container Terminal Świnoujście [1]; 1 – depot, 2 – depot's handling place, 3 – depot, 4 – rail terminal's segregation place, 5 – rail terminal, 6 – parking for road vehicles, 7 – storage yards

parts of Poland (Great Poland and Silesia), Eastern Germany (especially Berlin and Brandenburg), Czech Republic, Slovakia, Austria and Hungary constitute a natural hinterland of the port of Szczecin. Considering the competition of neighbouring ports, practically the whole area constitutes a disputable hinterland.

The ports of Odra River estuary, as intermodal nodes that service transport chains to Central and Eastern Europe compete not only with sea terminals of the Tri-City but also with railway terminals situated at the hinterland, e.g. in Poznań and Wrocław, from which direct railway connections are organized to ports of Western Europe.

Hinterland transport of significant part of European ports is dominated by road transport. This transport mode is most often chosen by shippers and sponsors, because it offers a relatively short time of delivery with substantial service flexibility. Alternative transport modes have difficulties to effectively compete with road transport in the port-hinterland transport market. Most often the choice of rail transport is subject to the need to carry large amounts of cargo over a distance of more than 300 km. The choice of inland waterway transport is determined by inland waterway access allows to minimise the cost of carriage. Importantly, both operators of rail and inland waterway, in opposition to road transport operators, are expected to offer their own network of connections to intermodal terminals located in the port's hinterland. One of the most important arguments in deciding on the choice of non-road transport, beside the price is reliability and the proper frequency of service offered.

Port Świnoujście should offer its clients, including clients of the projected container terminal, an effective alternative to road transport. Although terminal will be situated at the distance of about 4 km from expressway S3, this road shouldn't be the main corridor connecting terminal with its hinterland. The S3 section between Świnoujście and Parłówek will remain a single lane road which will substantially limit its capacity. Given the variation in truck arrivals, which means periodic triplication of the number of trucks entering the terminal, it can easily predict the congestion on the main access road. An additional aspect to be taken into account, it is possibility to overlap the peak port with the increased tourist traffic during the holiday season.

Above arguments tend to accept the assumption that the share of road transport service to the terminal should not exceed 20%. It means enough heavy traffic on access road, on average 20 trucks per hour. Other modes of transport should take over the

rest of the cargo, and the share of inland waterway transport in total hinterland transport should reach up to 35%. These assumptions enforce suitable development of the terminal's area and adjustment of land-side handling technology. In particular, processes of loading/unloading barges need to be taken into consideration. It should be remembered that the increase of the share of inland shipping will result in decreasing accessibility to the quay for sea-going ships. That will be caused by the necessity to save up time from the working hours of the quay in order to handle barges.

Developing the hinterland railway to service the container terminal it is possible to introduce the network of container block trains. That type of trains run between a port terminal and an intermodal transshipping terminal. At so called hub terminal, containers after being unloaded await further loading onto a next train taking them to a destination terminal. Since 2011, there operate three big hub terminals in Poland: in Gądki close to Poznań (operator Polzug Polska), in Kutno (PCC Intermodal) and Euroterminal in Sławków (PKP). The suggested block trains to service the Container Terminal Świnoujście should initially run on the connections: Świnoujście-Gądki and Świnoujście-Sławków. The first connection is directed to clients in Poland and the second one is dedicated to clients in post USSR countries.

Introducing inland shipping connections to/from terminal depends on the navigability of the Odra River. Currently, only lower Odra, from Odra-Havel Canal to Szczecin and further via the Szczecin Lagoon to Świnoujście (the section called "Maritime Odra") fulfils the minimum conditions of a class IV international navigation allowing for transportation with barges of over 1500 tons. The currently being realized long-term "Program for Odra 2006" constitutes the strategy for the modernization of the Odra waters system. Its realization should lead, among others, to creation of stable long-route navigation on the Gliwice-Szczecin section. Unfortunately, the time perspective of realization of the program is very distant. Given the closer perspective to year 2015, there are still opportunities to run shorter, but still rational port-hinterland inland shipping connections.

### **Inland shipping service to the Container Terminal Świnoujście**

From the cargo-carrying function point of view, at present, the most relevant is connecting the ports of Szczecin and Świnoujście with Berlin via Odra-Havel Canal. Infrastructural limitations, with relation to requirements raised for container navigation

Table 1. Limitations on inland waterways on Świnoujście-Magdeburg and Świnoujście-Kostrzyn lines (own study on the basis of [2, 3])

| No.                            | Location                                                                          | Type of limitation                                                                 | Consequences of the dangers                                                                    |
|--------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------|
| <i>Magdeburg-Hohensaaten</i>   |                                                                                   |                                                                                    |                                                                                                |
| 1                              | Road and railway bridges over Odra-Havel Canal                                    | Clearance under 13 bridges is lower than 5.25 m. The smallest clearance is 4.36 m. | Restriction to pile up containers                                                              |
| 2                              | Lakes, locks and waterway crossings on Odra-Havel Canal                           | Maximum permissible vessel draught is lower than 2.2 m. The lowest one is 1.65 m.  | Restriction to vessel's capacity                                                               |
| 3                              | 23 kilometres long section of Odra-Havel Canal between Kreuzbruch and Niederfinow | Alternate one-way traffic                                                          | Possible delays in navigation                                                                  |
| 4                              | Niederfinow lift                                                                  | Dimensions of the lift 83.44 m/11.95 m/36.00 m. Small capacity of the lift.        | Restriction to vessels length down to $L = 82.00$ m and to vessels width down to $B = 9.50$ m. |
| <i>Kostrzyn-Hohensaaten</i>    |                                                                                   |                                                                                    |                                                                                                |
| 5                              | Siekierki – railway bridge (653.9 km of Odra River)                               | Clearance under the bridge is 4.14 m.                                              | Restriction to pile up containers                                                              |
| 6                              | Osinów Dolny – road bridge (662.3 of Odra River)                                  | Clearance under the bridge is 5.03 m.                                              | Restriction to pile up containers                                                              |
| <i>Hohensaaten-Świnoujście</i> |                                                                                   |                                                                                    |                                                                                                |
| 7                              | Gryfino – railway bridge (718.2 of Odra River)                                    | Clearance under the bridge is 5.17 m.                                              | Restriction to pile up containers                                                              |
| 8                              | Podjuchy – railway bridge (733.7 of Odra River)                                   | Drawbridge                                                                         | Frequency of lifting the span depends on railway traffic                                       |

with the use of push-tows loaded with two layers of containers, are shown in the table below (Table 1).

By 2015, it is planned to complete a few of the key investments in relation to the Szczecin-Berlin waterway:

- 1) Construction of Niederfinow lock;
- 2) Increasing of clearance under bridges to a minimum 4.5 m on Odra-Havel Canal;
- 3) Reconstruction of span runners of the railway bridge across Regalica River;
- 4) Waterside reinforcements of Western Odra;
- 5) Introduction of harmonized River Information System (RIS) on the lower stream section of Odra River;
- 6) Deepening of Dąbie Lake.

The effect of the above mentioned investments will be the liquidation of the biggest limitations to navigation. On the Świnoujście-Kostrzyn route, the too low clearances under the bridge in Siekierki, at the high navigable water, will remain a problem. The greater depths in those places will however allow passage under the bridges under the condition that draught of a vessel is increased, for example by filling up ballast tanks.

Taking into account above it is possible to start three inland waterways connections connecting the container terminal with the hinterland (Fig. 3):

- 1) Świnoujście-Szczecin-Schwedt-Berlin-Magdeburg;
- 2) Świnoujście-Szczecin-Kostrzyn;
- 3) Barge bridge Szczecin-Świnoujście.

The connections are feasible even with the existing technical parameters of the waterways. The efficiency of those connections would up to a great extent dependent on current water levels, especially on variable transit depths and clearances under bridges. Additionally, the connections would have to be temporarily stopped for the period when the waterways are closed by respective waterways administrations, e.g. during heavy icing or flooding. The improvement of the parameters of the waterways will happen after conclusion of the currently being realized and the planned investments on Polish and German sides.

With respect to technical parameters of inland waterways vessels carrying containers, it may be assumed that the connections to/from the terminal might be serviced by container barges currently operated by the Deutsche Binnenreederei (DBR) of the OTLogistics group, or by OBP 500 barges operated on Odra River by many shipowners. The parameters of the vessels are [4, 5]:

- 1) SL 65 Type (65 m / 9.5 m / 2.4 m) with capacity of 54 TEU (9 lengthwise, 3 rows, 2 layers) and capacity of 1190 ton;
- 2) SL 32 Type (32.5 m / 9.5 m / 2.17 m) with capacity of 24 TEU (4 lengthwise, 3 rows, 2 layers) and capacity of 530 ton;
- 3) OBP 500 Type (41.3 m / 8.98 m / 1.70 m) with capacity of 24 TEU (4 lengthwise, 3 rows, 2 layers) and capacity of 475 ton.

The above vessels are not typical container barges. The first two were adjusted to carrying

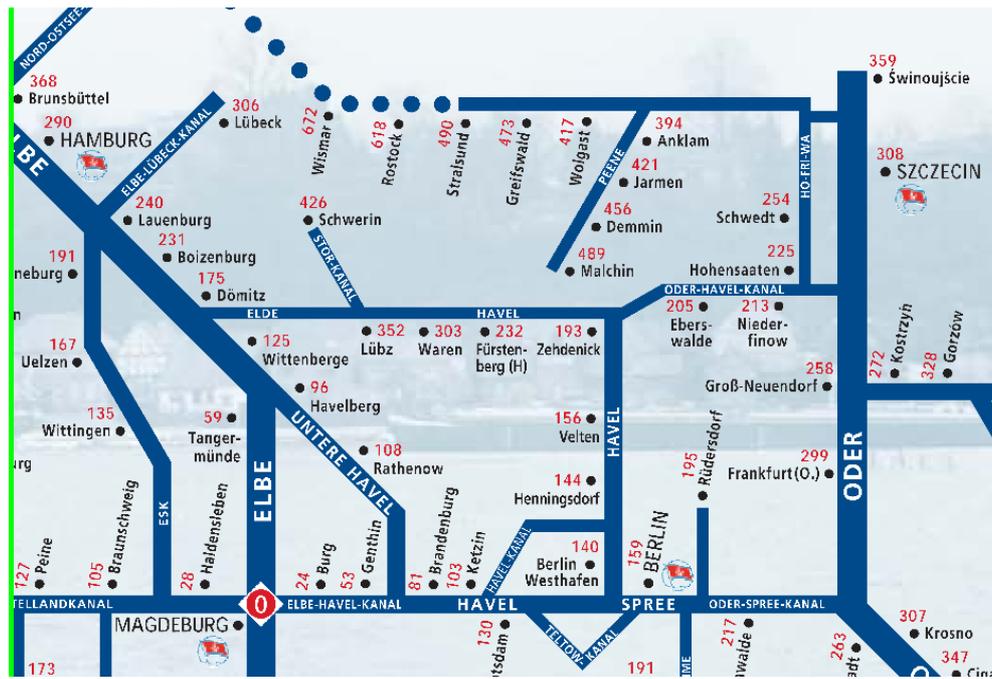


Fig. 3. Inland waterways connection Magdeburg-Świnoujście (source: Das Netz europäischer Wasserstraßen, Advertising material of Deutsche Binnenreederei; materiały reklamowe Niemieckiej Żeglugi Śródlądowej)

Table 2. Exploitation parameters of inland waterways connections Świnoujście-Magdeburg and Świnoujście-Kostrzyn [own study]

| No.                          | Parameter                  | Value                                                                                                                        |
|------------------------------|----------------------------|------------------------------------------------------------------------------------------------------------------------------|
| <i>Świnoujście-Magdeburg</i> |                            |                                                                                                                              |
| 1                            | Distance                   | 359 km                                                                                                                       |
| 2                            | Navigation time            | abt. 55 hours (on the way the units pass 6 locks and the lift at Niederfinow, which incurs possible additional waiting time) |
| 3                            | Configuration of push-tows | 4×SL 32 <sup>1</sup> or 2×SL 65, more seldom 1×SL 65 + 2×SL 32                                                               |
| 4                            | Capacity of push-tows      | 96–108 TEU                                                                                                                   |
| 5                            | Freight                    | abt. 150 EUR/full cont. 40 <sup>2</sup>                                                                                      |
| 6                            | Alternative connection     | rail, road                                                                                                                   |
| <i>Świnoujście-Kostrzyn</i>  |                            |                                                                                                                              |
| 1                            | Distance                   | 181 km                                                                                                                       |
| 2                            | Navigation time            | abt. 20 hrs                                                                                                                  |
| 3                            | Configuration of push-tows | 4 × OBP 500                                                                                                                  |
| 4                            | Capacity of push-tows      | 96 TEU                                                                                                                       |
| 5                            | Freight                    | abt. 70 EUR/ full cont. 40 <sup>2</sup>                                                                                      |
| 6                            | Alternative connection     | rail, road                                                                                                                   |

<sup>1</sup> DBR intends to use an attachable bow thruster with radar and, after obtaining a permit from the German administration, additionally attach a fifth SL 32 barge creating a push-tow 5×SL 32.

<sup>2</sup> The calculation is based on the freight rate for carriage of containers on the Hamburg-Magdeburg line amounting 120 EUR/40<sup>2</sup>.

containers by being widened by 1.3 m in order to allow loading of three rows of containers. Presently, the company DBR has 26 barges of SL 65 type and 13 of SL 32 type. The OBP 500 barges are commonly used for bulk cargoes.

Considering the current conditions of inland waterways transport in Eastern Germany operated by the company DBR, the following operational assumptions for the connections may be taken (Table 2).

The barges may be handled in river ports in Magdeburg, Berlin, Schwedt and at the container

terminals in Szczecin and Świnoujście. It is initially possible to use the existing transshipment potential of river ports after its adjustments to handling containers, among others by the use of spreaders for the existing land cranes. It is also necessary to adapt storage yards in areas of river ports to handle containers and to yard-to-semi trailer transshipments. Equipping each river port with a reach stacker will be the most suitable.

The foundation for the cooperation should be the start of regular barge transports on Świnoujście-Szczecin-Świnoujście line. That connection would

constitute an extension of sea lines calling at the Container Terminal Świnoujście, i.e. the barge bridge. Because of the possibility of handling in Świnoujście of vessels much bigger than in Szczecin Port, total costs of carrying containers to Szczecin with the use of the barge bridge may turn out to be comparable to those in the direct connection. The additional cost of transshipments sea vessel-storage yard-barge in the Container Terminal Świnoujście will be compensated by the lower sea freight to the port of Świnoujście. It's typical for container shipping, the bigger the containership the lower marginal cost of sea transport.

Finally, it is worth noting that the majority shareholder of the port of Świnoujście is OT Logistics, which is the European leader in inland shipping. The company has experience in the carriage of containers through its subsidiary Deutsche Binnenreederei AG, which in 2011, carried 92 thou. TEU, mainly in service to the port of Hamburg. It seems, therefore, OT Logistics should be the most appropriate operator for the implementation of the proposed inland transport and the correlation the connection with existing inland shipping services.

## Conclusions

Presented to the above system of inland waterways to use the Container Terminal Świnoujście is an attempt to tear down the old way of thinking about the container transport system in Poland, and

in Eastern Europe. The efficient inland shipping service to the Container Terminal Świnoujście requires breaking the longstanding habits shippers that have traditional road and rail hinterland services. Convincing operators to forgotten means of transport, which is a barge, is the challenge in terms of logistics and marketing. It should be necessary to develop a comprehensive, competitive and reliable door-to-door intermodal offer including carriage by sea, river and road. It is important at the same time, to rail transport and river not competed with each other but complement each other. Moreover, it would be necessary to keep this intermodal offer by the longest possible time, a minimum of two years, even though the initial phase unprofitability. Every innovative logistics product has to defeat customers' mistrust and their confidence in a new solution, it is the key to a stable position in the market.

The terminal services in the scope of hinterland transport should be technologically and organisationally integrated with the services relating sea container lines. Thanks to that, the terminal will fulfil the role of an efficient link in sea-land transportation chains. The quicker and smoother the ship-yard-wagon, ship-yard-barge and ship-yard-truck handling operations are the higher competitiveness of serviced transportation chains. On the basis of the conducted analyses it is possible to propose a scheme of integration of cargo streams handled at the terminal, with division by direction (Fig. 4):



Fig. 4. Sea-land transportation chain services via Container Terminal Świnoujście [own study]

- 1) Far East – Antwerp / Rotterdam / Hamburg-Świnoujście-Polska-Ukraine;
- 2) Germany / Poland-Świnoujście-Russia;
- 3) Ireland / Gr. Britain-Świnoujście-Polska-Ukraine.

Processes taking place in the Baltic Sea Region container transport will result in limitation of the importance of ports not having depths enabling handling of bigger and bigger container ships. Practical possibilities of realization of investment intentions regarding accessibility of DB Port Szczecin terminal do not guarantee preservation of its current market position. Shipowners will be resigning from calling at Szczecin Port by choosing the offer of bigger and better accessible terminals, i.e. the Tri-City terminals. Construction of the Container Terminal Świnoujście seems to be a reasonable

solution enabling development of container handling services in the Odra River estuary ports, and inland shipping seems to be the key drivers of the whole enterprise.

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