"Odra-Vistula" – the shortest inland waterway binding the west with the east of Europe

M. A. Michalski
Institute of the Port and Fleet Operations
Maritime University of Szczecin, Poland

Abstract
There are two main river systems in Poland, the basin of the Odra and the basin of the Vistula. They are bound by the waterway "Vistula-Odra". This waterway forms part of the transeuropean waterway E70. Forty years ago a pilot of Polish waterways was printed. This book is now out-of-print and moreover it is largely obsolete. The author tries to describe the Vistula-Odra as of 2000 and to anticipate its future.

1 Introduction
There are two main river systems in Poland, both leading in parallel from the south to the north. The first is the Odra and the other is the Vistula.

Today there is only one waterway binding the above mentioned systems. It is the waterway "Vistula-Odra".

The first canal was built in 1774 and allowed traffic to the weight of 150 tons. The second canal was finished in 1915. It has the parameters for the barge laden weight of 550 ton. The second canal partly follows along the route of the old one but 1.6km is new, because the thick building up of the town of Bydgoszcz did not allow widening of the old canal. For 85 years there has been no modernization on the whole. For the last twenty years it has not been maintained adequately.

2 Transeuropean waterway E70
According to the European Union plans (AGN) from the west to the east leads, in the northern part of our continent, the waterway designated as E 70. This waterway runs from Antwerp in Belgium, through the Netherlands, Germany, and Poland to Russian territory around the town Królewiec and to Lithuania. The Polish part of E 70 begins at Odra in km 667.0 (exit from Germany through the East-lock Hohensaaten), then 49.5 km up the stream of
Odra to the estuary of Warta and now 294.3 km along the waterway Vistula-Odra. That is just this sector, which is described in this paper. In continuation E 70 runs 114 km with the stream of Vistula, 62 km with the stream of Nogat, then along Vistula Bay to Russian border. Polish sector of E 70 is shown on the figure 1.

3 Present condition of the waterway “Vistula-Odra”

Above-mentioned waterway is composed of seven parts with different characters. In the paper above waterway is described from Vistula to Odra according to the kilometre marking. The initial 21.3 km of the waterway is lodged on territory of the town Bydgoszcz (about 400 000 inhabitants). On quite waterway are 22 locks located and 21 of them (No2 - No22) have the same length - 57.4 m and the same width - 9.5 m.

3.1. Canal of the lock Czersko Polskie and the southern part of the boat race track Legnowo (km 0.0 - 3.0)

This section is only 3 km long and leads from Vistula (km 772.15) along the canal of the lock and racetrack to the natural bed of the river Brda. The last 3-km of the river Brda are unnavigable and its mouth is in km 771.4 of Vistula.

On the whole distance of this part the speed of the vessels is limited to 8 km/h.

In km 1.4 of the waterway is the lock Czersko Polskie located. It is the most modern Polish lock in service from 2000. It is 115 m. long, its width is 12.4 m. It has computer control, internal video system, floating bollards etc. Inauguration of the activity of new lock allows on approach to the port in Bydgoszcz the ships with bigger parameters than formerly. The old lock

Fig.1 Fragment of Transeuropean Waterway E 70
Brdużyście is now out of the work.

In this part there is only one bridge on the lower head of the lock. Its clearance is compatible with European requirements (over 5.25 m).

The traffic on the boat racetrack ought to be realized only on the streap nearest to the lock; the rest of this aquatory is destined for sport boats. On the opposite shore there are some sailing clubs.

The width of the waterway bed oscillates among 25 and 35 m; the middle depth is 2.15 m by SW and 2.00 m by SNQ (Łyczewek [1]). In the first section the left side of waterway is on our right hand and the right side on our left hand.

3.2. River lower Brda (km 3.0 - 14.4)

From km 3.0 the waterway comes in riverbed against the stream, therefore on the left hand we have the right shore and on the right hand the left one. The speed of the vessel is limited to 8 km*h from km 3.0 to 9.0 and to 6 km*h from km 9.0 to 14.4. The width and the depth are the same as in part one. In this section there are 13 bridges and one lock. The less clearance - 3.24 m has the bridge on the beginning of the route (km 3.1).

Between the bridges Łęgnowo and „coal arterial road” on the left shore is wooden harbour. There is the cargo port of Bydgoszcz on km 5.1. In km 5.6 on the left side there is the basin of the shipyard. In km 6.1 the place has the name „Old lock”, but actually there is no lock more. This part of the waterway is shown on the figure 2.

Fig.2 Connection: Vistula and Vistula - Odra Waterway
From the bridge "Pomorski" the centre of the town Bydgoszcz begins and on both shores there are sailing clubs.

From the bridge "Bernardyński" the city begins. On left side is the street "Stary Port" with monumental granary, on the right one "Rybi Rynek" with beautiful style palace, disfigured by two glass-buildings for the bank. Farther we see some granaries. Behind the bridge "Staromiejski" on the right shore - parish church (XV-th century).

In km 12.1 there is the worst radius of the curve for the whole waterway - 110-m and in the same place shallows are formed. This difficult point is characteristic due two weirs on the right shore and monumental building of opera on the left one.

Under the bridge "Królowej Jadwigi" the curve has radius 180 m. In km 14.4 in face there is unnavigable part of river Brda. We turn on the west in Bydgoski Canal. Between three railway bridges and the beginning of the Bydgoski Canal some yacht clubs on both shores are located. On the right shore there is the camping too.

3.3. Bydgoski Canal (km 14.4 - 38.9)

From the beginning of Bydgoski canal to the end of the Vistula-Odra waterway we have the left shore on our left hand and the right shore on our right one.

In this section 17 bridges cross the canal. The lowest clearance 3.78 m has a bridge on lower head of the lock No.6 and only 5 bridges have the lower edge of their construction over 5.25 m.

The whole Bydgoski Canal and lower Noteć have limited speed of the vessels to 12 km*h⁻¹. On the canal the anchorage is not allowed.

On this route there are 6 locks. The top stand of the canal is 16.23 km long and it is alimented by the water from the lake Goplo. From Bydgoski Canal branches away in km 23.2 Górnonotecki Canal. Above-mentioned waterway will be not more said in this paper.

The width of the canalbed is 30 -35 m. The middle depth amounts to 2.00 m by SW and 1.80 m by SNQ (Łyczyniec [1]). The fragments of the canal are going in excavation, the other ones on embankment. 6.9 km of the canal lies inside the territory of the town Bydgoszcz.

In km 16.1 branches off the Old Bydgoski Canal.

3.4. Cascaded river "Sluggish Noteć (km 38.9 - 106.1)

The first part of cascaded Noteć is named sluggish, because it has a small descent (11 cm*km⁻¹) and therefore very weak current. 8 bridges cross this part and in this number only 3 have the clearance over 5.25 m. The lowest of them has the clearance 4.54-m.
The first difficult appears about 100 meter below the lock No.8, in the place in which couples the waters of middle Noteć and Bydgoski Canal. It is very shallow point.

In discussed section there is one town - Nakło on right shore (22 000 citizens). There used to be a shipyard and in other place the port with a mill and grain storage, on boulevards reloading from and on the barges took place (Trybuszewski [2]). Now the ships pass this town non-stopping here. In the town there is the mouth of the tributary Kolczatka (right shore), here is also the turn with radius 210 m.

In this section there are three locks. One of them has very unique rustical character. It is probably a single exhibit in the whole Europe, the lock with the earth chamber.

In km 75.6 on the right shore there is a port of waterway administration in Białośliwie.

The width of riverbed account to 21 - 40 m. The middle depth of riverbed is 1.20 for SW and 0.90 m for SNQ (Łyczwyk [1]). The river has in these section four tributaries: above-mentioned Kolczatka and Młyński Rów (left), Rokitka (right), Łobżonka (right).

The mouth of Łobżonka takes much sand to the riverbed, and therefore in this point forms shallows.

3.5. Cascaded river „Rapid Noteć“ (km 106.1 - 176.2)

The name „Rapid Noteć“ issues from the quick current and great descent (28 cm* km\(^{-1}\)). It begins from the estuary of river Gwda. This part is crossed by 5 bridges and in this number only two have the clearance over 5.25 m. The lowest of them has the lower edge of construction on 4.16 and it is the bridge of main railway route Szczecin - Poznań.

In this section there are 11 locks and in 13 points there are too small radii of the curves (from 130 to 280 m). Three the worst are below described.

Along this part of the waterway we meet 3 towns. On the beginning Ujście on left shore (3900 citizens), on right shore is the port with grainstore, on left one, below the town, there are glassworks with their own quay.

Between the locks No.12 and No.13 the radius R = 165 m.

The next tributaries are: Krępica (right), Łomnica (right), Trzcianka or Niekurska Struga (right). Between the locks No.13 and No.14 is the radius R = 145 m. In km 119.6 the waterway is crossed by the trajectory of high-rope ferry in Walkowice. The farther tributaries are: Rudnica (right) and Bielawa (left). To the estuary of Krępica the river has western direction, from the mouth of Łomnica it flows to the south.

The next town is Czarnków (14 000 inhabitants), located on left shore. Near below the bridge are two port basins. The first one is anticipated for future marine, the second one lodges the shipyard. From Czarnków Noteć flows again to the west. Between the locks No.15 and No.16 the radius is R =
165 m, and No.16 and No.17 R = 130 m. In km 141.2 (Ciszkowo) exists the second high rope ferry. The farther tributary is Gulczanka (left).

The third town is Wielen (6400 citizens) with the centre on left shore. Below the lock No.20 can be shallow. Now one after another two right tributaries: Bukówka and Słopnica. The lock No.22 ends this part of waterway.

The width of riverbed accounts to 25 - 40 m. The middle depth is 1.60 m for SW and 1.10 for SNQ (Łyczewek [1]).

3.6. **Free flowing river lower Noteć (km 176.2 - 226.1)**

6 bridges cross this part and only two of them have the clearance over 5.25 m. The lowest are two bridges, both with the clearance 4.00-m.

Minimal width of the riverbed amount to 29 m, the middle depth is 1.90 by SQ and 1.05 m by SNQ (papers...[3]).

The first difficult we meet directly below the lock No.22. The weir in Krzyż is the last stage of fall in the whole cascade, therefore below it can be shallow. Now on right shore is the port Krzyż. The town Krzyż (about 6000 citizens) is in a distance about 2 km to a river. One kilometer below the lock on right shore is estuary of river Drawa, alimenting Noteć.

In km 185.7 below the railway bridge on left shore there are ruins of fortifications from the II. World War, a part of „Pomeranian rampart”, named „Water barrier”.

In km 187.66, on the right shore there is a port of waterway administration. The second town in this part is Drezdenko (10,700 inhabitants). The centre of the town is lying on left shore. Below the bridge the left shore to a mooring for tourist vessels is prepared.

Left shore has four tributaries: Stara Noteć, Rudawa, Lubiatka and Gościnka.

Below the bridge (km 225.59) on right shore there is marine in Santok. Santok is now a village, but 1200 years ago it was a great Polish castle on western border. Santok is lying by the mouth of Noteć, which is a tributary of river Warta.

3.7. **River lower Warta (km 68.2 - 0.0)**

7 bridges cross this part and only two of them have the clearance over 5.25 m. The lowest of all has only 3.14 m. and the second 3.40-m.

Discussed sector is regulated on both shores with the groins. The width of the waterbed amounts to 50 m. Minimal depth by SNW is 1.20 m. (papers...[3]).

In Santok the low-rope ferry is crossing the river (km 67.7).
Gorzów is the first big town in this part of waterway (125 000 inhabitants). City is lying on the right shore. In km 59.5 on the left shore the relief flood canal begins. On the same shore in km 57.7 there is the basin of the shipyard. Below the entrance to the basin limnigraph is standing. In km 56.35 - 57.00 on the right side is a boulevard for tourist vessels and on opposite side the other one for cargo ships. In km 49.5 relief flood canal (left shore) ends.

Twice the anchorage is prohibited (km 49.4 and 39.0). In km 28.0 on right shore is the port of waterway administration in Świeckocin). Minimal radius of the curve is 250 m (km 28.0 - Świeckocin). In km 23.0 in Pyrzany the low-rope ferry is crossing the waterway. In km 19.0 on the left shore there is the beginning of the ornithological preserve Słonisk (4200 ha). In km 4.0 on right shore the canal leads to old pumping plant in Warniki (Virgin Canal).

Near above the road bridge in Kostrzyn on left shore there is the mouth of tributary Postomia.

Town Kostrzyn before the Second World War was lying on both shores of the river Warta and on both shores of river Odra. The middle part of the town on peninsula between Odra and Warta, around the old fortress, during the last hostilities was quite destroyed (Paszyłka[4]). Now the Polish town Kostrzyn is only on the right shore of Warta. The third part of the town, on the left shore of Odra remains in Germany and actually has the name Kietz. So we have Kostrzyn from km 4.0 to km 0.0 (17 000 citizens). Below the road bridge, on the right shore is the place for tourist vessels mooring. On opposite shore there is marine. Right shore between km 1.7 and 1.0 is open cargo port.

In km 0.0 Warta has its mouth to river Odra (km 617.6). It is shown on the figure 3. The Odra shores of Kostrzyn are not described in this paper.
4 Future of the waterway Vistula-Odra

Present condition of above mentioned waterway shows its antiquating and neglect. Because the present condition does not allow to treat this waterway as full of value transeuropean international waterway, is necessary to find other solution.

Easier, quicker and not so expensive would be renewal of previous waterway. In the first place it ought to be:
- dredging of the riverbed and taking out the slime covered the bottom;
- to accomplish the repair and to fill up of wastes in shore buildings;
- to accomplish the correction of some curves through increasing of radii;
- to rebuilt some lockheads, changing the offset of the sills;
- replacement of high-rope ferries through low-rope ones.

The second place - the rebuilding of some bridges with to low edge of the construction for receiving the better clearance.

More expensive would be the ground modernization of the waterway. In such conception the waterway ought to perform all requirements of the international waterway of IV-th class. So it have to perform such parameters as (Rogala [5]):
- width of the riverbed 60 m and the canalbed 80 m;
- width of the bed under navigable spans 40 m;
- width of the lockgates 12.0 m;
- depth of the locksills 3.5 m;
- length of the lockchambers 125 m;
- radius of the curves 650 m. for the rivers and 800 for the canals;
- clearance of the bridge 5.25 m. WWŻ;
- clearance of the low and high-tension power lines 12.0 and 14.0 m. WWŻ.

Above allow on the traffic for the ships with parameters such as: L=120 m, B=9.50 m, T=2.50 m., the burden = 1500 t.

Such modernization can induce the replacement of natural parts of the river by lateral canals and certainly replacement of Bydgoski canal and river Brda, by new canal passing by the town Bydgoszcz from the south ( Piskozub[6]). Unfortunately in this town lacks place for rebuilding of the waterway. The new canal could lead from Naklo along the middle Noteć and then to the town Sołec Kujawski near km 760 of the river Vistula. The new canal ought to have the less number of the locks ( ca. 50%), of course with bigger fall of water.

Other connections between Odra and Vistula are not described in this paper.
References