

# Analysis of the Vessels' Service Time in the Port of Gdańsk, Based on the Time Registration of Ships Entries and Departures, as a Proposition of Multi-aspect Method of Port Monitoring

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**ABSTRACT:** The aim of the paper is to analyse the length of time that ships spend in the Port of Gdansk. It is based on the examination of the time when ships come into and leave the port. Source of data used in the study is public web platform - Marine Traffic. Analysis which was conducted, enables to get information about duration of ships servicing in the port with a division into dimension, load capacity and type of the ship. Due to that information, it is possible to observe the duration of complete service for each vessel, including entering the harbour, reloading and the departure. Gained knowledge would allow to forecast, plan and model future development operations more properly. In addition, due to the method based on counting the number of hours that ships spend in the harbour, it is possible to estimate the amount of pollution emitted to the air.

## 1 INTRODUCTION

Constant development of technical progress in harbours and introducing more and more effective methods and reloading techniques require the analysis of duration of ships servicing in the ports. A good understanding of this issue is relevant to make an assessment of forward looking projects. It is particularly important during planning to acquire additional production capacity [1].

The actual methods of upgrading service rate in the harbours, concentrate on increasing effectiveness of terminals' work and on improving access to the harbour. The essential indicators of the duration of ships servicing such as : roadstead-roadstead indicator or mooring-mooring indicator, enable to indicate the length of time that ships spend in the harbours. Settlement of the duration of ships servicing in the harbour includes time from arrival to the roadstead to departure from harbour to roadstead. This period consists of four essential elements:

waiting time for entering the port, time for docking and mooring, time for servicing ships at the quay (transshipment and additional actions connected with ship service), waiting time for departure and time for leaving the harbour [2], [7]. Market-based approach to analysing and improving harbour's capacity means meeting the customers' needs and accepting the required level of services. Harbour's customers are less interested in periodic capacity but they are highly concerned about individual service of their own ships to be as good as possible. According to this, the quality of ships service measured by indicators, is an instrument of creating competition on the market of port services [9]. Due to the fact that handling time ratios have strong influence on harbour's service demand, they are an important element of the offer and promotion of each harbour. In addition, they are the basis of price calculation. Taking into consideration the above-mentioned aspects, making declarations of ships' service time is connected with huge responsibility and financial risk [3], [5].

## 2 SCOPE AND GOAL OF RESEARCH

The aim of the research is to verify the usefulness of analysis, focused on the length of time that ships spend in the harbour, for economic assessment of its functioning. In addition, the study discusses the question: if verifying the time that ships spend in the harbour, in the long term, enables to monitor the influence that ship's stay in the harbour has on environment, for example: if it helps to estimate air pollution. The scope of the study includes analysis carried out at the Port of Gdansk.

## 3 METHOD

Test method which was used, was the analysis of the length of time that ships spend in the Port of Gdansk. It was conducted on the basis of public web platform - Marine Traffic [11]. This platform enables to observe movements of ships and the current location of ships in harbours and ports. Observations concentrate on 200 ships which entered the Port of Gdansk between 25/11/2018 and 28/01/2019. Provided information included date and time when ship enter and leave the Port, ship type, its name and deadweight tonnage. Types of ships have been classified into two categories by physical state of cargo. This distinction arises from conviction that diversification of port infrastructure used during unloading and especially its handling capacity is essential. First group includes dry cargo vessels which comprise of bulk carriers, general cargo vessels and container ships. The second group consists of liquid cargo ships. Fishing vessels and tugs have not been taken into consideration in the study. The first twenty observations as an example of got data are presented in the table number 1.

## 4 RESULTS OF ANALYSIS

Analysing the length of time that ships spend in the Port of Gdansk, it could be noticed that the average

duration of servicing the dry cargo ships, during the period considered, was thirteen hours longer than duration of servicing liquid cargo ships (Chart 1).

The above result means that unloading of bulk carriers and container ships is associated with greater number of activities that need to be undertaken and their time-consuming nature. What is more, in this case, the extend of handling equipment in the harbour and its transshipment capacity is also relevant. Duration of the ships servicing in the port could be also influenced by technical state of traffic system in the harbour, its working time and shifts, as well as adopted rules and Port Regulations. Moreover, the significant feature is the type of cargo, because it is necessary to clean the cargo hold in case of full unloading in the harbour. It is particularly important in the event of liquid and bulk cargo. Adverse weather conditions also could delay the period of ship's stay in the port, especially when cargo is hygroscopic. In case of unloading and reloading the duration of ship servicing is also extended.

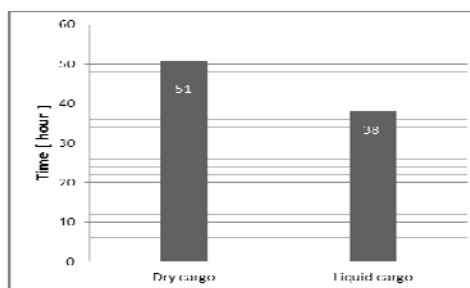


Chart 1. Average time (hours) of the vessels' service in the Port of Gdańsk

In reliance on data presented in Table 1. it is possible to conduct the analysis of average time of the vessels' service in the Port of Gdańsk with reference to its deadweight tonnage. Research shows that in case of dry cargo vessels, the service of ships with deadweight tonnage above 100000 take the longest time, while service of ships with deadweight tonnage below 5000 is the shortest.

Table 1. The first part of the data according to examined ships.

NAME OF SHIP	TYPE OF CARGO	DATE OF ARRIVAL	TIME OF ARRIVAL	DWT	DATE OF DEPARTURE	TIME OF DEPARTURE
Wilson Belfast	Dry cargo	25.11.2018	16:33	3516	28.11.2018	14:53
Nissos Delos	Liquid cargo	25.11.2018	14:49	115691	26.11.2018	22:07
Klara	Dry cargo	25.11.2018	15:01	5489	28.11.2018	08:16
Astrosprinter	Dry cargo	25.11.2018	10:31	9544	25.11.2018	17:22
Ramona	Liquid cargo	25.11.2018	00:15	17592	26.11.2018	00:08
Delphis Gdansk	Dry cargo	24.11.2018	23:52	24700	25.11.2018	13:37
Matz Maersk	Dry cargo	24.11.2018	19:28	194284	28.11.2018	07:35
Annaba	Dry cargo	24.11.2018	18:10	20614	25.11.2018	04:52
Romanka	Liquid cargo	25.11.2018	18:09	1400	26.11.2018	09:56
Ligovsky Prospect	Liquid cargo	25.11.2018	19:02	114639	27.11.2018	00:44
Ania	Liquid cargo	25.11.2018	20:56	1500	28.11.2018	21:14
Andesborg	Dry cargo	25.11.2018	22:04	17294	30.11.2018	06:23
Excello	Liquid cargo	26.11.2018	19:32	19999	29.11.2018	12:06
Bulk mexico	Dry cargo	26.11.2018	17:40	176354	01.11.2018	00:39
Swedica Hav	Dry cargo	26.11.2018	16:18	2276	27.11.2018	15:41
Ava D	Dry cargo	26.11.2018	14:20	20646	27.11.2018	17:54
City of Sunderland	Dry cargo	26.11.2018	12:59	2417	26.11.2018	20:20
Oslo TS	Liquid cargo	26.11.2018	12:56	112949	27.11.2018	16:08
Ocean Fortune	Dry cargo	26.11.2018	10:06	8058	30.11.2018	14:02
Hilal Bey	Dry cargo	26.11.2018	09:44	9688	28.11.2018	23:57

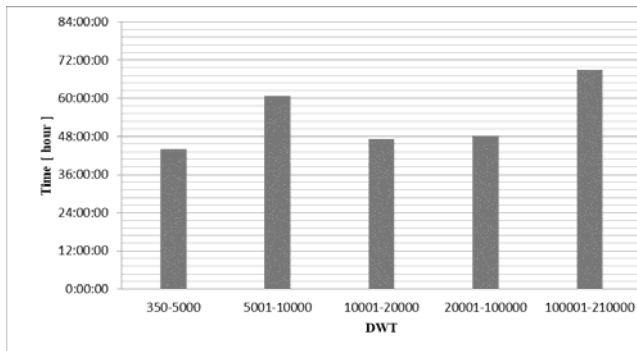


Chart 2. Average time of the vessels' service in the Port of Gdańsk (dry cargo)

In relation to the group of ships with deadweight tonnage between 5001 and 10000 the duration of their average servicing time is thirteen hours longer than in case of ships from two following sections. Conducting the analysis concerning only this group of ships more properly, it appears that these ships probably got to the points with temporary significant reduce of efficiency of a used technological line. This could be connected with equipment failure and its repair or with temporary shortage of staff. This conclusion results from the fact that at particular hours over two weeks, the service time of all vessels is above average, which causes an overestimation of the average time for a group of ships with indicated deadweight tonnage. If it is not enough, it has been noticed that ships arriving in the early morning hours are servicing longer. This could be connected with delay of one of the ship service stage.

When analyzing the duration of service for ships carrying liquid cargo, it turned out that the service of ships with lower deadweight tonnage take the longest time. It could result from priority in the harbour for ships that carry more cargo (Chart 3.). Furthermore, these ships are usually liners because they arrive with constant regularity and most often their shipping limits to the area of the Baltic Sea. Ships with the highest deadweight tonnage are unloaded over 48 hours, on average. This could be justified by limited capacity of unloading devices and the necessity of cleaning a large space of the cargo hold to take another load on board.

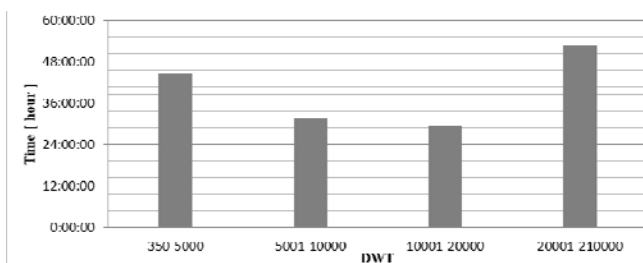


Chart 3. Average time of the vessels' service in the Port of Gdańsk (liquid cargo)

According to the abovementioned analysis, dry cargo vessels are serviced in the Port of Gdansk longer than liquid cargo ships. In the observed time, there were no relationship which could indicate that higher deadweight tonnage means longer ship's stay in the harbour. On the contrary this results from many different factors such as time slot, availability of harbour's facilities, priority of transoceanic ships and

another bottlenecks that occur in the harbours, which have been mentioned in the conducted analysis.

## 5 DISCUSSION AND SUMMARY

The research, which verify the length of time that each type of ship spend in the harbour, enables to evaluate the quality of harbour service. It is also worth mentioning that the most common subject of trade negotiations between port operators and shipping companies (shipowners, forwarders, affreighters) is rate of loading and discharging and thus the time of these operations. The authors suggest conducting the research over a long period, as a form of data collection on functioning and monitoring the harbour [6]. The analysis of the results of the study enables to estimate the efficiency of ship service at individual port terminals. Therefore, long term observation of time spent by ships in harbours, translate into economic and marketing results. In addition, this type of research allows to appraise the impact that ships staying in the harbour have on environment [8]. By counting the number of hours, that ships spend in the harbour, it is possible to estimate the amount of fumes emitted to the air. Moreover, when the amount of ships' pollution emitted in one hour while staying in the harbour is known, it is feasible to define a reduction of pollution resulting from connecting ship to local energy networks during transshipment. Furthermore, electric power supply for ships staying in the harbour is highly beneficial. It has a favourable effect on environment, because of reducing pollution, vibration and noise [4]. It also contributes to financial savings resulting from price difference between the cost of electric energy and the cost of fuel as well as the cost of technical review of auxiliary generators [12]. In the Baltic Sea Area, this type of actions, make it possible to achieve the compliance with the regulations MARPOL VI for Emissions Controlled Areas (ECA) [10].

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