

The chosen safety aspects of maximum size vessels passing in the presence of pleasure crafts at the Świnoujście Port entrance area

Adam Kowalski

Maritime University of Szczecin, Faculty of Navigation, Institute of Marine Traffic Engineering
1–2 Wały Chrobrego St., 70-500 Szczecin, Poland, e-mail: adam.kowalski@am.szczecin.pl

Key words: marine traffic engineering, safety of navigation, harbour approach, pleasure crafts, maritime pilotage, port rules, yacht marina

Abstract

Approaches to the port are usually considered high traffic areas. Not only deep draft vessels pass through this limited manoeuvring space, but also intensive pleasure craft traffic, especially during the summer season. Crossing of both commercial ships and pleasure craft traffic may generate dangerous situations for navigation. The aim of the following article is to present solutions to the aforementioned safety problem. The article focuses on the navigation safety aspects at the Świnoujście seaport entrance. Currently, Świnoujście-Szczecin Port Regulations take only large ships into consideration while specifying the safety passing at this area, at the same time, belittling the presence of small crafts up to 20 m in length. In order to prove the need for change, one should first present the necessary research concerning the evaluation of the safety level of maximum sized ships navigating at the Świnoujście entrance area in the presence or absence of small pleasure crafts. The surveys were conducted on a group of pilots and captains possessing pilot exemption certificates. The research findings clearly show that the traffic of small crafts and large ships should be separated due to safety concerns. Thus, marine traffic engineering solution is suggested in order to eliminate the most plausible dangers.

Introduction

It should be noted that movement of yachts and other pleasure crafts navigating across Polish territorial waters has gradually increased over the last few years. Moreover, due to the continuous expansion and modernization of the existing port infrastructure which, in the broad meaning, serves such type of seafaring vessels, the intensity of pleasure craft navigation in Polish seaports is also raising. Thus, collision of commercial and recreational craft traffic seems to be inevitable in the port's waters.

What is worse, is people steering these kinds of boats and yachts on internal waters do not often have sufficient knowledge of local port regulations. Furthermore, inexperienced helmsmen navigating small crafts do not pay enough attention to proper look-outs, including in the stern sectors, what may result

in fault determination of large ships manoeuvring nearby.

Therefore, the possibility of dangerous situations is extremely high. A good example of this problem is represented by the unexpected perception of a large vessel behind the small craft's stern. Consequently, the inexperienced helmsmen of small crafts are likely to change the course in a chaotic and reckless way or even cross the course of approaching large vessels. In many cases, captains of large ships are forced to make heavy manoeuvres to avoid collisions. It is difficult to expect a radical increase of nautical knowledge among groups of amateur seafarers, due to the liberalization of the rules governing recreational crafts issuing licenses. Thus, one of the methods of improving navigation safety is to introduce a complete prohibition on the movement of yachts and power-boats in the port waters.

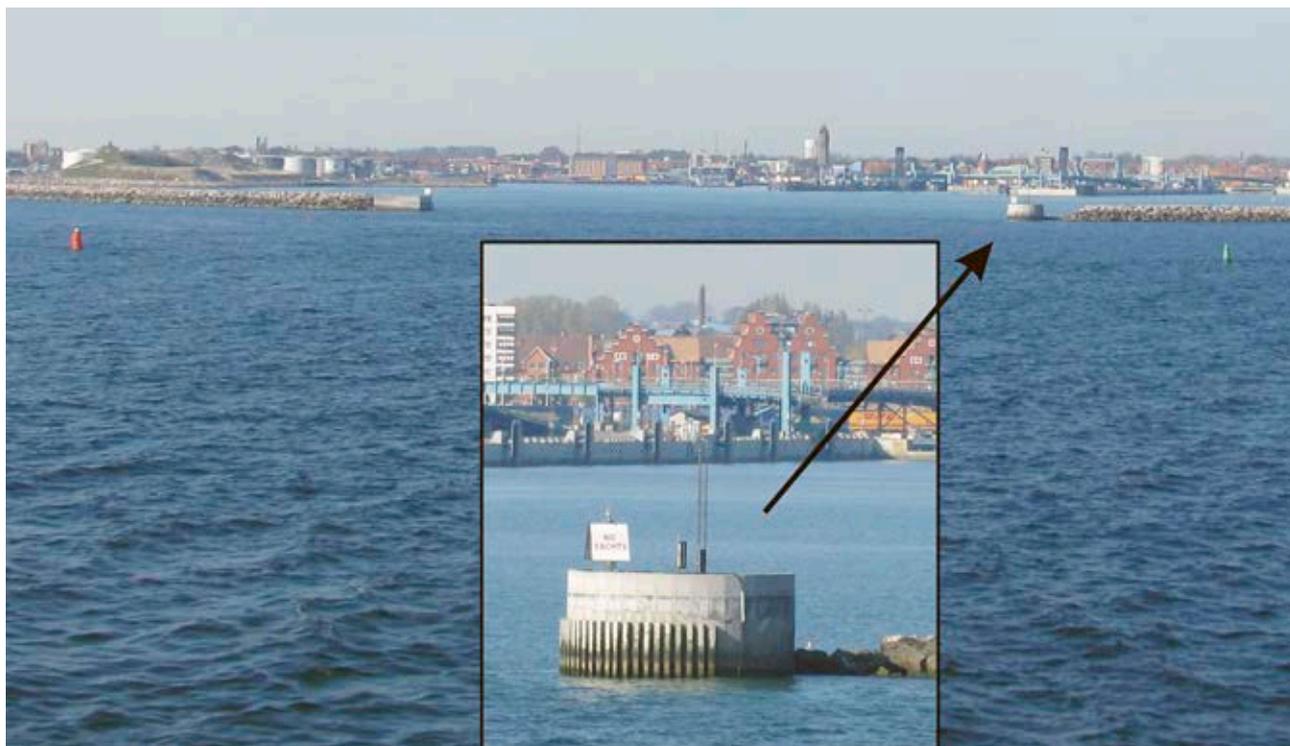


Figure 1. The heads of Trelleborg port with “NO YACHTS” sign

For an example, the drastic separation of commercial and recreational traffic has been applied in the Mississippi entrance – SW Passage and also throughout the mainstream of the river in the New Orleans area, where transshipment services are carried out. It is worth noticing that harbour authorities have solved this problem by directing recreation craft traffic to another area of the river estuary. A similar solution has also been applied at the ferry port of

Trelleborg, where the legible inscription prohibiting yachts from entering port has been placed on the breakwater’s head – Figure 1. In this part of the Baltic Sea, the yacht berthing is provided in a different way – very convenient the Gislövs Marina is located just 2 miles east from ferry harbour.

The above mentioned solutions are only applicable in ports where it is possible to separate the traffic of different types of shipping. Such a solution cannot



Figure 2. The screenshots from ECDIS showing the current situation (2018) of the entry to the Świnoujście port

be applied in the area of the entrance to the port of Świnoujście. The aim of the following article is to present the solution to the problem of simultaneous navigation of commercial ships and pleasure crafts in that harbour.

Selected aspects of safety navigation in the area of entry to the port of Świnoujście

Both commercial and pleasure crafts are obliged to use the same area on the approach to the port of Świnoujście. One should agree that small crafts can use the area located west of the series buoys from

“A” to “E” for navigation – see Figures 2 and 3. However, this alternative route outside the main channel is not popular due to the fact, that recreational unit skippers do not have appropriate knowledge concerning available depths. According to pilot’s practice, contrary to the rules, small sailing yachts violate the port regulations and navigate in the centre of the dragged deep draft channel. At the same time deep draft vessels are forced to sail near the edge of the main fairway.

In the above mentioned cases, due to the lack of complete knowledge of port regulations (Official Journal, 2013), it may be particularly dangerous if

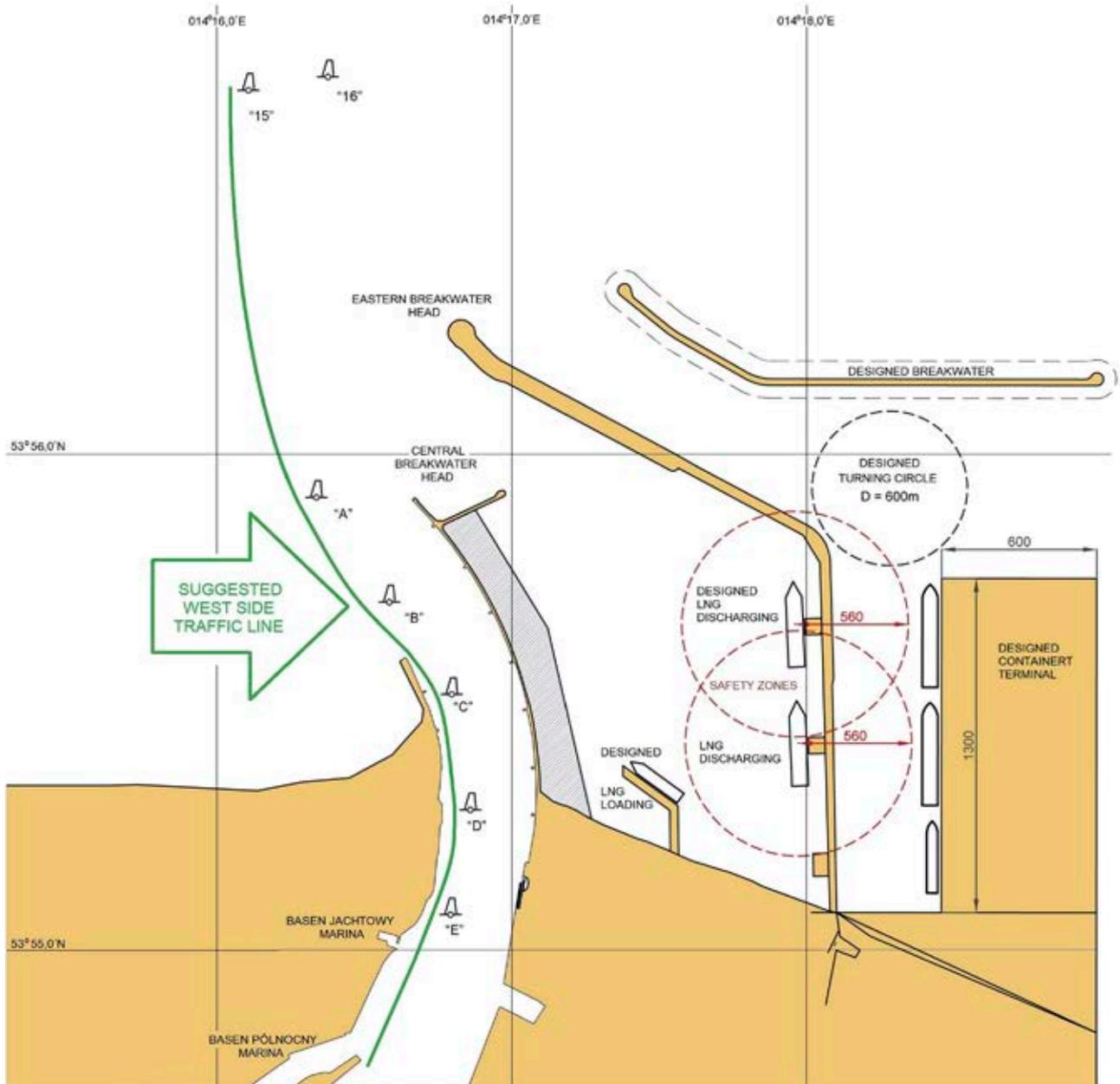


Figure 3. Concept of Świnoujście entry west side traffic channel complying with the plans of the port modernization, prepared on the basis (Gucma, Kotowska & Ślęczka, 2016)

the skippers of the pleasure crafts know only the port regulation namely §33.2:

„Traffic of vessels solely under sail on fairways, Anchorage and within the port limits is permitted during day time only and at visibility above 5 cables”,

without being aware of the provisions of §33.1:

„Traffic of All vessels of length overall below 20 m, including port crafts, on fairways, anchorages and within the port is subordinated to traffic of ships which length overall is 20 m and more”.

The situation presented above may suggest the inexperienced skipper of a sailing vessel that he has the absolute right of way and consequently, may lead to dangerous manoeuvres. It is worth mentioning at this point that crafts no longer than 20 m are not subject to the Vessel Traffic System. At the same time there are no simple and effective methods of this type of traffic control. Crafts up to 20 m are not obliged to listen to any of the local VHF frequencies that allow connection to establish safe navigation. According to the Polish State Law, the only means of disciplining them is by the direct supervision by the Polish Coast Guard (Journal of Laws, 1990b) or simply by the Police (Journal of Laws, 1990a).

At the entrance to the port of Świnoujście, passing of vessels is limited from the pair of buoys “15”/“16”. It follows from port regulations under many restrictions (for example, they are taking into consideration the allowable sum of the length of two passing vessels). Thus, it is not so difficult to imagine a decrease in navigational safety level when two maximum size power driven vessels pass in the presence of a sailing yacht, whose skipper is mistakenly convinced of his or her priority on the fairway.

The simulation researches concerning safety of ships passing on the seaway Świnoujście-Szczecin Hacie has been conducted (Sokołowska, Marcjan & Gralak, 2013). In a PhD dissertation (Narękwicz, 2005), on the base of expert research, it was shown that the significant reduction of ships passing safely into the narrow entry to the port of Świnoujście. In the same thesis and also in Krystek, 2009, it was proven that the simultaneous occurrence of factors such as limited visibility or night time has a significant impact on the safety of two ships manoeuvring.

Thus, the additional factor, suggested here in this article, namely the presence of a pleasure craft, may affect the safety of power driven vessels passing at the entrance to the port of Świnoujście. Verification of the above statement unquestionably requires further detailed research. The importance of this problem

should be taken into consideration while elaborating the port development plan (Gucma, 2012).

Navigation safety improvement project of the entry to the port of Świnoujście

The town of Świnoujście pretends to have the largest yacht port in Poland (Analysis, 2009). For this reason, two marinas are located in the close vicinity of the port entrance: the “Basen Północny” Marina and the “Basen Jachtowy” Marina – Figure 2. As a consequence of the port’s development plans, the number of mooring places for yachts is increasing year by year. Therefore, it is not difficult to forecast the increase of pleasure craft traffic intensity in the area located between the “15”/“16” buoys and the entrance to the “Basen Północny” Marina in the near future.

Taking the plans of the port modernization approach into consideration, it is advisable to direct all traffic of pleasure crafts shorter than 20 m in length to the west of the main channel. The recommended area is located just between the series of buoys “A” to “E” and the western breakwater – Figure 3.

Additionally this concept will ensure the improvement of navigation safety in the port area due to the anticipated movement of very large bulk carriers up to 300 m in length with a maximum draft of 13.5 m (Gucma, 2016). Moreover, due to the already existing depths, dredging works will be required only to a small extent. The only expenditures will be cost by placing a few buoys (not marked on the Figure 3 – positions of these buoys should be determined by another research) that will limit the small crafts traffic from the west side. It is worth mentioning that the cost will undoubtedly be reduced by the fact that dredging works in the part of the channel were already conducted. In other words, the traffic for small pleasure crafts should be placed on the western side of the fairway, from buoy “A” to the entrance “Basen Północny” Marina. On the one hand, relocating of pleasure craft traffic from deep draft channel should improve safety by limiting the number of dangerous and unpredictable situations. To be more precise, it will eliminate the danger of unexpected crossing of the large vessels track by pleasure crafts in the narrowest part of the entry to the port of Świnoujście. This project reduces the heavy traffic crossing and moves the crossing area outside the described part of the port’s waters. The available manoeuvring space will be larger, starting from buoy “A” and ending at the entrance of “Basen Jachtowy” Marina. Moreover, there is better non-obstructed visibility, outside

the direct port entrance and beyond the breakwater, than in the most dangerous area of the bend (between buoys “B” and “E”).

Preliminary study of the small craft approach channel concept

To verify the purpose of the west side traffic channel concept, an expert survey was conducted on a group of sea pilots and masters of ferries. The group of experts consists of professionals who often manoeuvre large ships themselves on the approach to the port of Świnoujście. In this area, the port regulations (Official Journal, 2013) §38, §50 and §51 specify the maximum permissible size of two passing vessels. They take, among others, the allowable sum of the length of two passing vessels. The regulations also introduce the additional criterion of maximum drafts of passing vessels. It is well known that the passing manoeuvres complication rises proportionally to the area of the cross section to the wind due to the ship’s drift growing. It is worth noticing that there are no port regulations concerning passing criteria, which take the cross section of the wind into consideration. In some cases, the lack of regulations can cause a significant decrease of the safety of passing manoeuvres. Therefore, in order to obtain the most reliable research results, it is advisable to take the experience of masters piloting ships with huge cross section areas to the wind into consideration. Thus, the group of experts are also represented by the ferry masters.

The experts were asked about the level of manoeuvre safety of two passing vessels with maximum drafts and maximum permissible lengths. The next question concerns the same conditions but the situation concerns the presence of up to 20 m length yacht. It is obvious that the respondents who took part in the survey had to respect all rules imposed by both COLREG and port regulations. The safety was judged on a scale from 1 to 10, whereas 1 means an easy, very safe manoeuvre, whereas 10 means a very dangerous manoeuvre but with the acceptable risk level. Figure 4 presents a survey questions with the results from 3 parts of analysed fairway (6 options in total). 31 questionnaires with responses were obtained. All experts considered that there was a difference in manoeuvre safety level assessment for each of the 3 cases – 6 options. The median results for all variants of the study are also shown in Figure 4.

Conformity with normal distribution of all six variables was performed in accordance with the

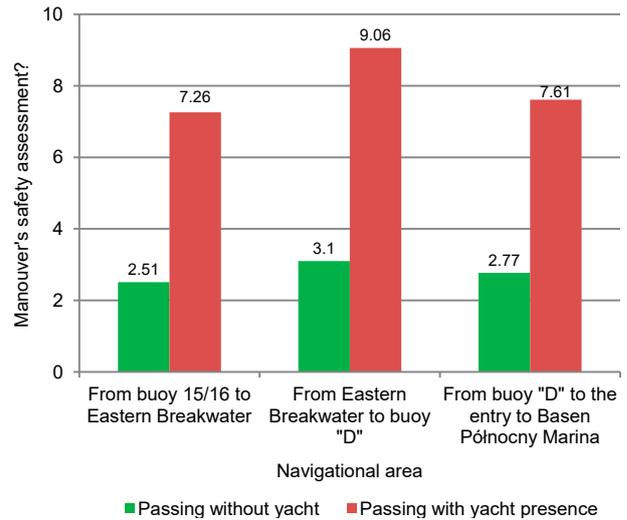


Figure 4. Questions and results of the survey concerning passing manoeuvres safety at the entrance to the Świnoujście port

Shapiro-Wilk test. The test results for each variable does not confirm normal distribution at significance level $\alpha = 0.05$. After analysing the data dissipation, it was found that failure to meet the normality of the distribution depends on the small number of expert groups rather than on the applied rating scale.

The consequence of the test failure for each variable, showing the incompatibility between empiric and normal distribution, is the inability to apply parametric these tests to compare the changes of each pairs of safety assessments. For this reason, a nonparametric test – the Wilcoxon Rank Verification Test (Aczel, 2000) was used to verify the changes of safety assessments. It examines the pairs of safety ratings of passing ships in both the presence and absence of a yacht in the same area. The test gives the opportunity to accept or reject the null hypothesis H_0 , which claims that the median of differences is zero for two safety assessments in the population represented by the test samples. The alternative hypothesis H_1 is that the median of differences is different from zero for safety assessments in the population represented by the tested trials. Taking the Wilcoxon’s statistics into account, next the value of test statistic should be calculated and on that basis the value p will be determined – Table 1.

Table 1. Results of Wilcoxon Rank Verification Test

Manoeuvring area	p – value
Buoys 15/16 to Eastern Breakwater	5.97917e-007
Eastern Breakwater to Buoy „D”	5.88807e-007
Buoy „D” to the entry to Basen Północny Marina	6.97040e-007

Supposed the significance level $\alpha = 0.05$:

If $p \leq 0.05 \Rightarrow$ reject H_0 , accept the alternative hypothesis H_1 ;

If $p > 0.05 \Rightarrow$ there is no reason to reject H_0 .

By comparing the p values given in Table 1 with the significance level $\alpha = 0.05$, one may claim that there is a statistically significant difference between the safety level of two passing ships with and without the presence of a yacht up to 20 m in length. What the above investigation has clearly proved is that the presence of a yacht significantly reduces safety of passing manoeuvres.

The passing manoeuvre, without the presence of yachts is evaluated, as quite safe in accordance with the respondents. The mean rates are fairly balanced and reach 2.51, 3.10, 2.77 for the three surveyed areas correspondingly. Thus, in the above described situations there is an additional necessary safety reserve. This safety margin is necessary for example for manoeuvres during unfavourable hydro meteorological conditions.

In the most dangerous navigational part of the entrance, on the bend, close to the "D" buoy, the passing manoeuvre in the presence of a 20 m yacht is evaluated as the most dangerous – the average evaluation is "9.06" and, in most cases, the median reaches the maximum value of "10". At this part of the Świnoujście port entrance any other additional risk factor leads to extremely dangerous situations. Therefore, the evaluation of large ships' manoeuvre safety reaches the non-acceptable risk level.

Conclusions

The statistical analysis presented above clearly shows that the improvement of the safety of passing vessels at the entrance to Świnoujście port is not possible if the pleasure crafts traffic is not directed westward beyond the deep water route. The presence of only one yacht in the specified area was assumed in the preliminary surveys. At the same time, port regulations do not prohibit the presence of more than one pleasure craft in this area. For obvious reasons safety assessments achieve higher values (even sometimes may be declared as unacceptable) when there is more than one yacht in the described area.

The research described in this article covers only situations when port rules are respected. But taking captains and pilots' experience into consideration, it can be concluded that pleasure craft skippers, in many cases, do not follow port's traffic rules. Unfortunately, captains of larger ships are often forced to

stop their manoeuvres in the presence of smaller recreational crafts to avoid collision. Moreover, in this situation where there is no safety margin, it is very difficult to prevent the ship's drift at reduced speed, especially during strong winds blowing perpendicularly to the track. Additionally, any stopping of traffic introduces further difficulty in the movement of other ships in the same area. The above described situation shows the importance of presented safety considerations.

However, the proposed new traffic regulations have one more advantage from the point of view of manoeuvrability of ships in the port. The risk of crossing the path of large ships by pleasure crafts will be minimized in the narrowest area of the entrance to the port of Świnoujście. According to the new traffic suggestions, pleasure crafts cross the track beyond the most complicated area. The manoeuvring intention of the small boats will be visible from afar, and the bend of the fairway will not interfere with observing the entire manoeuvring area. On the one hand, the examined area at the north side is available for ships' dredged depths. Close to Eastern and Central Heads of the Breakwater are located the natural depths of the port of Świnoujście roads. On the south side of the surveyed area, manoeuvres can be undertaken at the dragged "Obrotnica Północna" turning area. According to the new regulations, large ships have a much larger space for manoeuvring there, in case of unexpected crossing of the deep draft route.

The proposed concept of small craft approaching the channel is only a preliminary and very approximate survey. If the project will be implemented, further research will be necessary. Surveys should be conducted taking not only the shape and size of the pleasure craft channel but also the cost optimization into account. Lastly, it is worth mentioning that the above concept of pleasure crafts traffic will be definitely more secure than the present situation, if the general safety and security (The ISPS Code, 2004) of LNG Terminal is taken into account.

Acknowledgments

This research outcome has been achieved under the grant No. 1/S/CIRM/16 financed from a subsidy of the Ministry of Science and Higher Education for statutory activities.

References

1. ACZEL, A.D. (2000) *Statystyka w zarządzaniu. Pełny wykład*. Warszawa: Wydawnictwo Naukowe PWN.

2. Analysis (2009) *Zmiana studium uwarunkowań i kierunków zagospodarowania przestrzennego miasta Świnoujście*. Praca pod kierunkiem T. Cykalewicza na zlecenie Gminy Świnoujście.
3. GUCMA, S. (2012) Determination of optimal waterway system parameters and operating conditions for LNG Tanker operation in the port of Świnoujście. *Scientific Journals Maritime University of Szczecin, Zeszyty Naukowe Akademia Morska w Szczecinie* 30 (102), pp. 52–60.
4. GUCMA, S. (2016) Optimization of Świnoujście port areas and approach channel parameters for safe operation of 300-meter bulk carriers. *Scientific Journals of the Maritime University of Szczecin, Zeszyty Naukowe Akademii Morskiej w Szczecinie* 48 (120), pp. 125–133.
5. GUCMA, S., KOTOWSKA, I. & Ślęczka, W. (2016) Wybór lokalizacji terminalu kontenerowego w Świnoujściu. *Inżynieria Morska i Geotechnika* 6, pp. 366–377.
6. Journal of Laws (1990a) Ustawa o Policji, z dnia 6 kwietnia 1990, chap. 3, art. 15, Dziennik Ustaw Nr 30, as amended.
7. Journal of Laws (1990b) Ustawa o Staży Granicznej, z dnia 12 października 1990, chap. 1, art. 1, Dziennik Ustaw Nr 78, as amended.
8. KRYSZEK, R. (Ed.) (2009) *Zintegrowany System Bezpieczeństwa Transportu. Tom II. Uwarunkowania rozwoju integracji systemów bezpieczeństwa transportu*. Warszawa: Wydawnictwa Komunikacji i Łączności WKŁ.
9. NARĘKIEWICZ, M. (2005) *Metoda oceny bezpieczeństwa manewrowania statku na dwukierunkowych torach wodnych*. Rozprawa doktorska, Akademia Morska w Szczecinie.
10. Official Journal (2013) *Przepisy portowe*. Dziennik Urzędowy Województwa Zachodniopomorskiego (Official Journal of West Pomeranian Voivodeship), item 2932, as amended.
11. SOKOŁOWSKA, S., MARCJAN, K. & GRALAK, R. (2013) Simulation analysis of safe passing between ships on the seaway Szczecin–Świnoujście with the applicable port regulations. *Scientific Journals Maritime University of Szczecin, Zeszyty Naukowe Akademia Morska w Szczecinie* 36 (108), pp. 175–181.
12. The ISPS Code (2004) *The International Ship and Port Facility Code*. London: International Maritime Organization.