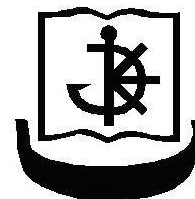


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**In Memoriam**  
**Jānis Bērziņš**  
**(24.12.1938. – 16.12.2016.)**



It was with great sadness that we learned of the passing of Rector Magnificus of the Latvian Maritime Academy Professor *Dr. sc. ing.* Jānis Bērziņš who died early on the 16<sup>th</sup> of December 2016 at the age of 77. Jānis Bērziņš was born in Rīga, left Rīga Secondary School No. 29 in 1956 and graduated from the Faculty of Mechanics of Rīga Polytechnical Institute in 1962 with a degree in Engineering Science. Professor Bērziņš started his academic career as a teaching assistant and a lecturer at the Department of Machine Building of his alma mater where he worked until 1969. During the following three years he was a doctoral student of N. Bauman Higher Technical School in Moscow where he gained PhD in Engineering in 1972. Afterwards he returned to Latvia. Whereas from 1972 to 1990 Professor Bērziņš held faculty positions of teaching assistant, lecturer and assistant professor at the Department of Physics, from 1976 to 1986 he was a Head of this department. In 1990 he became a Dean of the Faculty of the Latvian Maritime Academy at Rīga Polytechnical Institute. Two years later his PhD degree was nostrified as a doctoral degree in Engineering (*Dr. sc. ing.*). In the years 1993-2004 Professor Bērziņš took the position of a Rector of the Latvian Maritime Academy. During the next five years he was a Vice-Rector for Academic Affairs. In the year 2010 Professor Bērziņš was re-elected as a Rector and took this position up to his death. In 1998 Professor Bērziņš became a member of the Latvian Association for Transport Development and Education but four years later took the position of a Vice-President. In addition, since 1990 he performed the duties of the Member of the Board of the Latvian Maritime Association.

Professor Bērziņš was the author of more than hundred research papers on Physics and Engineering, numerous research patents as well as articles on the development of modern maritime education in Latvia. The main field of his scientific research was laser technology and optoelectronics. In addition to heading the Editorial Board of the Journal of Maritime Transport and Engineering, he also was a member of Editorial Boards of other leading journals.

Professor Bērziņš led an active social and political life. He was a member of student corporation *Fraternitas Metropolitana* and Rīga Latvian Society. Several years he performed the duties of a Member of the Board and a Vice-Chairman of the latter. A number of times Professor Bērziņš was proposed as a candidate for the Parliament and Rīga Municipal Council.

Jānis Bērziņš is survived by his wife, Silvija, several children and grandchildren.

The Editorial Board

# THE EFFECT OF HYDROMETEOROLOGICAL CONDITIONS ON THE SHIPS SAILING IN THE ABSHERON AREA OF THE CASPIAN SEA

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## Abstract

*This article analyses various wind and sea regimes of the Absheron area of the Caspian Sea according to long-term information. Data on ships of various types and tonnage owned by Azerbaijan Caspian Marine Shipping Closed Joint-Stock Company are used in calculations.*

**Keywords:** Caspian Sea, Absheron area, wind – wave power

## Introduction

The main negative hydrometeorological factor is a wind and resulting rough sea. Following the protest it's existed compulsory decreasing importance of acting ships speed together both during wind and rough sea conditions. This position is also influenced by the requirements of safety exploitation of ships.

The Absheron Sea region is one of stormy areas of Azerbaijan sectors in the Caspian Sea. In recent years, intensive exploitation of carbohydrate resources attracted attention of the intelligence (secret) services. Therefore, ships of various tonnage and assignment intensively observed them. It is important to analyze both scientifically and practically decreasing speed of ships that is compulsory under wind and rough sea conditions.

Absheron Sea Region consists of Absheron Peninsula and declined area of water attaching to the land. Borders of the territory are limited from South and North by 40 and 42 degrees parallels, but from West and East 49 and 51 degree with along meridians gradually. Having narrow lines about 10 km of Absheron, itself calls at the sea from West to East. It covers from the North, West and South to the sea. While the length of Peninsula is 70 km, its breadth is 22 km (Figure1).

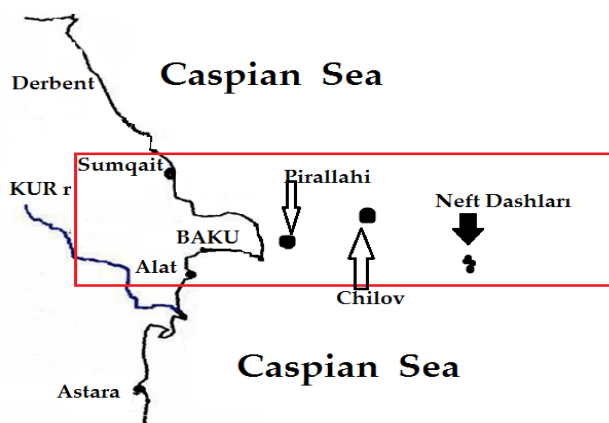


Figure 1. Scheme of the Absheron region in the Caspian Sea

## The wind regime of the Absheron region of the Caspian Sea

Absheron region of the Caspian Sea is considerably different from other sea territory. This area is considered windlier. There are many oil-gas devices, terminals and other objects. Thus, the sailing ships depend on wind in general and rough sea regimes in particular (especially storm or thunder). In different parts of Absheron (north, mean, south) there are shown mean seasons and average repetition annual. From the Table 1, it is shown that head winds along the season are directed from north-west to west in the north-west of the area. The least part of this area is the north-east and south. These parts are less repetition parts. The delivery part of winds are equal as its direction due to the table. The direction of the wind is increased, it's from Peninsula to East of the area in the Oil Bearing Rocks (Oil-Stone) region. The speed of this region is increased at least. The wind regime is differed in the South-West part of Absheron. These head winds are directed as North-Eastern particularly. [4,5].

Table 1. The repetition of winds of the Caspian Sea Absheron region due to the direction of the seasons (in percent)

Point	Season	N	NE	E	SE	S	SW	W	NW
Sumgayit	Winter	21	6	3	5	24	10	4	7
	Spring	27	8	3	6	27	7	3	19
	Summer	37	11	4	4	18	5	3	18
	Autumn	26	8	4	6	23	8	3	22
	Year	28	8	4	5	23	7	3	22
Oil Stones Island (Neft Dashlari)	Winter	23	10	6	12	16	13	6	14
	Spring	27	8	7	11	14	7	5	21
	Summer	42	11	6	4	6	5	5	21
	Autumn	27	14	14	14	12	6	2	11
	Year	29	11	8	10	12	8	4	18
Alat	Winter	23	27	3	3	4	23	13	4
	Spring	16	28	7	15	9	16	6	3
	Summer	19	33	12	18	6	5	4	3
	Autumn	24	30	7	9	4	13	8	5
	Year	20	29	7	12	6	14	8	4

The Isles situated in Absheron Sea region it is given the statistic information connected with the wind season in this points (Table 2). Here it is shown average annual value too. The repetition of heavy strong winds is larger than that one. Average annual value is blowing from the West. (7-8 m/s). The other parts of the region, the mean speed of the wind is about equal, during open sea process. But as to the North-West and South-West the speed of the wind is decreased gradually. It doesn't take into consideration of information of wind power direction which is shown on this table as well.

Table 2. The average of wind power seasons value in Absheron region (m/s)

Point (islands)	Winter	Spring	Summer	Autumn	Total per year
Pirallahi	6,9	6,5	6,4	6,6	6,6
Chilov	6,5	5,8	6,2	6,5	6,2
Oil Stones	6,7	5,6	5,8	6,6	6,2
Sangi-Mugan	6,6	6,0	6,1	6,9	6,4

For various points there are given numerous days during heavy sea condition or storm, with the speed more than 15 m/s of ships as well (Table 3). As to the table, it is shown 37-50 days during the average of annual in the North-West of Mean Caspian Coast from the Peninsula. The West part of this area, it is increased the quantity of days, as 3 times according to the table (115-145 days as well), but in the middle of the Peninsula it is decreased, as 2 times according to the table (70-100 days). The quantity of wind days from the Peninsula are decreased, directed to the East accordingly, in the open region (till 55 days). According to the given information in Table 3, it is not satisfied with the requirements of

delivering wind positions due to seasons during heavy wind conditions (more than 15m/s). Approximately, the quantity of average storm days are equal both in summer and winter.

Table 3. The average number of stormy days ( $v > 15\text{m/s}$ ) in Absheron region

Point (islands)	Winter	Spring	Summer	Autumn	Total per year
Pirallahi	21	18	14	19	72
Chilov	16	12	12	14	54
Oil Stones	15	13	11	13	52
Sangi-Mugan	19	16	17	21	73

A conclusion of wind regime in Caspian Sea for Absheron region is “Privileging wind is from norths, north –west directions are blowing year around”. The main reason there is lined Caucasus Mountains in the north-west part of this area, as a result, the air course is compulsory intended to the north and north-west direction as well. [3, 4, 5]

### Wave regime of the Absheron region of the Caspian Sea

This area is rough territory due to the wave condition on the Caspian Sea. Here, the level of the sea wave is very more than others. The head level of waves is 39% in the north, 14% in the east and 13% in the south direction. The most dangerous wave direction is north one, which with more power is characterized only. The major wave months are: October, November and January. But it is sometimes observed in summer season.

The level of the wave according to the calculation is more than 4,0 m, in deep water area of Absheron region, but in close area it is 3,5 m. The average level of wave is 4,5 m. It is near the foot of Absheron to the north of areas directly. The mean period of the wave is 8, 5-9 second, in the deeps, the elevation of these sea waves are 4, 5 m. and 9, 5 seconds. There took place once from each 20 years. The repetition of wave is increased. It took place from Absheron to the East and their mean level is 5,3 m. and mean period is between 10,5 seconds gradually. The heavy area is situated between Absheron of the Caspian area and north-east part directly. The mean level sea wave is between 4,0 m, it takes place each 9 seconds once from each 5 years and maximal height is 14 meters.

### The loss of wind-wave calculation during the ship speed process

The calculation can be done using the following formula (1).

$$dV = V_{wh} = (m/L+n) V_0/100 \quad (1)$$

where  $dV$  – the loss of ship’s speed during the effect of wind and wave (percent),  
 $V_0$  – the speed of ship during calm process,  
 $L$  – the length of the ship (m),

$n$  – factor coefficients.

These coefficients are for all kinds of ships, which are determined for all ships which depend upon the power, height directions. [1,4]

### The loss of speed for various types of ships sailing in the Caspian Pool

The ships which are sailing in the Caspian Pool are directed to the ports, by means of Volga-Don canal to the ports of Azov from Kerch to the Black and Mediterranean Seas. These ships take place for carrying cargoes between these pools of parts. As a rule, these ships are “President Haydar Aliyev”, “Nizami”, “Mehdi Hero”, “Maestro Niyazi” and other can be given as an example. For calculation of each ship loss speed special program there is existed. Here, it has been used certain parameters of each ship during the process of forming.

Tables 4-7 show the calculation of ship loss speed which is influenced by the level of wave of four direction due to multi average mean wave level for various kinds of ships in the Absheron Sea region.

Table 4. Wind-wave power loss under various waving conditions for the dry cargo ship “Nizami” ( $\Delta V$  in percent)

Length of the ship (m)	Speed of the ship (knot)	Power of the wave (degree)	Height of the wave (m)	Direction of waving			
				Opposite	Bottom	From hull	From stern
				$\Delta V$	$\Delta V$	$\Delta V$	$\Delta V$
123,5	11,7	5	3.0	1.08	0.89	0.45	0.09
		6	4.2	1.93	1.53	0.59	0.30
		7	5.8	3.27	2.26	1.25	0.27
		8	7.4	3.98	2.84	1.78	0.34

Table 5. Wind-wave power loss under various waving conditions for the railroad sea cargo-passenger ferry “Azerbaijan” ( $\Delta V$  in percent)

Length of the tanker (m)	Speed of the tanker (knot)	Power of the tanker (degree)	Elevation of the wave (m)	Waving direction			
				Opposite	Bottom	From hull	From stern
				$\Delta V$	$\Delta V$	$\Delta V$	$\Delta V$
154.47	17.15	5	3.0	1.34	1.12	0.56	0.11
		6	4.2	2.47	1.96	0.72	0.39
		7	5.8	4.21	2.92	1.63	0.38
		8	7.4	7.05	4.64	2.31	1.35

Table 6. Wind-wave power loss under various waving condition for dry cargo ship “Maestro Niyazi” ( $\Delta V$  in percent)

Length of the ship (m)	Power of the ship (knot)	Power of the wave (degree)	Elevation of the wave (m)	Waving direction			
				Opposite	Bottom	From hull	From stern
				$\Delta V$	$\Delta V$	$\Delta V$	$\Delta V$
140.0	10.4	5	3.0	0.88	0.73	0.36	0.07
		6	4.2	1.59	1.26	0.48	0.25
		7	5.8	2.70	1.87	1.04	0.24
		8	7.4	3.52	2.56	1.43	0.33

Table 7. Wind-wave power losses under various waving conditions for the tanker “President Haydar Aliyev” ( $\Delta V$  in percent)

Length of the ship (m)	Power of the ship (knot)	Power of the wave (degree)	Elevation of the wave (m)	Direction of the waving			
				Opposite	Bottom	From hull	From stern
				$\Delta V$	$\Delta V$	$\Delta V$	$\Delta V$
149.9	12.3	5	3.0	0.98	0.82	0.41	0.08
		6	4.2	1.80	1.43	0.53	0.28
		7	5.8	3.07	2.13	1.19	0.28
		8	7.4	5.52	3.82	1.87	0.97

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# LATVIAN TAX POLICY IN RELATION TO THE MARITIME EMPLOYED PERSONS

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## **Abstract**

*The article explores the Latvian tax system with regard to persons who are in labor relations and are employed on international transport vessels by focusing on the taxes that are generally levied in Latvia. It outlines the historical development of seamen's tax system and performs detailed analysis of responsibilities of employed maritime persons to the tax authority in Latvia - the State Revenue Service.*

**Keywords:** *taxes, sailors, Latvia*

## **Introduction**

Latvia is a seaside country that ranks fourth in Europe in the number of seamen. In total there are almost 13 000 active mariners in Latvia and Latvia still ranks first in the European Union based on the number of mariners to the total national economically active population. More than half of the Latvian seamen are ship officers - captains, navigating officers, mechanics but the others - rank sailors. [7] The registry statistics of mariners maintained by State Joint Stock Company "Latvian Maritime Administration" shows that 46% of Latvian seafarers are employed in the European Union countries including Latvian ships, but 54% work on ships under the flags of other countries.

Tax policy is one of the cornerstones of any economically active state because the state cannot exist without resources. Tax is imposed payment required by law made by a natural or juridical person to create part of the State budget. Tax is the income or the property part that the state or local government receives as definite amount from their own citizens that is used for economic activities and general expenses. [1]

Taking into account the ever-changing tax policy in Latvia with special activity in autumn 2016, article authors have set an aim to analyze the Latvian tax system with regard to persons who are in labor relations and are employed on international transport vessels by focusing on the taxes that are generally levied in Latvia, outlining the historical development of Seamen's tax system and give detailed analysis on responsibilities of employed Maritime persons to the institution which deals with tax collection in Latvia - the State Revenue Service (hereinafter - SRS).

## **The theoretical aspects of the tax system in Latvia**

Latvian tax system is affected by both the Latvian regulatory framework and the European Union regulations. Latvian tax system can be described as average, because every taxpayer pays in on average 30% of his /her income in the budget. [12]

Tax principles are established by law "On Taxes and Duties" and there are direct and indirect taxes. Direct taxes apply to all natural persons and corporate taxable income. Indirect taxes are taxes imposed on goods and services. [13] According to the Law "On Taxes and Duties" Article 1, paragraph 1, the tax is a statutory mandatory periodic or lump-sum payment to the state budget or local government budget (basic budget or special budget), as revenue for government functions and local finance function. [1] In Latvia there are 16 taxes defined [1] which are levied in accordance with specific tax laws (see Appendix).

## **Historical development of seafarers' tax systems**

Seamen's tax system in its historical development has changed. During the war sailors received their wages in cash after having done their working trip. They were often detained because of a change in government, the ship owners changed very often, too. A seaman on board had to spend a longer time until his salary was paid. Taxes from salaries were not deducted because it was actually impossible to calculate how much a sailor earned and where he was located.

For the first time on April 30, 1943 the Law "On Personal Income Tax" was established and after Latvian territory had been included in the Union of Soviet Socialist Republics (USSR) it was the first tax, which was levied on Latvian residents. The law "On Personal Income Tax" in Soviet Latvian territory, with minor amendments remained unchanged up to the gaining back Latvian independence in 1991. [14]

Taking into account the situation in Latvia in 1990, Latvian tax system was very complicated. There was a two-sided system of taxation. Work on the formation of the new tax system began in diarchy conditions and until 21 August 1991 there was a double taxation in Latvia. At the end of 1993, after uniting the Customs Department and the Financial inspection, a single tax administration agency was established. In November 28, 1993 the Law "On the State Revenue Service" was adopted [14].

On 22 November 2001, the Latvian legislator - the Saeima passed amendments to the law "On Personal Income Tax" which was published on December 7, 2001 in the newspaper "The Latvian Messenger". The law came into force on 1 January 2002. These amendments also concerned Latvian seafarers and defined the tax payment, if the individual receives income on the basis of employment relations on international transport vessel owned by a domestic company and the ship is listed in the Latvian Ship Register. Person's income, for which tax on wages is payable, is the main part of the revenue based on the employment relationship set out by the Cabinet of Ministers and it is the amount of a two-year (monthly) minimum wage. Such a payment system existed until 2009. [9]

On 9 October 2008, a new project was submitted to the Cabinet of Ministers: "The State Budget for 2009". One of the amendments was to change currently existing order how Latvian sailors paid personal income tax. In this amendment for the first time the order how a person who is employed on international transport vessels, would pay payroll tax, appeared. It was agreed between the Ministry of Finance and the Ministry of Transport (Latvian Maritime Administration), that person's income for which the tax is payable, if the person is employed (labor relations) on the international vessel, is the employee's basic income in the following amounts: for officers the base of payroll tax was set at amount of 2.5 minimum salaries, other staff - 1.5 minimum salaries.

This special payroll tax regime for seafarers was necessary on the basis of international tax competition, to deal with maritime issues (in a number of EU Member States there was determined preferential regime to seafarers, for example, Lithuanian seafarers' income obtained on the board, was not subject to income tax). The new project proposes to extend the special payroll tax regime to all seafarers, no matter of the flag their ship is registered under. At the same time, taking into account the actual wage difference, payroll tax-based differentiation for the officers and other personnel was introduced. [9]

On March 8, 2012, the Law "On Amendments to the Law" On Personal Income Tax", stated that seafarers', employed on international transport ships, income derived from 1 January 2011 are applicable to:

- # Eligible expenses,
- # The non-taxable minimum,
- # Tax relief.

Such a personal income tax model still exists now. [5]

## **The peculiarities of seafarers' tax policy**

Persons (seamen) who are employed on the international transport vessels, income taxation is different from the general arrangements. Income tax is dependent on the seaman's rank. Personal income tax is a tax levied on natural persons' income. The tax is calculated and paid into the budget in two ways: in advance, also in the form of payroll tax, and summary procedures by drawing up the annual declaration of income. [1]

On March 8, 2012 the Saeima passed the Law "Amendments to the Law "On Personal Income Tax"", published on 16 March 2012 in the newspaper "The Latvian Messenger" No. 44 (4647).

Amendments to the Law "On Personal Income Tax" stipulates that seafarers', employed on international transport ships, income derived from 1 January 2011 are applicable to

- # Eligible expenses,
- # The non-taxable minimum,
- # Tax relief.

At present, the current version of the seafarer's income, from which the payment of payroll tax is levied, is in the following amounts:

1. for officers - determined by the Cabinet of Ministers at amount of 2.5 monthly minimum salaries (in 2016 - 925 EUR);

2. The rest of the staff - 1.5 monthly minimum salaries (in 2016 - 555 EUR). [5]

The monthly minimum wage was determined by the Cabinet of Ministers in November 24, 2015- Regulations No 656 "Regulations on amount of the minimum monthly salary within the normal working hours and the minimum hour rate calculation" and in 2016 it is 370 Eur. [3]

If the person's (seafarer's) employer is a resident of the Republic of Latvia and is required to withhold personal income tax costs, then the declaration of income of seafarers doesn't necessarily have to be provided.

Conversely, if the employer is not a resident of the Republic of Latvia and is under no obligation to withhold income tax costs, the person has to submit an annual declaration of income. According to the report of the State Revenue Service, not all sailors submit the declaration of annual income (Table 1 and Table 2).

Table 1. Submitted declarations in 2015

<i>The year declaration relates to</i>	<i>Together with D2 supplement</i>	<i>Sailors</i>	<i>Officers</i>	<i>Submitted eligible expenditure</i>
<b>2012</b>	173	135	38	60
<b>2013</b>	527	398	129	283
<b>2014</b>	8017	3680	4337	6328

Table 2. Submitted declarations in 2016

<i>The year declaration relates to</i>	<i>Together with D2 supplement</i>	<i>Sailors</i>	<i>Officers</i>	<i>Submitted eligible expenditure</i>
<b>2012</b>	34	27	7	9
<b>2013</b>	151	114	37	70
<b>2014</b>	408	248	160	211
<b>2015</b>	7862	3485	4377	6237

According to the latest statistics, 7862 income declarations have been submitted in 2015, of which 3485 mariners and 4377 officers have submitted income declarations. Taking into account the fact that at the moment there are 11,731 active sailors, it appears that not all of them have submitted declarations.  $(7862 \times 100) / 11,731 = 67.02\%$ . In other words - the declarations are submitted by 67.02% of seafarers, therefore, 32.98% haven't done that. From the Table 1 and Table 2 it can be seen that the sailors submit their declaration not only for the last year, but also for previous years.  $(4377 \times 100) / 7862 = 55.67\%$  from all, who have submitted declarations, are officers, the remaining 44.33% are sailors.

Personal income tax has to be paid to the budget by 16 June. If the deposited tax exceeds 640 EUR, the person may pay it into the budget in three installments - up to 16 June, 16 July and 16 August, each time paying a third of that amount.

The taxpayer (mariners), who gained income abroad and did not obtain any other taxable income in Latvia, has to fill out an annual declaration of income D2<sup>1</sup> due to the law "Foreign-sourced income of natural persons(seafarers) employed (labor relations) on international transport vessels". [10]

The tax levied on natural persons' incomes, such as taxation of the month if the person is employed on the international transport ship, that person's income from which the tax is payable, is obtained in the following amounts:

- Officers - determined by the Cabinet of Ministers - 2.5 monthly minimum salary (in 2016 - 925 EUR);

- Other staff - 1.5-monthly minimum salary (in 2016 - 555 EUR). [10]

The main principle that income tax system is based on, is the principle of justice of taxation on the basis of the tax payers' ability to pay. The implementation of the principle of justice is respected both vertically and horizontally.

Implementing the principle of vertical equity, taxable persons with different solvency have different tax burden, that is, those whose ability to pay for some reasons is higher, have proportionally higher taxes. In accordance with the principle of horizontal equity, tax payers with the same ability to pay have to be imposed equal tax burden, that is, all individuals who are in relatively similar conditions, have to be taxed equally. [12] Turning to the definition of the horizontal equity principle that applies to the same solvent sailors, I conclude that this principle is not fulfilled. Mainly ships of commercial fleet has three captain's assistants with different experiences and, of course, salary. It should be noted that the remuneration of the third mate and the first mate drastically differs, but the tax rate for them is the same. The difference is not only among officers. Latvian legislator - the Saeima has not examined properly also the tax on issues of maritime education institutions - Latvian Maritime Academy and Liepaja College where the students in their practice time at sea receives a relatively small salary, which in principle is comparable to the scholarship. SRS collects the same taxes from this salary.

As mentioned above the horizontal equity principle is not fulfilled. Officers' tax object, from which the personal income tax is calculated, is unchanged regardless of position grades. The problem is that the officers' salaries are different, so the applicable coefficient is not correct for all. With the introduction of differentiated rate coefficient to a younger officer - 1.5 ( $1.5 \times 370 = 555$  EUR (2016)); the third captain's assistant - 1.8 ( $1.8 \times 370 = 666$  EUR (2016)); the second captain's assistant - 2.0 ( $2.0 \times 370 = 740$  EUR (2016)); the first captain's assistant - 2.2 ( $2.2 \times 370 = 814$  EUR (2016)); Captain- 2.5 ( $2.5 \times 370 = 925$  EUR (2016)), each officer pays taxes proportionally to the size of the salary. Of course, such tax payment is more complex, but it corresponds to the principle of justice in relation to persons who are employed on international transport vessels. Such tax rate would certainly be "friendly" to the seafarers and it would raise their self-esteem.

A seaman who is an employed or self-employed person on a sea ship under the flag of any EU Member State, has to pay social security contributions in that member State. If such a person receives a salary from the company, which has its registered office or place of business in another member State, social security contributions must be carried out in that country, if the person lives there permanently.

Seamen who live in Latvia and are employed on the vessels, which are in the Norwegian International Register, have to follow the system of Latvian social security laws and regulations. Thus, the Latvian sailors doing the work on those ships, continue to pay the national social security contributions in Latvia. The State Social Insurance Agency (SSIA) issues to such seamen an A1 certificate stating that the state compulsory social insurance contributions are carried out in Latvia. To receive an A1 certificate, a seaman has to fill in an application due to retention of social insurance status in Latvia, working in the country with the treaty of international agreement. [5]

More complex situation is for seafarers who do not have state social insurance on a compulsory basis. These seafarers are not employed on ships under the flag of Latvia or Norway. The number of such seamen in Latvia is considerably higher. The students of Latvian Maritime Academy spend their practice time mostly on ships that do not provide social protection for seafarers. Based on the law "On State Social Insurance", a 15-year old person with a permanent residence in the Republic of Latvia can join state social insurance voluntary in case if the person is not subject to compulsory social insurance in the Republic of Latvia. [1] This means that if the person is under legislation of another Member State, but the he/ she is interested to remain insured in Latvia, for example, in case of short-term employment, then the State Social Insurance Agency (SSIA) may agree with the competent authority of other Member State that the person is subject to Latvian law. In this case, based on the rules No 976 of the Cabinet of Ministers on October 12, 2010, "Regulations on the voluntary accession to the state social insurance", the person has to go to the SSIA payment section and submit an application for receiving a certificate A1. [4] So the sailors, including trainees - students can join the state social insurance. Voluntarily joining the state social insurance the person has to pay both the employer and employee's rate. In 2016 voluntary contribution rate of a person who has voluntarily joined the pension insurance is 23.86 % of the voluntary contributions. A person who voluntarily joined the state pension insurance, disability, maternity, sickness

and parental insurance, it is 31.47 % of the voluntary contributions. This means that there is a choice whether to join only the pension insurance or pension insurance, disability, maternity, sickness and parental insurance. Voluntarily insured person has a right to withdraw from the voluntary joining state social insurance, by giving a written notice to SSIA department. The object of voluntary contributions are voluntarily chosen person's amount of money from which calculations are done and voluntary contributions are made. The amount of minimum voluntary object of contribution of voluntarily insured persons is twelve minimum monthly salaries - 4440 EUR a year (12 x 370 EUR, in 2016). [4]

According to the Law "On State Social Insurance" Article 13, the subjects of social insurance and employers are registered by the State Revenue Service (SRS). The employer or the worker of any Member State can register in SRS, if he or she and the employer have agreed that contributions will be done by the worker. If a person is applicable to legislation of the Republic of Latvia – the certificate A1 is issued and the person has agreed with the employer that the contributions will be carried out by person himself, then the person will have to do that under the foreign status.

The domestic employees under the foreign status have to register in the Taxpayer Register of the State Revenue Service reporting their place of residence within 10 days from the date of acquiring the status. The domestic employees under the foreign status are obliged to submit a report on the SRS object of mandatory contributions and compulsory contributions till the deadline of carrying out the mandatory contribution. [11]

So a person who is employed on an international transport ship and the students of Latvian Maritime Academy can register themselves as a domestic employee under the foreign status and pay state social contributions independently. The amount of social insurance contributions is 34.09%. [11]

According to the data of the Latvian Maritime Administration register, there are 12,738 active sailors registered in Latvia. 11,731 of them have been certified to serve in commercial fleet, but in 1007 of them for work in the fishing fleet and on inland waterway vessels. 5812 or 49.5% of seamen in commercial fleet are boatswain, sailors, motor mechanics and maintenance personnel while 5,919 or 50.5% are marine officers (captains, navigators and mechanics). This year for the first time the number of Latvian naval officers and rank seafarers has leveled. In 2010 the ratio of rank seafarers and marine officers was 54 : 46, but in the beginning of 2015 – 52 : 48 [6]. Sailor employed (labor relations) on international transport vessels, the income paid applies to the law "On Personal income tax" Article 8, the 4th paragraph withhold personal income tax from 1.5 or 2.5 minimum wages, depending on the seafarer's position. This is the essential difference in comparison with other people working in Latvia. In Latvia the income tax of the gross salary is calculated as follows:

- SSC (State social insurance contributions)
- deducted non-taxable minimum and relief for dependents,
- the personal income tax is calculated from the rest of the amount.

For persons who are employed (labor relations) on international transport vessels, the tax amount is calculated not from the salary that person receives a month, but from the amount that is 1.5 monthly minimum salaries for sailors, and 2.5 minimum salaries - for officers. [8] Since January 1, 2011 for sailors, like all other natural persons, working income is applied with the tax-free minimum, tax relief for dependent persons, as well as eligible expenditure.

The program for students (navigation officers) of Latvian Maritime Academy includes two practices on ships at sea - a total of 1 year. For each practice the student can receive a daily allowance. The amount of remuneration depends on the company in which the student has practice, on average it is 500 EUR monthly, in other practices it is not paid at all.

Employers' views on the daily subsistence payment during the practice is divided - some believe that the salary should be paid, others explain that the practice is a great way to gain experience, but due to the lack of practical skills, students may not occupy or replace a fully fledged employee's place, that's why the payment for the work done can't be given. Practice and paid employment is not one and the same. To get a job a candidate offers his competence, quality and experience in accordance to the position. In turn, the practice is an opportunity to acquire knowledge and skills to prepare better for the profession in the maritime sector. In addition, the practice is also a very good opportunity to understand in reality whether this is an area that really interests a person.

Latvian tax system does not give any special incentives for students when they pay taxes. Tax payment procedure is the same as for all seafarers who constantly go on voyages. Students under 24 years of age are still dependent on parents. At the beginning of the school year, parents submit a report issued by Latvian Maritime Academy to the State Revenue Service informing that a particular man is studying at the institution. A person who is in charge of the student in the family receives tax relief 175 EUR per month (in 2016), if the student has not been granted a pension, he does not receive a pension within the

Law "On State Pensions" or other public pension. A natural person does not apply to tax relief for dependents on the tax part of the period (the calendar month), in which the dependent person receives taxable income that exceeds a certain monthly amount of tax relief and subject to the overall 23% tax rate. [2]

Filing in the tax declaration, maritime students who are studying have two tax options: Declaration D2 or D2<sup>1</sup>. Filing in declaration D2<sup>1</sup>, the taxable amount is calculated from 1.5 monthly minimum salary (in 2016 - 555 EUR). In turn, filling the D2 declaration of the amount of tax is calculated on all income. In other words - if cadets' monthly income is more than 555 EUR, then the best way is to fill D2<sup>1</sup> declaration of income and tax amount will be less than in case of completing the declaration D2. Conversely, if the income is less than 555 EUR, then the best way is to fill in the D2 declaration.

Sailors who are not working on the Latvian or Norwegian registered ships and are not joined the voluntary state social insurance do not qualify for public pensions, unemployment benefits, state social services, etc.

Implementing the principle of vertical equity, taxpayers with different solvency imposes different tax burden. For those whose ability to pay for some reasons is higher, their taxes are proportionally higher as well. According to the horizontal principle of equity, taxpayers with the same ability to pay are imposed the same tax burden. Remuneration for the third captain's assistant and the first captain's assistant is drastically different, but the tax rate for them is the same. In this case, the horizontal equity principle is not respected.

## Proposals

In the tax system of Latvia (the Law "On Personal Income Tax" the fourth paragraph, article 8) the addition should be introduced to facilitate the students' taxes in maritime sector, because students do not have permanent income.

In the Law "On Personal Income Tax" in Section 8 of the fourth paragraph some amendments should be introduced, for instance, a differentiated rate of persons depending on their position on the board.

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## Appendix

### Taxes in Latvia

<i>Type of tax</i>	<i>Scope</i>	<i>Provision</i>
Personal income tax	The personal income tax levied on natural persons' income	The law "On Personal Income Tax"
Corporate income tax	Imposed on natural persons' obtained income	The law "On Corporate Income Tax"
Property tax	Paid by Latvian or foreign natural and legal persons and based on the contract or other agreement established groups of such persons or their representatives who own real estate	The law "On property tax"
Value-added tax	Consumption tax, which is included in the price of goods or services and a customer pays for the product or service	The law "On Value Added Tax"
Excise tax	Specific excise tax applicable to certain commodity groups that have been produced or imported into the country	The law "On Excise Tax"
Customs tax	External marketing tool which helps to protect the European Union's (EU) internal market.	Customs law
Natural resource tax	The tax is to promote economically efficient use of natural resources by limiting environmental pollution, to reduce pollution in production and marketing by promoting a new environmentally friendly technologies to support sustainable economic development as well as to ensure financially the measures of environmental protection	Law "Natural Resource Tax"
Lottery and gambling tax	Paid by corporations according to the procedure specified by the Supervisory Inspection of Lotteries and Gambling and if the corporations have received a special permission(license) for the organization of lotteries / gambling	Law on Gambling and Lotteries and the Law "On Lottery and Gambling Tax"
State social insurance contributions	A statutory compulsory payment in the special budget account, which entitles the insured person to receive statutory social insurance services	The Law "On State Social Insurance"
Car and motorcycle tax	Car and motorcycle tax application and administration procedures for tax rate	"Law on Car and Motorcycle Tax" and the rule Nr.1618 based on the Cabinet of Ministers on 22 December 2009 "The procedure of Car and motorcycle tax payment, charging and administration"
Electricity tax	It is levied on electricity delivered to the consumer, as well as the electricity, which is supplied and used for own consumption	Electricity Tax Law and the relevant Cabinet regulations
Micro-enterprise tax	The applicability of tax legislation for corporations under special conditions	The Law „On Micro-enterprise Tax"
Vehicle exploitation tax	Applicable tax rates for vehicles and the procedure administration	Vehicle operating tax and company Car Tax Act based on the Cabinet of Ministers on 11 December, 2012, the Regulations Nr.858 "Vehicle operating tax and Company's Car Tax Payment Procedure"
Company Car Tax	Applicable tax rates of Company's vehicles and administration arrangements	Vehicle operating tax and Company's Car Tax Law, issued on 11 December 2012, by the Cabinet of Ministers, regulations Nr.858 "vehicle operating tax and Company's Car Tax Payment Procedure"
Subsidized electricity tax	Applied to the income from the electricity sold within the framework of compulsory purchase, the revenue of the guaranteed fee for installed electric power in the cogeneration or electrical station	The Law "On subsidized electricity tax"
Solidarity tax	The tax applied to insured persons - employees, the self-employed whose income in a calendar year exceeds the mandatory state social insurance contributions to the maximum amount	"Rule of Solidarity Tax "

# INLAND WATERWAYS TRANSPORT SERVICE: DEVELOPMENT STRATEGIES AND EVALUATION MODELS

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## **Abstract**

*Inland waterways transport is one part of the general transport system. This system includes rivers, lakes and canals, which often are connected to the sea and seaports. The most problematic task of the increasing sector of services is ensuring the quality of services. High and exclusive quality of services is a way to attract new clients and make them loyal to the company for a long time. So, the object of the research is a service of the inland waterways transport. More important strategies of the inland waterways transport development are discussed by characterizing prerequisites of their evaluation models. Main methods such as scientific literature analysis, comparative analysis of service evaluation, and synthesis were used in the research. The methodological principle is constructivism. It orients companies that providing the inland waterways transport service to combine their marketing visions with the constructs of potential clients' mentalities and their needs by creating the common construct of service marketing regarding relationships between science and practice. The results of the research can be applied in the marketing processes of the inland waterways transport service.*

**Keywords:** *inland waterways, transport, service, development, strategies, evaluation models.*

## **Introduction**

Inland waterways transport is one part of the general transport system. This system includes rivers, lakes and canals, which often are connected to the sea and seaports [15]. Only AB "Smiltynes Perkela" has most experience in area of the inland waterways transport of passengers in Lithuania. This company is characterized by the strategic aim - to guarantee the connection between two banks through the Curonian Lagoon to the Curonian Spit. AB "Smiltynes Perkela" takes in account the quality of service for clients. It is based on the company's mission and values.

## **The grade of the exploration**

The most problematic task of the increasing sector of services is ensuring the quality of services [2; 3; 4; 9; 11]. High and exclusive quality of services is a way to attract new clients and make them loyal to the company for a long time. So, the quality of providing services is quiet often investigated. This problem of the research is always relevant to each company [17; 18].

It is appropriate to discuss the inland waterways transport service by analyzing some development strategies and evaluation models, application of which is less investigated worldwide. Researches are usually limited by the local problems of some companies.

How much it was possible to explore, majority of investigations include the technological level [16] more than a psychological one [8] as an exploration of the needs of customers and development of them regarding using of the inland waterways transport service.

## **The object, goal and tasks of the research**

The object of the research is a service of the inland waterways transport. The goal of the research is a discussion on more important strategies of the inland waterways transport service development and models of its evaluation. The tasks of the research are as follows:

1. Revelation of strategies of the inland waterways transport service development.
2. Characterization of prerequisites for evaluation models of inland waterways transport service.



## **The type of the research and methodological principle**

The type of the research is theoretically descriptive. The methodological principle is constructivism. It orients companies that are providing the inland waterways transport service to combine their marketing visions with the constructs of potential clients' mentalities and their needs, by creating the common construct of service marketing regarding relationships between science and practice.

## **Methods and methodological limits of the research**

Main methods such as scientific literature analysis, comparative analysis of service evaluation, and synthesis were used in the research. Methodological limits of the research are based on the theoretical approach to the investigated phenomenon, which as scientific prerequisites can be applied in practice.

## **Development strategies of the inland waterways transport service**

Peculiarities of the inland waterways shipping service are investigated. It is appropriate to clarify, what the inland waterways are, and what the representing inland waterways system is, by investigating the characteristics of inland waterways transport services. Inland waterways transport is one of the common transport system. Inland transport system consists of:

- Waterways (rivers, lakes and canals);
- Lock systems;
- River ports;
- Navigation inland waterway system;
- Sliding and swing bridges.

General inland waterways transport trend is transferring of a part of cargoes to alternative types of the transport, and it allows to develop the inland waterways transport. Busy road traffic promotes to use the inland waterways transport for transportation of freight and passengers from seaport terminals and backwards [15].

The main inland waterways advantages are as follows:

- Relatively small ships carrying quite a lot of cargoes;
- Simple loading technology;
- Comfortable berths are used for ships loading and unloading processes.

911.1 km of inland waterways, 448.3 km of which is suitable for the transportation of freight and passengers, are in the Republic of Lithuania. The main part of freight and passengers transported on inland waterways transport of Lithuania consists of the ferry to Neringa. Passenger flows formed between people and places concentration goes through the main transport hubs [14].

Passenger flows can be relatively divided into three types:

- Random passengers traveling at a one-off needs;
- Business travelers usually take place on a regular basis;
- Vacationers whose flow depends on the season and the economic situation.

Random passenger traffic consists of passengers who have a necessity to go to a specific location for various reasons, such as visiting relatives. Such passenger traffic is chaotic and predicting of that receives a very high coefficient of variations. Business passenger flow depends on the general economic situation. If the economic situation is favorable, the number of business passengers are stable or increasing. Economic crisis situations decline the business passenger traffic [14].

Vacationing flow also depends on the economic situation but the flow of passengers is affected by seasonality. The largest flows of passengers are staying in the warmer months. The business objective is to acquire and retain customers. It has only two basic functions - marketing and innovation. The main function of marketing is to grab and keep the profit consumers.

One of the basic rules of the market declares that only a good knowledge of the user and constant working with him/her ensures the success of the service. Nowadays marketing is seen as the process consisting of several parts:

- Identification of the user: the most important marketing figure is the consumer's needs and desires; it is important to set potential users and their needs;
- Engagement of the user: there are analyzing and suggesting ways and means to help grab the attention of the user;
- Brand recognition: the effort for branding goods and services;
- Decision making: the promotion of the user to decide to buy [3].

Much is in common among the overall strategy of the inland waterways transport organization and marketing strategy. Marketing cares about the needs of consumers and the company's ability to meet them. Most of the company's strategic planning is related to the marketing variables. Sometimes it is difficult to distinguish between the strategic planning and marketing planning.

Marketing strategy is a coherent set and a coordinated set of marketing actions directed to achieve its long-term goals of the inland transport service marketing. The marketing strategy is to balance between the different and frequently conflicting with each other forces and factors influencing the organization, to find and transform the long-term benefits to the organization. An exclusive marketing management feature is that marketing decisions must be based on knowledge of the market and responded to its changes.

Strategic planning of service marketing includes marketing targets, package selection, market segmentation and marketing programs for the future period of development, the strategic and tactical marketing action planning, monitoring and evaluation. Marketing plan of the inland water transport service should answer five key questions:

1. What does company want?
2. Where is it now?
3. Where does the company want to enter?
4. How can it get there?
5. Where has it gone so far?

Marketing plans are based on detailed information obtained from users, participants of distribution channel, competitors and marketing environment. This information is continuously collected and processed. The mechanism of marketing decisions, to get the required data, called Marketing Information System – it is a general term used to define the formal way, in which the company receives, processes and uses the information needed to develop a marketing strategy [11].

The organization of inland water transport service decides on a type of the strategy, positioning and marketing mix in preparing a marketing strategy. Organizations mostly use one of the alternative strategies - undifferentiated, differentiated or concentrated [2] (Table 1).

Table 1. Marketing strategies

STRATEGY	CHARACTERISTICS
Undifferentiated	Identical services for all target segments. Organizations, presented new services, uses it. The main task to properly deliver the service is to inform about it as more users as it is possible. The limitations of the strategy highlights when the needs of users have changed.
Differentiated	Several supply options are for each segment. This is being applied when the market is well-established and its needs are well-known. Service organizations meet not only the needs of different segments but also of individual users. Disadvantage of that are increased costs. If the organization is more adaptive to users, it has a larger market and is less vulnerable.
Concentrated	Strategy is implemented by the organization with the scarce resources and the fierce competition. The organization serves one segment and there is a risk of acquiring competitors.

A further step in marketing strategy is positioning of services and preparation of marketing mix. Positioning is a creation of the company offer and image, which aims to occupy a privileged position in the consumer's mind.

Positioning strategy is to create the consumer's mind of the services that is clearly distinguishing it from in the services offered by its competitors. A common assumption is that the positioning is characterized by the greatest influence of advertising. But the service position depends on all elements of the marketing complex. Positioning is very important for new services. However, it is necessary to maintain and improve the incumbent's position of the services. When the organization is fundamentally modernizing services and the supply, it needs a repositioning to replace the user's former consciousness with the new service image.

A service organization can use various dimensions for the positioning - needs, benefits offered, exclusive service features, service use location and time, the user of services etc. The successful positioning of the service is based on quality dimensions. The following criteria such as tangibility, reality, image of workers and of consumers are also relevant for service positioning [2].

When the organization of inland transport services decides for positioning, it is considered how users will get the promised benefits and how the aims of competitiveness will be achieved. The complex of marketing element is prepared for each segment.

Marketing complex is a whole of decisions and of market impact tools used by the company in order to cause the desired response in the target market, and to meet consumers' desires and needs by achieving its goals. Marketing can be defined as a set of controlled marketing tools used in conjunction with the desired target market reaction to achieve payback. Marketing complex includes everything that the company can make for influencing the demand of its services.

The most important characteristic of marketing mix decisions and factors is belonging to the jurisdiction of the organization. They can be controlled, regulated and changed by the organization. The company relies on all elements of the marketing mix by planning its marketing activities. However, each of them can be implemented using a variety of alternative means and different strategies. The task of the marketing specialist is a coordination of different marketing mix elements, strategies and implementation factors [11].

Creation of the diversity of services and constant innovation is one of the strategies that help the inland shipping companies to increase the demand for their services provided.

An example of the diversity of services in the inner waters of Lithuania is pleasure boat "Venus". The initial operation of the ship was the tours in the port for free. A number of users have emerged, so the range of services has expanded. It was started to organize the events, conferences, seminars, musical evenings on board and cruises within the Curonian Lagoon. Then deals appeared to sail to Juodkrante, Nida and Minge [1].

Another unique attraction in the Curonian Lagoon was performing ferry "Nida". The activities carried out in the summer for eight seasons, starting in 2007. Musical evenings and performances were organized at the ferry [13].

There is an example from the Australian inland waterways in Melbourne - educational mini-cruises is organized nearby islands where people can see unspoiled nature and can enjoy a parade of penguins and pelicans, also feeding them, in Phillip island. People can order a trip by horse and get a meeting with the koalas in another island [7].

Weekend trips by ferries at the unique nature are organized in Danish inland waterways. Tourists can choose from several options the most suitable ferry trip. Here is offered various services in order not to prolong the journey. Tourists can be savored with wide-ranging food and shopping by traveling to the selected location. The assortment of goods is not wide but is conforming to the needs of customers [6].

The main part of the number of passengers, carried by inland waterways transport in Lithuania, consists of cargoes and passengers carried by the ferry to Neringa. It is the main activity of AB "Smiltynes Perkela". However the company also has added to its range of services and offered the new service - it is a journey by catamaran from Klaipeda to Smiltyne, Juodkrante, Nida and back.

## **Evaluation models of the inland waterways transport service**

The service quality aspects and factors are discussed within the various public and private services and almost all studies presented amendments or additions that reflect the specific service. Therefore, the attempt to present a unified, generalized evaluation methodology for inland transport services was not useful.

However, there are 18 factors of quality [5]. This list is often used and applied in different models of the quality evaluation:

1. *Access*. Physical availability of local services, including a simple and easy orientation of service locations and routes clarity.

2. *Aesthetics*. The degree, to which services are appropriate and meet consumers, including the appearance of service, goods and personnel appearance and presentation.

3. *Attentiveness and helpfulness*. The service, particularly the contact employee, helps the user or consumer or makes an impression of their willingness to help.

4. *Availability*. There are service tools, staff and product available to users, and contact staff and relations of employee and customer. It means also the time that each employee can share with each customer. Product availability consists of products quantity and range.

5. *Thoughtfulness*. Concern, diligence, patience and sympathy are shown to a consumer.

6. *Cleanliness and tidiness*. Clean, tidy and attractive appearance characterizes the service environment, tools, products and contact personnel.

7. *Comfort*. Physical comfort of services environment and tools.

8. *Devotion*. The obvious commitment of employees, as well as pride and satisfaction experienced by them at work.

9. *Communication*. Service provider's ability to communicate with the customer in a meaningful way for him/her. This includes both oral and written information provided to the client, clarity, completeness and accuracy of the employee's, his/her ability to listen and understand the client.

10. *Competence*. There are skills necessary for service provision, experience and professionalism. This includes the necessary procedures for the enforcement of the correct implementation of the client's instructions, contact staff demonstrated knowledge of the product or service, good, fair advice and the ability to do a good job.

11. *Respect*. Politeness, respect and proper behavior demonstrated by serving, in dealing with the customer and working with the client's property. This includes the ability of employees to be not bothersome and unobtrusive.

12. *Flexibility*. Willingness of the service provider and his/her ability to change or adjust the service or product by meeting the customer's needs.

13. *Friendliness*. A positive attitude of service providers and sincerity to the client and the ability to show the client that he/she is welcome.

14. *Functionality*. Practicality and relevance of services and goods are relevant for a concrete purpose.

15. *Integrity*. Honesty, fairness, impartiality and trust are qualities, which the service provider organization has as guidelines in its relationships to the client.

16. *Reliability*. There are services, goods and personnel reliability and consistency. This includes the punctual service and the ability to comply with the agreements with the customer.

17. *Sensitivity*. There is the speed and timeliness of service. This includes fast and efficient services and the ability of service providers to quickly respond to customer's needs without wasted time.

18. *Security*. Private client and his/her estate security while the customer using the service. This includes preserving the confidentiality [5].

We have to figure out, how a quality of service and satisfaction of consumers are managed, in order to properly understand, how many factors are affecting the quality of services. It can be defined on the basis of assessment of the quality of service models.

**Ch. Gronroos** commonly perceived quality model. This model of service quality is considered as one of simplest models of the service quality. It consists of two parts - the expected quality and quality of the experience. Technical and functional quality, received and accepted by the user, based on the emergence of the image of the service, forms the quality experienced by the user (Figure 1).



Figure 1. Ch. Gronroos service quality model

The resulting image is very important to the inland waterways transport demand, especially when it relates to the passengers' recreation. The two discussed quality aspects are - what is available and how to provide it. It is related to the user's experienced quality dimension.

However, it does not exhaust the quality concept of inland waterways transport service, which is broader and more complex. User's experienced quality must be supplemented by another aspect - the concept of quality expected by the user. It is important for companies' marketing. If the user's expectations are unrealistic, the general perceived quality will be maintained low even if the objective evaluation of experienced quality is appropriate.

The resulting of inland passengers' preconceptions is very important for inland waterways transport services. If the provider is good from the passenger's point of view, the user usually looks beyond the minor errors. The same principle works on the contrary. If the image of inland transport services is

negative, the users' reaction to errors will usually be much higher. Thus, the image becomes a kind of filter when the passenger perceives both technical and functional characteristics of the service quality [10].

User's experienced quality of services is formed by the technical and functional aspects of the quality. It is managed by the local image, which the user has formed regarding a provider. Thus, it is an integrated concept, for which is of key importance the assessment made by the user of services.

The scientific literature also gives other models of the quality of services.

**E. Gummesson 4Q (4 qualities model).** E. Gummesson submits his four qualities model based on Ch. Gronroos model. The model includes: design quality (modeling) - both product and design services have to attract the customer; products / services (production) quality has to meet the needs of customers; the quality of delivery must fulfill the promise for the customer; rational quality (relationships) includes interaction between the customer and staff.

4Q model quality is oriented to the customer and to the process. The model includes the quality of consumer's expectations and of image of the service provider, and the main determinants of the quality - design, production, presentation and relationships [2] (Figure 2).

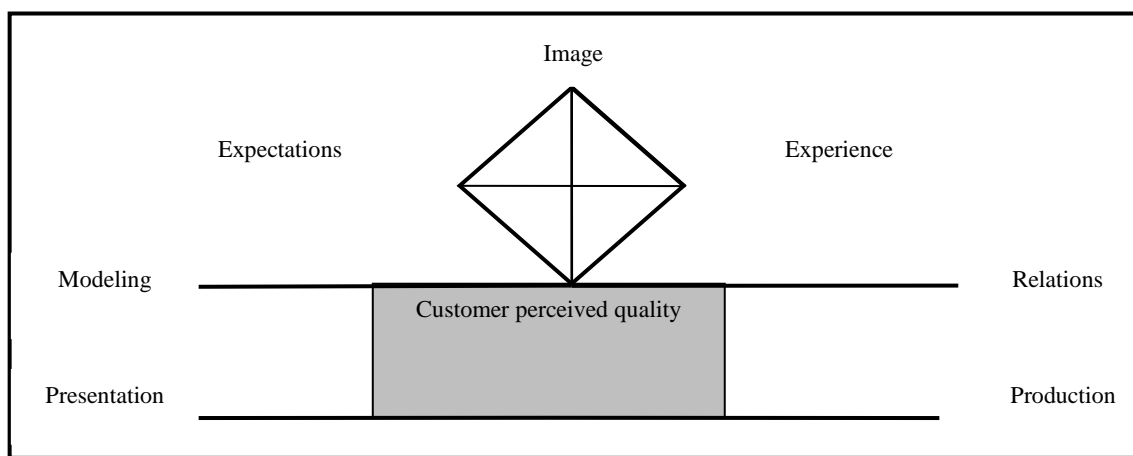


Figure 2. E. Gummesson 4Q model

The essence of the Gummesson model is that the service quality is affected by the user's expectations, experience and image of the service's provider.

However, this model can be applied only to those services, which have tangible results, such as printing services. The model more includes quality of service at the time of its creation and can be effectively used to deliver new services. But the assessment of existing services does not focus on the feedback. Therefore, it is not suitable to assess the inland waterways transport service.

**W. Muller service quality model.** Evaluation of the service quality starts at the offer stage. This model considers the quality of evaluation before, during and after the using of services. It reveals the relationship of the quality evaluation and consumer's behavior. The individual quality assessment is determined by the perceived quality, cognitive comparison and reaction after the psychological evaluation.

The tourist satisfaction is the main factor in the case of inland waterways transport services. The passenger's satisfaction or dissatisfaction depends on a loyalty to the inland waterways transport organization, on complaints and opinions, which are spread to other users of services.

The user's reaction after using of services helps the service provider take the appropriate strategic decisions [2].

**N. Kano service quality model.** This model is developed to help identify and understand the relationship between the service performance and customer's satisfaction. The model analyzes the features, which are divided into 5 categories: attractiveness, one-dimensional assessment, "must-be" elements, different elements and feedback [12]. It is a wide application model. It analyzes the quality from the perspective of service providers and recipients.

Later the enhanced N. Kano model focuses on the customer's perception of the quality. The model produces better results when the criteria are selected according to the target customers' audience. The feedback and monitoring of the customers' continuous satisfaction are most relevant.

Monitoring of customers' satisfaction requires the evaluation of the inland waterways transport information related to the users' perception of services.

**A. Parasuraman** quality gaps assessment model. The model reveals that the quality is formed by two components - the customer and the service provider. Gaps reflect the key factors, which ensure the quality of services based on the view of customers and the service company. There are main gaps of the quality that determine the users' dissatisfaction (Table 2).

Table 2. The main quality gaps

TITLE	DESCRIPTION
Knowledge gap	It is a difference between the knowledge about service consumers' expectations and the actual expectations of consumers.
Standards gap	It is a difference between the perception of the service consumers' expectations, and the quality standards.
Presentation gap	It is a difference between the actual services provided and standards.
Communication gap	It is a difference between what the company believes to provide and the real providing.
Perception gap	It is a difference between what was actually presented and what did users perceive.
Interpretation gap	It is a difference between the provider's promise and what users understood that was promised.
Service gap	It is a difference between the expectations of consumers and their perception about the actual service.

The table presents the main quality gaps. Services gap is the most important because it reflects the common assessment, compared what is expected with what is actually received. The main task of improving the inland waterways transport service quality is to minimize this kind of gap.

**ACSI (American Customer Satisfaction Index)** model. The ACSI model is a cause-and-effect model. The customers' expectations, their perceived quality and perceived value are on the left side of the model. The satisfaction of users is in the center. The outcomes of satisfaction and customers' loyalty are on the right side (Figure 3).

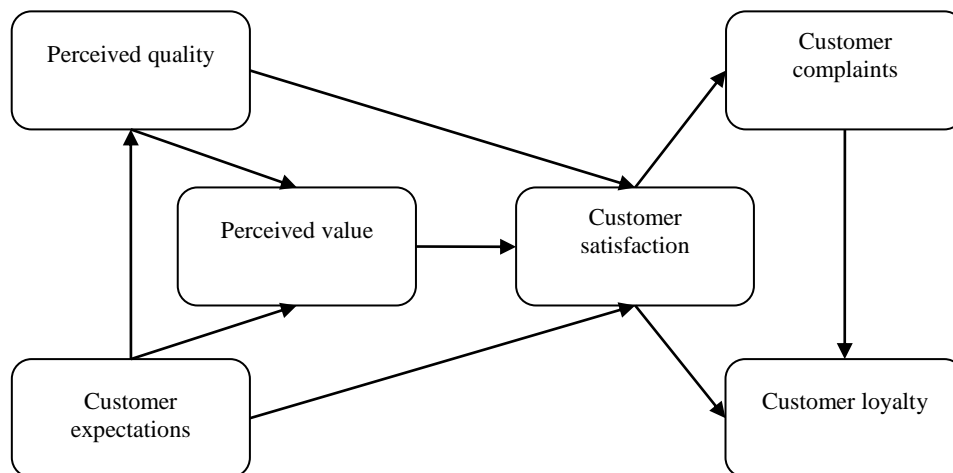


Figure 3. ACSI model

The components shown above are changeable. The survey and modeling methodology determines the strength of relationship between the components on the left and components on the right. These arrows represent the impact to the satisfaction of the customer. It is related to the loyalty of customers as well.

The scientific literature provides an abundance of service quality evaluation models by showing a complexity of this issue. As the best and universally recognized model is one of A. Parasuraman, V. A. Zeithaml and L. L. Berry. It is a SERVQUAL (service quality) model. This model was composed according to the A. Parasuraman quality gaps model and five additional dimensions of quality assessment. SERVQUAL model is considered as a valid service quality assessment instrument because of opportunity to improve the service regarding consumers' expectations and their perceived quality [19].

SERVQUAL methodology is characterized by the fact that it can be used to evaluate a variety of service quality because of a possibility to determine the strengths and weaknesses of services [2]. The

SERVQUAL methodology to evaluate the service quality is based on five dimensions - tangibility, reliability, responsiveness, assurance and empathy [9] (Table 3).

Table 3. SERVQUAL dimensions of services

DIMENSIONS	DESCRIPTION
Tangibility	The physical environment made of objects (e.g., ferry interior design) and individuals (e.g., ferry staff appearance).
Reliability	The service provider's obligation to provide an accurate and reliable service.
Responsiveness	Organizations desire to assist their customers to ensure the fast and efficient service performance.
Assurance	Features that give confidence to customers (e.g., specific ferry service knowledge, polite and reliable staff behavior).
Empathy	Preparation of the organization and its ability to give the personal services to each customer.

Subsequent tests showed a very close connection between these criteria. So, this model is optimal to assess the quality of the inland waterways transport service.

## Conclusions

A company, that provides the inland waterways transport service, has to make decisions by preparing the marketing strategy especially in regard to a type of the strategy, positioning and marketing complex. Organizations usually prefer one of alternative strategies - not differentiated, differentiated or concentrated one. The most important marketing strategy of the inland waterways transport service is a creation of the diversity of services by continuous innovation for increasing of demand for services provided.

A basis of all evaluation models for the inland waterways transport service is the needs of clients. The needs must be combined with the proposed activity of the organization. There are divided different needs and methods of their selection. It is appropriate that each shipping company used a model as the basis for the evaluation of its service quality but not directly implementing the theoretical methods presented because the evaluation of service quality aims to change, improve and supplement the provided transport service. The results of the research can be applied in the marketing processes of the inland waterways transport service.

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# CRUISE SHIPPING IN KLAIPEDA PORT: MARKETING PREREQUISITES

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## **Abstract**

*The main issue of the research is a possible development of cruise shipping in Klaipeda port. It is appropriate to evaluate the marketing tools in cruise shipping in Klaipeda port by finding opportunities to improve them. Klaipeda port is able to establish itself in the cruise shipping market by using marketing methods, taking into account the needs of tourists and aims of the port, the appropriate business conditions and competitive advantage. The object of the research is a marketing activity of cruise shipping in Klaipeda port. The goal of the research is a discussion on the optimal marketing tools for cruise shipping in Klaipeda port. The tasks of the research are analysis of external and internal factors, and analysis of marketing mix elements. The type of the research is descriptive. The methodological principle is constructivism. Main methods such as scientific literature analysis, PEST and SWOT analysis, comparison, analysis of marketing mix elements and synthesis were used in the research.*

**Keywords:** *cruise shipping, Klaipeda port, marketing tools, marketing mix elements.*

## **Introduction**

The need of cruise shipping is globally increased. Incomes from cruise shipping are also increased and consists of on average 2.5 billion US dollars annually. Cruise travels remain popular. 25 new cruise ships are under construction for the European market. Those ships will be built in 2-3 years. Their total capacity should be more than 76 thousand passengers [2; 12].

The number of cruise ships in Klaipeda port did not change. However, the number of tourists increased by 10 thousand each year (2011-2015) [3]. It relates to the activity of the Klaipeda seaport authority administration. Main functions of the authority administration are as follows: control of the port, attracting of new customers, port development and innovations. The authority administration is applying the marketing tools in order to attract new shipping lines and to use all available resources. It is investing in advertisement of cruise shipping and participation in exhibitions for the development of the port attractiveness. Cruise shipping mostly enriches the Klaipeda region. One tourist on the shore spends on average of 52.33 EUR [4].

It is appropriate to evaluate the marketing tools in cruise shipping in Klaipeda port by finding opportunities to develop and improve them. Klaipeda port is able to establish itself in the cruise shipping market by using marketing actions, principles and methods, taking into account the needs of tourists and aims of the port, the appropriate business conditions and competitive advantage.

Many authors investigate the problems of cruise shipping marketing [1; 3; 4; 7; 8; 9; 10; 11; 12; 13]. However, there is a lack of publications on cruise shipping in Klaipeda port regarding its changing marketing situation. So, it is appropriate to discuss the marketing tools and their suitability.

The *object* of the research is a marketing activity of cruise shipping in Klaipeda port. The *goal* of the research is a discussion on the optimal marketing tools for cruise shipping in Klaipeda port.

The *tasks* of the research are as follows:

1. Analysis of external and internal factors.
2. Analysis of marketing mix elements.

The *type* of the research is descriptive. The *methodological principle* is constructivism. It orients maritime companies to combine their marketing visions with the mentality constructs and needs of potential tourists by creating the common construct of marketing regarding relationship between science and practice. *Main methods* such as scientific literature analysis, PEST and SWOT analysis, comparison, analysis of marketing mix elements and synthesis were used in the research. *Methodological limits* of the research are based on the methods used and on the constructive approach to the investigated phenomenon. The results of the research as scientific prerequisites can be applied in cruise shipping marketing of the Klaipeda port.

## Analysis of external and internal factors

It is appropriate to apply PEST analysis by analyzing external factors (Table 1).

Table 1. PEST analysis of cruise shipping in Klaipeda port

POLITICAL FACTORS	ECONOMIC FACTORS
Lithuania is: - A member of Schengen zone; - A member of the euro zone; - A member of the EU and NATO (it is relevant for tourists' safety).	Stable economic growth of the port. Economic difficulties in Lithuanian tourism markets. Well-developed banking system (opportunity to pay by credit cards). EU structural support for tourism marketing.
SOCIOCULTURAL FACTORS	TECHNOLOGICAL FACTORS
Residents of the Klaipeda city do not think well on port development. The port provides most of jobs in the region.	Infrastructure of modern port was developed: - Specialized terminals built; - The port waters were deepened; - Companies are providing additional services.

Tourism infrastructure is not yet developed and residents of the city should be encouraged to change.

Security of the Schengen zone is ensured by control of external border, collaboration between the protection service and police, and a common information system. It provides additional security for tourists. The euro zone is characterized by stable prices for consumers, opportunities for companies and markets, greater economic stability, European identity mark and easier payment method.

SWOT analysis shows the activity of the Klaipeda port regarding competitors, and different factors in port marketing through the strengths, weaknesses, opportunities and threats (Table 2).

Table 2. SWOT analysis of the cruise shipping market of the Klaipeda port

STRENGTHS	WEAKNESSES
Geographical position, Objects of the UNESCO World Heritage List, Abundant natural resources, Developed healing resources, Infrastructure of business tourism in the city.	Closeness to the zone of conflict between Russia and Ukraine, Limited port area, Lack of skilled labor force, Undeveloped inland waterway transport, Cruise tourists are not staying overnight, Lack of popularity of tourism in Lithuania.
OPPORTUNITIES	THREATS
To increase competitiveness of the Klaipeda port, To attract direct foreign investments, To improve tourism image in the region, To reduce seasonality of tourist flows, To expand themed cultural routes, To implement international standards of services.	Global and regional economic crisis, Political instability in Europe, Deterioration of relationships with Russia, Declining security because of the war in eastern Ukraine, Degradation of natural resources, Competition with the Baltic countries.

**Strengths.** 7 heritage objects were included in the UNESCO World Heritage List. Most important is the Curonian Spit. There are the unique nature (5 national parks and 30 regional ones), good conditions for ecotourism, and the developed infrastructure for themed tourism. There are developed retail chains with modern shopping and entertainment centers, and the convenient infrastructure for business tourism.

Lithuania is characterized by the favorable geographical position because of the ice-free port and less probability of extreme cold. There would be a possibility of an extension of the cruise season in winter. It is opportune to carry passengers for East, West, North and South directions. There is a broad market between Asia, the European Union and other markets guaranteed. Lithuania is the geographical center of Europe.

Therapeutic mud and mineral water attract the cruise tourists. There is abundant natural resource (forests, lakes, rivers, sea, mineral water springs and clean potable groundwater). The infrastructure of active recreation with bike trails, water trails, golf courses and adventure parks was developed. There are clean beaches. Water quality is monitored. Resorts are build up.

**Weaknesses.** Tour operators do not invest enough in new markets of cruise tourism. There is a little attention for events tourism. Lithuania is not widely known as an attractive tourist country.

The port area is limited because of the city and Curonian Spit protected by the UNESCO World Heritage. There is a lack of the territory to receive the cruise ships.

The geopolitical situation is not favorable for Lithuania because of transnational conflicts. In addition, the inland waterways transport and infrastructure of small ports are not developed. There is a lack of ports for marine yachts. The area of the Castle harbor in Klaipeda is shown (Figure 1).



Figure 1. The area of the Castle harbor

220 parking spaces are in the Castle harbor area [5]. The area is fully completed. Conveniences such as toilets are not so much as necessary.

Tourists consider that Klaipeda city is too quiet. The tourist services and entertainments are limited. The infrastructure for tourism year-round was not created [6].

The providers of travel service pay too little attention to events tourism, service quality and collaboration between public and private sectors of tourism.

**Opportunities.** Lithuania lies in the cold temperate zone. The developed infrastructure of tourism allows to reduce the tourist flows seasonality, to expand themed routes by introducing to the history of Lithuania. It is possible to offer the “Christmas cruises”, to organize winter fairs, to develop the products of tourism with the high added value. There is the best relationship between the price of tourism services and quality compared with neighboring countries.

Competencies of staff of the tourism sector should be developed, especially by foreign languages and hospitality, by collaborating with the schools of higher education.

**Threats.** Processes of globalization increasingly impact on the market of cruise tourism. In addition, tourists from Russia were lost due to political conflicts. The war in eastern Ukraine undermines confidence in Baltic countries regarding security.

It is difficult to compete with other Baltic countries because of their larger old towns and a richer culture of entertainments.

Weaknesses and threats are solved by strengths and opportunities for cruise tourism.

### Analysis of marketing mix elements

Analysis of marketing mix elements allows to investigate the marketing tools of the Klaipeda seaport authority administration due to cruise shipping:

1. *Service.* Tourists need diversity and innovation of services. They are ready to pay more for a qualitative service. Different excursions, e.g. hot air balloon trips, are offered to them.

2. *Place (distribution).* The right place, according to the needs of tourists, determines the development of cruise tourism. So, the Cruise Ship Terminal is well located along the old town of the Klaipeda city.

3. *Pricing.* Service prices and their policy are oriented to the consumers. The Klaipeda seaport authority administration offers the competitive port charges by maintaining regular cruise lines and attracting new ones.

4. *Sponsorship* is a set of measures to increase sales volumes by orienting to cruise shipping. Consumers have to aware of advantages of the seaport, so that they would be convinced to visit the Klaipeda seaport.

5. *Processes* are delivery of services for consumers. E.g. when workers of the cruise ship are properly communicating with tourists, they promote them to come back again.

6. *People*. There is an orientation to the group of passengers of cruise ships. Their consumption habits and other psychographic and demographic features are investigated. So, the service is maximally adapted to the needs of tourists.

7. *Physical evidence*. Facilities were adapted to cruise tourists. The old town was arranged, so that tourists could recognize it as a right place of recreation.

8. *Image*. The port is presented as a reliable and safe for consumers. Crews of cruise ships positively evaluate the port and quality of services.

In addition, there are other marketing tools that affect the amount of cruise ships:

- *Service design*. How services are provided and how the port is presented to potential customers? The Klaipeda seaport authority administration presents the port as modern, safe and adapted to cruise shipping.
- *Quality* is a very important factor in the sale of services. The port must provide only qualitative services. If the consumer will be satisfied with the quality of services, he/she would recommend them to other consumers. So, this is the way to attract new consumers. It is very effective advertisement usually.
- *Advertisement* is the most important and popular tool of marketing. It requires most costs but also gives high return. Cruise shipping promotes its service globally. It is characterized by the participation in advertising campaigns, exhibitions, conferences and seminars. There are festivals created and information publications such as articles, press releases, brochures, leaflets and flyers issued. TV and the Internet are used, too. Advertising souvenirs, gifts and attributes are distributed. Membership in international marketing projects is also important. The Klaipeda seaport authority administration applies the mentioned advertising tools by promoting the Klaipeda port for cruise tourism.
- *Additional attractions of cruise shipping*. It is collaborated with the cruise lines. The visits to seaports and excursions to cities are promoted. The Klaipeda seaport authority administration organizes the fairs and celebrations of the opening or closing of cruise shipping seasons. Museum working hours are adapted to cruise tourists.
- *Infrastructure and buildings*. It is collaborated with seaports and sectors of other various services in order to ensure acceptance of cruise ships, safe shipping and satisfaction of the traffic needs of cruise ships. We can state, that the Klaipeda seaport currently is maximally developed and adapted to cruise shipping.
- *The development of experience*. It is collaborated with the tourism industry and with local retailers. The interesting shore excursions help meet the needs of tourists and crews of cruise ships. The Klaipeda seaport authority administration is regularly collaborating with the local entrepreneurs and with the Klaipeda municipality by creating and developing recreational activities for cruise tourists.

The Klaipeda seaport authority administration uses the marketing tools, whose return consists of the number of cruise ships and increased number of tourists (Figure 2).

Increase in number of cruise tourists is noticeable during the period of 2010-2015. The number of tourists has increased approximately 45 percent since 2010. The number of cruise ships is constantly changing during the period analyzed. The number of cruise ships does not increase gradually. The number of cruise tourists increased because of larger vessels that can accommodate higher number of passengers [6]. So, we could assign the cruise shipping to the growing market.

In order to develop the sector of cruise shipping, it is necessary to collaborate with:

- The Klaipeda municipality,
- State institutions;
- Tourism companies.

The flexible system of the infrastructure must be created and qualitative services should be ensured. The Klaipeda port rapidly adapts to the needs and expectations of tourists. An important factor is the nationality of tourists and their language. In addition, the city government has solved the problem of transportation between the city and the Cruise Ship Terminal, improved access from this terminal to the different areas of the city that are attractive to cruise tourists. Lack of new attractions may lead to a declining number of cruise ships.

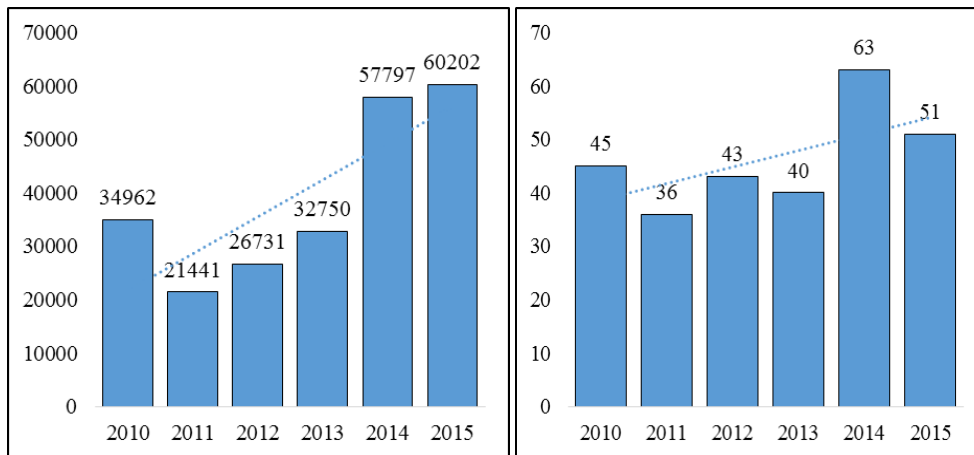


Figure 2. The number of tourists and cruise ships in Klaipeda port (2010-2015)

Evaluation of cruise shipping in Klaipeda port has shown that the number of cruise ship visits in Klaipeda port was placed in the top ten in the Baltic Sea region. However, the dynamics of ships is negative [13]. Tourists require activities and events in Klaipeda city. The Klaipeda municipality should better arrange the old town, restore Klaipeda Castle and allow to take place of various street performances, promote craft fairs and develop the entertainment sector.

Problematic areas and possible solutions of cruise shipping in Klaipeda port are shown (Figure 3).

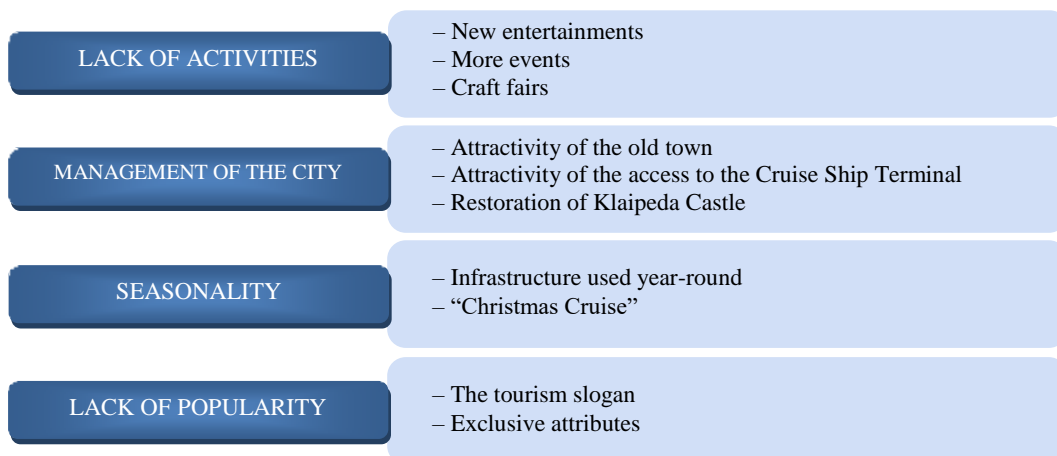


Figure 3. Problematic areas and possible solutions of cruise shipping in the port

Klaipeda city should have the tourism slogan and exclusive attributes, e.g. Ventspils city is characterized by cows, which have distinguished this city from others. The number of tourists in Ventspils increased. Klaipeda city should be characterized by “Christmas Cruise” with large fairs by attracting more cruise tourists.

Intensified collaboration among the Klaipeda municipality, entrepreneurs and the Klaipeda seaport authority administration would allow to create the new marketing product for attraction of cruise tourists. Possibility to attract greater flows of cruise tourists should be achieved by applying the marketing tools.

The Klaipeda seaport authority administration mostly gets these complaints of passengers:

- Deception of taxi drivers,
- Service in cafes,
- Lack of public toilets,
- Lack of excursions or their quality is disappointing,
- The city is not suitable for the disabled ones,
- Embankment of the river Dane is unsafe.

Main advantages of Klaipeda city are as follows:

- Competitive charging system,
- Two passenger terminals,
- The best relationship between the price of tourism services and quality in the Baltic states,
- The Curonian Spit as the object of the UNESCO World Heritage List,
- Abundant natural resources,
- Developed retail network.

Cruise tourists appreciate Lithuania due to the nature, food and low prices in general. They consider that Klaipeda city is clean, safe, calm and without large historical heritage.

## Conclusions

The Klaipeda seaport authority administration maximally uses the marketing tools for the cruise shipping development. The marketing tools and internal and external environments are investigated. The cruise tourists cannot get enough of business and entertainments in Klaipeda city. New entertainments, more events, craft fairs etc. should be organized in order to promote cruise shipping in the port. All mentioned scientific prerequisites can be applied in cruise shipping marketing of the Klaipeda port.

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# THE IMPACT OF ELECTROCONTACT WELDING OF METALLIC STRIP TO THE WORN SURFACE THROUGH GASKET ON STRENGTH AND STRUCTURE OF CONNECTION

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## **Abstract**

*In the article, the results of investigation of the impact of electrodes compression force, current intensity and its flow period on connection strength, structure and phase composition in electric welding of metallic strip to the worn surface through gasket are given. Depending on crumbs used as a gasket and size and mark of welded main metal, the welding modes providing necessary strength and structure have been identified. It has been determined that different types of defects do not form in the connection when using PG-CP2 crumb and the strength of the connection is equal to the strength of main metal.*

**Keywords:** *connection, strength, structure, welding modes, pressing force, current intensity, metallographic studies, microroentgenspectral analyze.*

## **Introduction**

The investigation of the impact of electrodes compression force, current intensity and its flow period on structure and strength of welding connection in the recovery of worn part of ball shafts with electrocontact welding is of certain scientific and technological interest. This is especially important in the recovery of worn working parts of crankshafts with electrocontact welding through gasket. In the recovery in order to obtain initial dimensions of the shaft, the metallic strip is selected and it is welded to the working part with gasket or without it. In this case, the quality of the connection is obtaining perfect structure and connection strength equaling to strength of main metal. However, providing this strength in the connection depends directly on correct selection of welding modes and creation of relatively homogeneous structure.

## **The impact of electrodes compression force, current intensity and its flow period on strength of welding connection**

The impact of electrodes compression force on formation of the coating and on strength of its connection with main metal has been evaluated in settings of  $J=4,5$  and  $5,5\text{kA}$  and  $t_i=0,04$  and  $t_i=0,8$  s providing cutting of area established in connection zone (Figure 1). As can be seen, the connection of coating with main metal ( $\tau$ ) is in extreme nature ( $P=0,8-2,0\text{kN}$  interval). It should be noted that  $\tau$  maximum of connection is obtained when  $P=1,4$  kN. Therefore the impact of other main technological parameters ( $J$  and  $t_i$ ) of the electrocontact welding on formation of the coating and on quality of its connection with main metal has been investigated when  $P=1,4\text{kN}$  [1-3].

The Figure 2 shows the impact of impulse current intensity  $J$  and its flow period  $t_i$  on strength of connection of 50XΦA steel coating with steel 45. As can be seen, the increasing of  $t_i$  in the values of  $J=3,5-4,5\text{kA}$  does not allow obtaining the connection that has equal strength with main material in the studied interval.

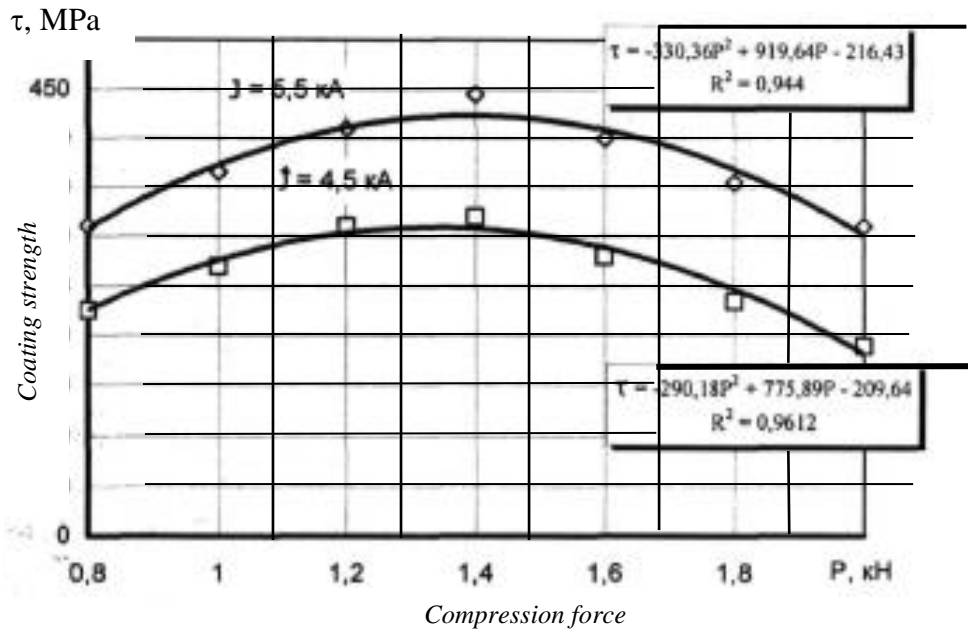


Figure 1. When using PG-CP2 ( $t_i=0,04s$ ,  $t_p=0,08s$ ) crumb gasket in the electrocontact welding dependency of strength of 50XΦA- 45 steel coating on compression force

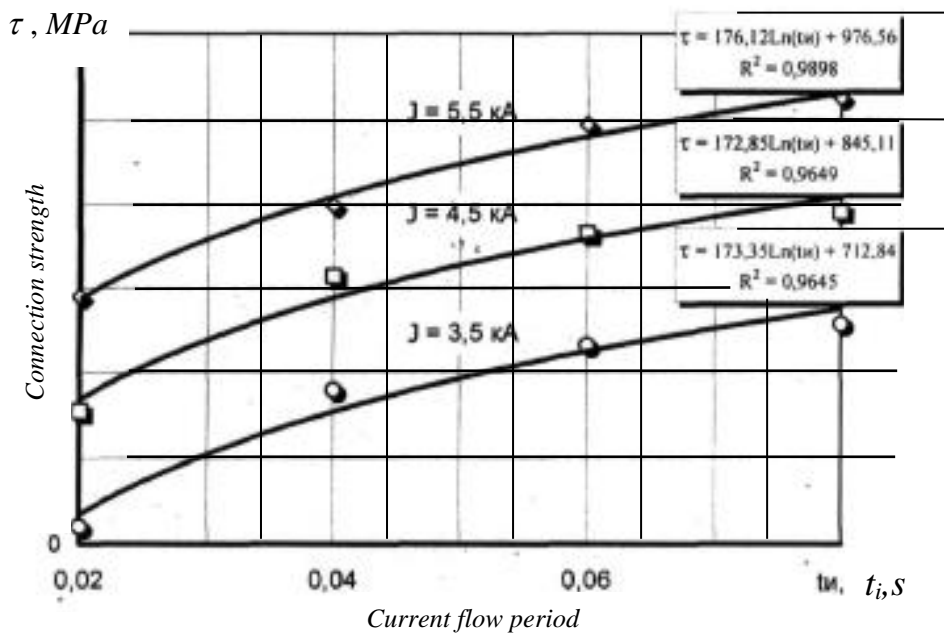


Figure 2. When using PG-CP2 ( $P=1,4$  kN) crumb gasket in the electrocontact welding, dependency of strength of 45 - 50XΦA steel coating on current intensity and its flow period

The increasing of 3 in the established values of  $t_i$  causes a sharp increase of strength  $T$  of connection of the coating with main metal. So, when  $J=5,5kA$  and  $t_i=0,06-0,08$  s the obtained connections have equal strength with main metal, because this time the enough heating is separated in the connection zone for strong connection of coating with main metal.



It should be noted that when  $J=5,5$  kA and  $t_i=0,08$  s the melting occurs in the central part of the contact. As a result the liquid phase flows from connection zone and this lowers the quality of obtained coating. Therefore, the following mode has been selected to weld 50XΦA steel strip onto steel 45:  $P=kN$ ;  $J=5,5$  kA,  $t=0,06$  s;  $t=0,08$  s. The similar results have been obtained when using PJG-14 and CH15 iron crumbs.

The metallographic studies has shown that when using PG-CP2 metallic crumb gasket the greatest micro solidity  $H_{1,0}=7730-7930$  N/mm<sup>2</sup> is observed in the edge of coating and near connection zone (Figure 3a). This is related to the greatest impact of thermo mechanical period in the electrocontact welding (Figure 4). The strip fitting value after welding is 140-180 mkm, the structure of the coating is martensite.

In the connection zone the gasket in the form of white jerky strip with thickness of  $<0,5$  mkm (Figure 3a) is observed. This strip occurs as a result of diffusion in the heating and volume deformation of elements included in welded materials (steel 50XFA, PG-CP2 crumb and steel 45). This strip does not influence strength of connection of the coating with main metal. The depth of thermic zone is 0,35-0,4 mm, the micro solidity of this zone is 7930-3670 H/mm (Figure 4). The structure of the coating is martensite near thermic impact zone and is martensite troostite away from it. In the back of thermic zone there are ferrite perlite structure and main metal with  $H_{t,0}=2900-3010$  N/mm<sup>2</sup> properties.

The micro solidity of the coating is  $H_{i,0}=7040-7745$  N/mm<sup>2</sup> (Figure 4) when using CH15 iron gasket (Figure 3b) and the coating has martensite structure.

The depth of heating impact zone is 0,5-0,55 mm, its solidity is  $H_m>8200-3670$  N/mm, its structure is martensite troostite. The connection zone consists of transition layer with width of 20-40 mkm. Its micro solidity is  $H_{0,3}=6930-7070$  N/mm<sup>2</sup>. The micro solidity and structure of the main metal coming after thermic impact zone is similar to previous welding other than electrocontact.

The micro solidity of the coating is  $H_{1,0}=6650-7590$  N/mm<sup>2</sup> (Figure 4) when using PGJ-14 crumb gasket and its microstructure is martensite.

There is a transition zone with micro solidity of 6630-6720 N/mm<sup>2</sup> and width of 15-35mkm in the connection zone. The depth of the thermic impact zone is 0,5-0,55mm, and its structure is martensite troostite while micro solidity is  $H_{1,0}=8200-4050$ N/mm<sup>2</sup>. The micro solidity of the main metal coming after this zone is 2900-3100 N/mm<sup>2</sup>. In this case, the strip fitting is 90-130 mkm.

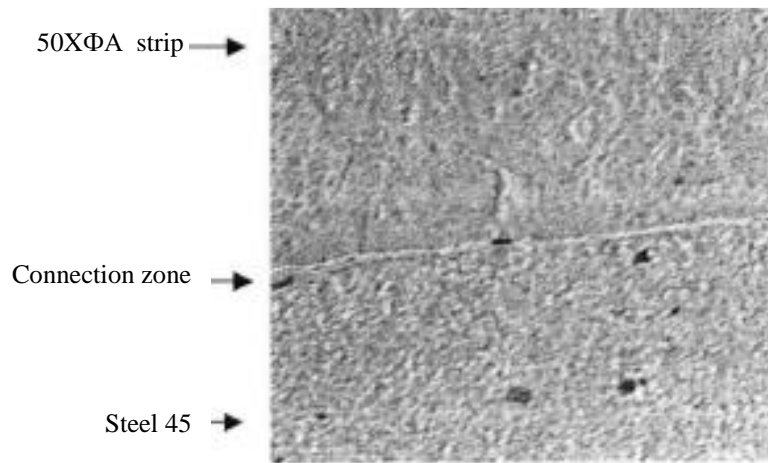
It should be noted that cross-sectional shape of the connection zone in all cases proves the greater impact of surface layer heating and deformation of the material and detail.

It can be concluded based on analyze that the most optimal material to be used as a gasket is ПГ-CP2 crumb. Because when using this crumb practically the length (depth) of the connection zone is considerably less (approximately 30-80 times) and the depth of the thermic impact zone is relatively low (approximately 20-36%) in the same firmness of the connection of the coating with main metal.

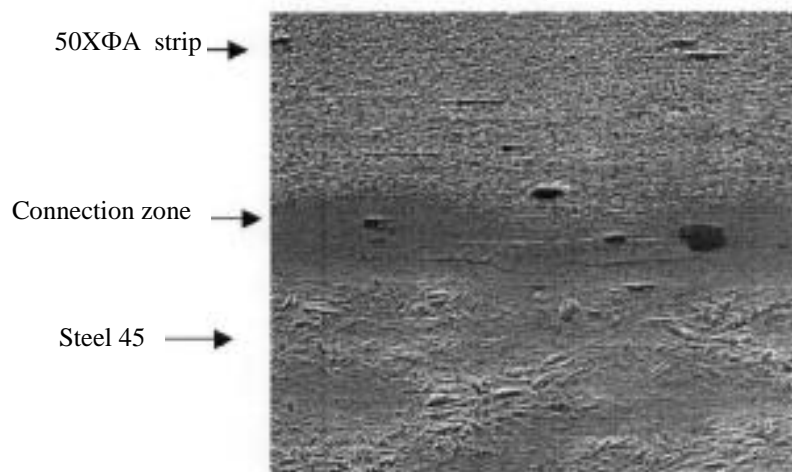
In addition the micro solidity of the connection zone is enough higher when using PGJ-14 and CH 15-crumb gasket in the electrocontact welding: appropriately 6630-6720 N/mm<sup>2</sup> (HRC 56-57) and 6930-7070 N/mm<sup>2</sup> (HRC 57-59). These considerably lowers the plasticity and viscosity of the connection zone.

In addition, it should be noted that there is a great likelihood of oxidation of iron included in crumb when using ПГЖ-14 crumb gasket. In addition, this may cause creation of defects in the connection zone. The similar case may occur also when using CH 15-iron crumb.

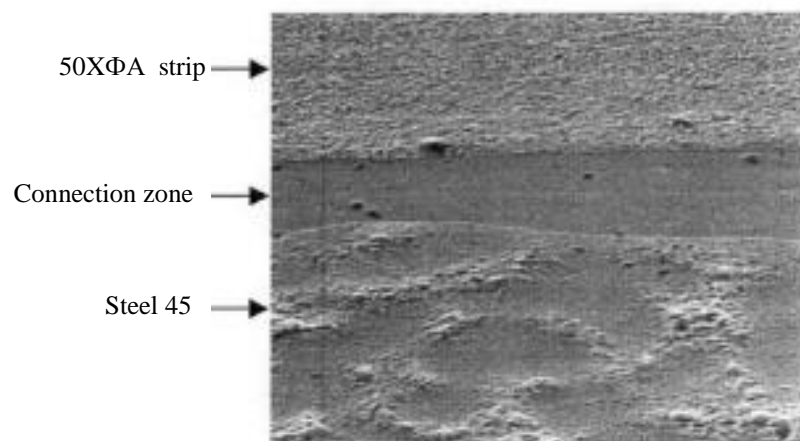
The results of the metallographic studies and the tests on micro solidity are approved with results of microoentgenspectral analyze. It is seen from them that the connection zone of the coating with main metal consists of solid solution of Ni, Mn, Cr, Si and V in the iron. It is assumed that the solid solution is formed as a result of diffusion of coating basis and crumb elements to each other. It has been determined that the thickness of this mutual impact zone of the elements does not exceed 0,4 mm (Figure 5).



a) a)

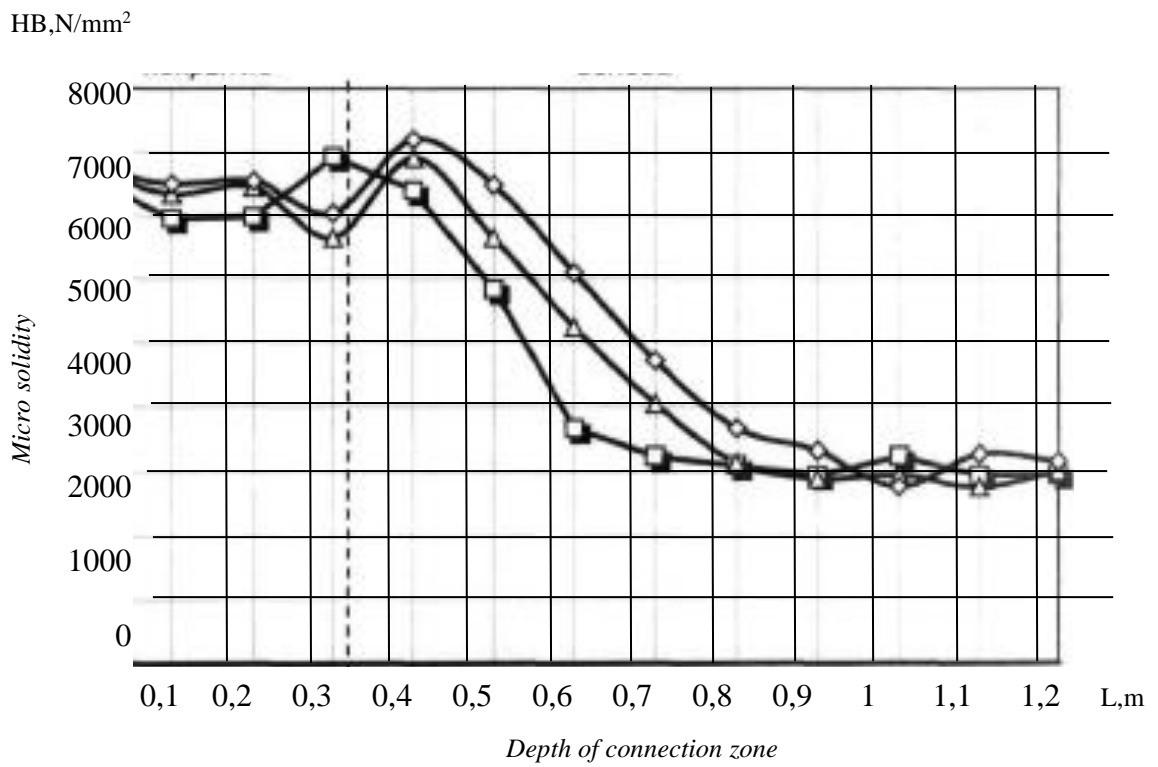


b) b)

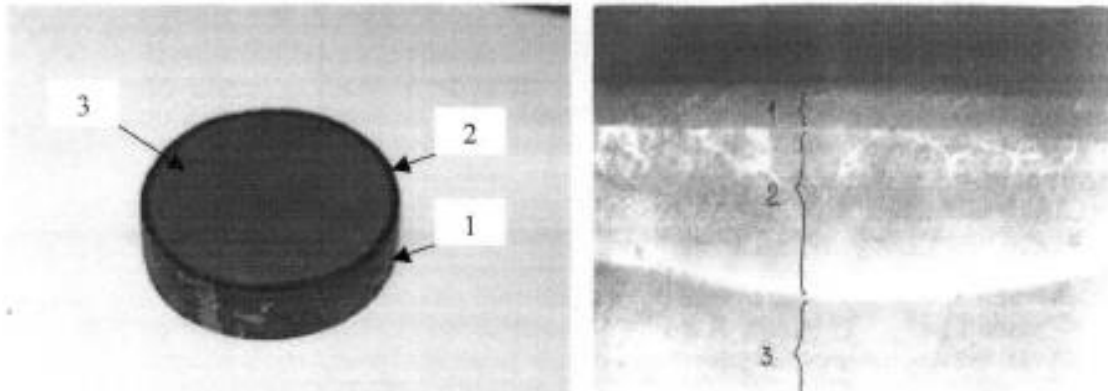


c) c)

Figure 3. The microstructure of coating of the connection zone of steel 50XΦA –45 by using crumb gasket: a – PG-CR2; b – CH15; c – PGJ (×400)



a)



b)

Figure 4. The examples for determining connection zone of steel 50XFA-45 when using crumb gasket (a) and for determining thermic impact zone (b):

□ – PG-CR2; ◇ - cast iron CH15; Δ-PGJ-14;  
 1-coating; 2- thermic impact zone; 3-main metal in initial condition

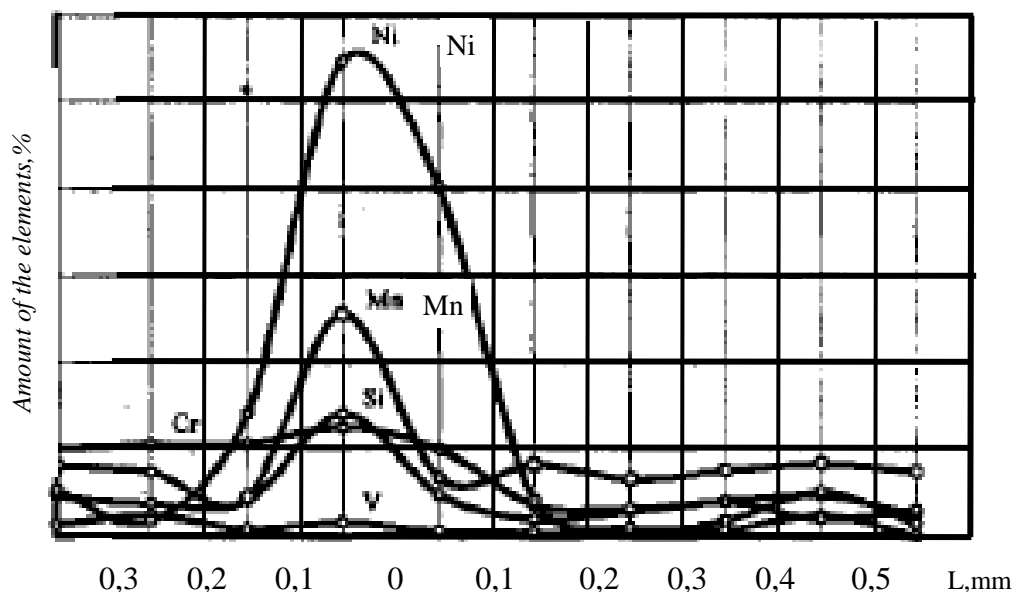


Figure 5. The results of microoentgenspectral analyze of steel 50XΦA- 45 connection zone coating by using PG-CR2 crumb gasket

## Results

1. The impact of the main technological parameters on quality of connections derived from electrocontact welding by using gasket without melting PG-CR2, PGJ-14 and CH 15 crumbs has been studied. It has been determined that the optimal mode of the electrocontact welding of 50XΦA steel strip to the steel 45 shafts with diameter of 50 mm when using studied crumbs is  $P=1,4$  kN;  $J=5,5$  kA;  $t_i=0,06$  s;  $t_n=0,08$  s-dir.

2. It has been shown that the PG-CP2 crumb is most optimal as a gasket in comparison with other crumbs, because the width of the transition layer is 30-80 times and the depth of the thermic impact zone is 20-36% lower in the same thickness of the coating obtained.

3. Metallographic studies and the tests on micro solidity and results of microoentgenspectral analyze have shown that the defects such as porosity, cracks and non-integrity are not observed in the connections obtained in the mode optimal parameters when using ПГ-CP2 crumb as a gasket without melting it. This time the transition zone, with thickness of  $<0,5$  mkm, as white strip in the form of solid solution of N, Mn, Cr and Si in is formed. This zone is probably formed as a result of diffusion of the coating, main metal and crumb elements to each other. It has been noted that the mutual relation zone of these elements does not exceed 0,4 mm. It has been determined that the structure of the coating is martensite, its micro solidity is  $H_{1,0}=7730-7930$  N/mm<sup>2</sup>, the micro solidity of the thermic impact zone is  $H_{1,0}=7930-3670$  N/mm<sup>2</sup>, the structure is martensite near connection zone and is martensite troostite away from it. The depth of the thermic impact zone does not exceed 0,35-0,4 mm.

4. It has been determined that the strength of the connection of the coating from steel 50XΦA-45 is equal to the strength of the main metal.

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# LATVIAN CAPABILITY AND OPTIMIZATION FOR GOVERNMENTAL SHIP BUILDING PROGRAMME

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## **Abstract**

*Maritime countries have their own international obligation. However, Latvian financial resources do not allow using common general approaches for the fulfillment of these tasks. In order to minimize governmental expenses for the execution of state maritime duties, tasks for involved organizations need to be carefully analyzed. An understanding of possible cooperation between organizations, similarity and overlapping of duties, resources needed; will allow us to define requirement for the vessels needed and optimize governmental shipbuilding programs.*

**Keywords:** *regulations, organizations, ship requirements, optimization.*

## **Introduction**

The price for fulfilling government functions is one of the most essential factors of state survival. Countries with maritime borders have not only privilege, but also obligations and responsibilities, tasks to ensure safe sailing through their waters, providing search and rescue service in case of emergency and distress, hydrographic supports and environmental control, defense of the territorial waters and exclusive economic zone, as well as many others. The state needs to establish different organizations to be responsible for the different duties, main assets for these organizations will be vessels, ships and boats capable of going at sea and conducting special missions. The problems with the financial aspects of maritime economics were covered by V. Bertram et al. [1], M. Landamore et al. [11] and A. Brown et al. [2].

Latvian membership in NATO, EU, and close cooperation with Baltic and Nordic countries put extra responsibilities in the maritime domain. All these activities require financial resources that can be limited for a small state. In Latvia to fulfill these requirements, we have several organizations:

# Latvian navy (with Coast Guard units);

# Latvian Border Guard;

# Environmental Inspection;

# Hydrographic service (within the Maritime Administration);

# other organizations with their own budget, procurements, and operational tasks.

Carefully analyzing Latvian capability, we can see possible financial outcome and find possible optimal solutions for the governmental fleet.

The aim of the research is to analyse Latvian capability for the fulfilment of government responsibilities in maritime domain and provide optimization plan for the governmental vessel building needs. The goals and tasks of the research are as follows: using generally accepted research methods (theoretical and data processing):

- 1) Figure out the present condition of legal requirements for the governmental fleet,
- 2) Analyse Latvian capabilities,
- 3) Evaluate international experience,
- 4) Define optimal solution for the Latvian case.

## **Legal regulations**

One of main regulation for the maritime activity is the United Nations Convention on the Law of the Sea [17], with define basic rules and principles for state cooperation in the maritime domain. Main documents for the regulation of the Latvian maritime activity is the Maritime Administration and Marine Safety Law [12]. The purpose of this Law is to specify the State administration institutional system concerning maritime matters and to ensure the implementation of and compliance with the requirements of international agreements and standards binding on the Republic of Latvia in the field of maritime safety and protection in order to prevent environmental pollution from ships and ensure the efficiency of maritime traffic. This law define general responsibilities and tasks for major organizations.

**Coast Guard** shall control compliance with regulatory enactments and norms of international law in Latvian waters. For this purpose, the Coast Guard shall perform the following major functions:

- 1) in co-operation with the State Environment Service, control environment protection and compliance with the regulatory enactments regulating fishery, and to arrest ships in Latvian waters in accordance with this Law;
- 2) eliminate the consequences of ship accidents and disasters, consequences of the spillage of oil, dangerous and hazardous substances;
- 3) co-ordinate and perform marine search and rescue of persons (MRCC activities) in the area of responsibility;
- 4) co-operation with Maritime Administration of Latvia control compliance with the navigation regime.

**State Environment Service** shall control compliance with regulatory enactments and the norms of international law. For this purpose the major functions of the State Environment Service are:

- 1) control environment protection in Latvian waters and port areas;
- 2) issue a special permit (license) to commercial companies for the reception and recovery of ship waste in ports;
- 3) co-ordinate dredging and soil burial work projects to be performed in sea waters;
- 4) co-ordinate implementation of the national contingency plan for cases of oil pollution in the sea;
- 5) organize the investigation of environmental pollution incidents;
- 6) compile data on marine environment pollution;
- 7) control compliance with regulatory enactments regulating fishery in Latvian waters and port areas;
- 8) control the utilization of natural resources in Latvian waters and port areas.

**Hydrographic surveys and research** need to be done by the Maritime Administration of Latvia with major tasks:

- 1) depth measuring in conformity with the international hydrographic survey requirements in waters, which are actively utilized for navigation; and for cartographic and other economic needs; for planning, performing and control of dredging works;
- 2) searching for sunken objects;
- 3) data collection and systemization regarding variations in currents and water level, soil sediments and earth magnetism;
- 4) geodesic research of coastal, hydro-technical and hydrographic constructions;
- 5) hydrographic work related to the utilization of the sea for the needs of State authorities.

**Border guard** tasks are defined by the State Border Law of the Republic of Latvia [16]. Detailed functions and ships tasks are described by Cabinet Regulation No. 675 [3] Technical Equipment Necessary for Performance of Border Control – border Guards ships, cutters, motorboats are used for the control of the state sea border and territorial sea, Inland Waters control, violators detection, persecution, detention and transportation.

**Latvian Navy** tasks are defined by the National Armed Forces Law [15]:

- 1) ensuring the territorial sea and inland waters (except for rivers and lakes) protection;
- 2) carry out coastguard control of the territorial sea and inland waters (except for rivers and lakes) as well as the exclusive economic zone (EEZ);
- 3) ensure unit combat and mobilization readiness;
- 4) co-ordinate and carry out search and rescue service at sea, eliminates accidents occurring at sea and the effects of pollution by oil products, as well as participate in ecological monitoring;
- 5) search for the explosive items at sea and disposed them;
- 6) provide ships for the Border Guard upon request. As NATO member, Latvia give to the Navy specific task to support ally combat readiness and participate in NATO readiness forces.

All mention organization have their specific by law defined tasks and to fulfil this tasks they need to have specific assets - ships, vessels, fast boats and others equipment suitable for missions.

## **Analyses of the capabilities**

Under what financial resources we can count on when planning a new purchase of ships. As we can see the biggest tasks from the legislation are for the Latvian Navy and Coast Guard- which is part of the navy. The Latvian Ministry of Defence (MoD) have the biggest budget between the organizations involved.

National Defence Concept (NDC) [14] determines resource planning: for the implementation of development projects and ensure timely equipment renewal, each year not less than 20% of the National Armed Forces (NAF) allocated to the state budget should be allocated to the NAF weapons and equipment purchases. At the same time ensure that the personnel costs does not exceed 50% of the NAF allocated from the State budget, continuing NAF professional development, training and upgrading, as well as providing for the NAF administrative element numerically does not exceed 10% of the total NAF personnel.

As can be seen, the concept requires 20% of the NAF budget need to be spent on the new armaments and equipment purchases. At the same time, the concept defines that "the priority is the Land Forces Component combat capabilities development ... other capacity development is closely linked to support for land operations and host nation support capability assurance." In 2016 the MoD budget [13] amounted to 367,934,394 euro, NAF budget of 255,167,351 euro. According to the NDC, 20% of the NAF budgets- 51,033,470 Euro can be planned for the new equipment, mainly for land forces. If we assume that the Land Force receive 50%, Navy, and Air Force by 25%, then new naval equipment can be planned for 12 758 368 Euro.

The State Defence Financing Law [17] determines the objective of national defence funding for 2020 and subsequent years not less than 2 % of the estimated GDP, prepare a medium-term budget framework law projects and the annual state budget law projects by providing funding for national defence:

- 1) 2015 - not less than 1.0 per cent of the year projected GDP;
- 2) 2016 - not less than 1.1 per cent of the year projected GDP;
- 3) 2017 - not less than 1.3 per cent of the year projected GDP;
- 4) 2018 - not less than 1.5 per cent of the year projected GDP;
- 5) 2019 - not less than 1.75 per cent of the year projected GDP;
- 6) 2020 and subsequent years - not less than 2 percent for the year projected GDP.

Optimistically looking to the state budget increase in the coming years and to defence funding grow, we can predict MoD funding increase, as a result, also a new equipment for Navy budget increase of up to 20 million Euro. Suppose the shipbuilding program can last 5 years, the total budget may be around 100 million euro. What kind of ships and equipment should or can be purchased for the Navy to execute the NDC and the requirements of the law and at the same time to fit into the budget?

## **International experience**

All coastal states deal with similar tasks. In accordance with its political will and ambition, financial resources, the security situation in the region they are building their navy. Fleets consist of different classes and types of military ships and submarines, specially constructed for different tasks and equipped with the appropriate weapons and technical means. Modern naval force in general have: aircraft carriers, amphibious ships, cruisers, destroyers, frigates, corvettes, patrol vessels, missile / torpedo boats, mine hunters / minesweepers and submarines, hospital vessels, support vessels and others. Each ship is a large financial investment and the acquisition requires comprehensive, militarily justified, scientifically validated and economically adequate decisions.

It is very difficult to define a military ship price, because each case is unique and the price is made up of a variety of factors. Nevertheless, in order to gain an understanding of the new ship prices we can look at different national shipbuilding program costs. Aircraft carriers, cruisers, destroyers and other large-sized floating objects will be out of our scope of interest, because they are not suitable for small countries, neither operationally, nor financially. Let us look at the same acquisition program carried out by the various national naval force (NF) in recent years: corvettes, patrol vessels, patrol boats and mine hunting vessels.

The Egyptian Navy in 2014 signed a contract with DCNS for 4 Gowind -2500 corvettes (Figure 1) - \$ 1.2 billion, the ship is equipped with anti-air weapons system, anti-ship missiles EXOSET MM40, anti-submarine lightweight torpedo MU-90, gun and other weapons and devices. One ship price- \$ 300 million [5; 7].





Figure 1. Corvette Gowind2500 [6]

Saudi Arabia plans to buy 5 corvettes from the Spanish shipyard Navantija, Avante 2200 (Figure 2) project of \$ 3 billion, \$ 600 million per vessel



Figure 2. Corvette Avante2200 [4]

To perform Coast Guard functions, Saudi Arabia uses small patrol vessels and to restore the aging (1980-1990 built) fleet, in 2013 have requested the United States United States Marine Incorporation shipbuilding company to deliver 27 meters long 30 MKV patrol boats, armed with 27 mm cannon, crew training, spare parts and additional equipment for \$ 1.2 billion, 1 patrol boat price- \$ 40 million. On September 2013 Spanish Shipyard Polyships Rodman signed a \$ 10 million contract with Saudi Arabia for 40 R33X1 project patrol boats, for coast guard service. Patrol vessel is 11.3 meters long, with a maximum speed of 50 knots and 230-mile area of operation. One patrol boat price - \$ 250,000 [8].

The Finnish Government approved a “Laivue 2020” program to replacing four obsolete Rama class missile boat with 4 multipurpose offshore patrol vessels (OPV). The platform must be able to provide anti-ship, anti-air, anti-submarine, mine countermeasures operations in the Baltic Sea and to participate in international operations. The Finnish Ministry of Defence assesses the program price- \$ 1.34 billion, one OPV- \$ 335 million.

In November 2006, the Finnish Navy signed a \$ 244.8 million contract with the Italian company Intermarine for building 3 mine hunters of the Katanpaa class (Figure 3). The ships’ main task is mine hunting in archipelago, coastal waters and offshore, as well as be capable to participate in international operations. One ship price- \$ 81.6 million and it should be noted that the price does not include a variety of weapon systems [9].



Figure 3. Katanpää-class mine counter-measure vessel [10]

### Optimal solution for Latvia

Survey of the new shipbuilding program shows that real military corvette or mine hunter ship prices start from \$ 80 million, small military patrol boats can be purchased for \$ 6 million. Taking into account the need for at least 3 ships to ensure the operational rotation, Latvian NF cannot afford to buy "ideal" ships.

There are two basic options:

1) Buy used ships. The price will be considerably less; we will have some experience in operation, can quickly fulfil the operational requirements, but have a large risk of high maintenance costs, old technology problems, need for modernization (if possible) and other problems.

2) Creatively and wisely build a new ship, through using an innovative approach, modern technology and a comprehensive analysis of operational requirements. National defence concepts states: "Although the probability of a direct military confrontation on the Latvian territory is relatively low, it cannot be completely ruled out. Taking into account the growing military capabilities in different countries, as well as their efforts to expand its influence in world politics conflict cannot be excluded. "In this case, on the basic principle what we can take that ships must to ensure maximum operational requirements for the peacetime, with the possibility of increasing (or changing) their capability depending on the political situation and to receiving tasks. We do not build ships for high-intensity warfare, but for low-intensity warfare with the possibility to participate in active war in an "operational niche", for example: detecting and destroying mines, submarine hunting, convoy defence, small area air defence, reconnaissance and others. Such an approach requires careful calculation for the ship design price and operational costs reduction in lifetime, which in turn to makes a demands on an innovative approach to the installed equipment, automatisisation of the ship, modern weapons and sensors, ship organization and crew responsibilities.

For example, we can consider the requirements of ship speeds. Most military ship speeds are over 30 knots, requiring powerful and expensive engines, fuel supplies, and large operational costs. However, to carry out policing functions of the Exclusive Economic Zone and most other tasks a speed of 20 knots is completely enough. Speed limitation we can compensate by improving surveillance capabilities. Use of powerful and sensitive sensors (radar, optical, infrared, electronic support equipment), helicopter or UAV for monitoring, fast (more than 45 knots) RIB boat for interception or boarding team delivery, network connection to other ship's, aircrafts' or shore sensors will allow us to install the economic engines with low operating costs without sacrificing operational capacity.

Special requirements are for platform stability. NDC requires the vessel to be able to operate close to shore, open sea and ocean, participate in international missions at any time. It means that ships must be able not only to sail from point A to point B, but also to carry out their tasks in different weather and climatic condition- use weapons and equipment, launching boats or helicopters /UAVs at the sea stay not less than 3 Beaufort scale. Stability has also a big impact on the long-term comfort of the crew and the ability to fulfil their duty.

To be able to participate in an active military conflict, the ship should be able to make a quick change in the mission configuration by installing or supplementing new equipment or weapons systems.

Ships need to have dedicated positions for the mission module installation. Different module installation must not compromise stability of the vessel. The vessel's produced electrical power must be enough to supply installed hardware. Ship command and control system need to have an open architecture, allowing connection of a new mission modules. New module equipment may require crew extra knowledge or an additional extra team of specialists on board.

Others technical and operational requirements for the new ships also need to be carefully analysed. Result of this analysis will be optimal solution for the vessel needed to support governmental tasks. This optimization will allow making a proper ship design and providing Latvian governmental organizations with affordable solution.

## Conclusions

In the situation where the country have a coastline and sea, country have an international obligation to fulfil several duties and tasks. This process is expensive and required involvement of several organizations. By the understanding and analysing of the organizations tasks, and operational requirements we can enhance their cooperation, make an optimal solution for the multifunctional vessel need, and reduce expenses for the government shipbuilding program.

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