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МОДЕЛЬ ДЛЯ ВИБОРУ ТА АНАЛІЗУ ВПЛИВУ ПІДЙОМНИХ ЗАСОБІВ НА ОСНОВНІ РОЗМІРИ ПІДВОДНОГО БУДІВНОГО СУДНА

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Анотація. *Розглянуто та графічно сформульовано аналізи, які використовуються в морських нафтопромислових вантажних кранах, встановлених на суднах, що працюють у басейні Каспійського моря.*

Методика визначення основних габаритів підводного судна відображена на початкових стадіях проектування з використанням номограми, відповідно до вантажного крана, який передбачає-ться встановити.

Графічно відображено запропоновану оптимальну вантажо-підйомність кранів.

Сформовано основні розміри та основні параметри вантаж-них кранів пропонованих суден підводної побудови, призначених для експлуатації в басейні Каспійського моря.

Ключові слова: *Підводна експлуатація, вантажний кран, головний розмір, метод бази даних*

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MODEL FOR SELECTING AND ANALYSING THE INFLUENCE OF LIFTING GEARS ON THE MAIN DIMENTIONS OF SUBSEA CONSTRUCTION VESSEL

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Abstract. *Considered and graphically formulated, analyses used in the offshore oilfield cargo cranes installed on ships operating in the Caspian Sea basin.*

The method of definition of the main dimension of subsea construction vessel is reflected in initial design stages with use of the nomogram, according to the cargo crane assumed to installation.

It is graphically reflected the offered optimum load capacity of cranes.

The main dimensions and main parameters of cargo cranes of the proposed subsea construction vessels intended for operation in the Caspian Sea basin are formed.

Key words: *Subsea operation, cargo crane, main dimension, database method.*

Presentation of the main material. In the publication the crane, vessels and the subsea construction vessel (SSCV) working of the Caspian Sea [1-3] are considered. Schedules of load capacity of the cranes installed on vessels and the number of crane courts of the Caspian Sea on the loading capacity of cranes are made. Using the system optimized design methods [4-8], on the made database of crane vessels and SSCV, dependences of load capacity and a departure of an arrow, height of a hook of cranes above sea level, depths of immersion of a hook, vessel displacement were drawn up. It is also shown to dependence of the main and auxiliary raising of cargo cranes.

The method of selecting of the main dimension of SSCV in parameters of the cargo crane, with use developed by the author of the nomogram [9] is offered.

The main dimensions of the SSCV were created based on the selected parameters of cargo cranes. At the same time relatives on load capacity crane vessels and SSCV were grouped and reflected in a tabular and graphic form. Optimum load capacity of the cranes installed on vessels with use offered SSCV is graphically reflected. Having the received load capacity of cranes, the main dimension and key parameters of the cargo cranes offered SSCV are created.

Analysis of the use of cargo cranes in the caspian sea basin. At development of a sea oil field and ensuring subsea operation, the role of cargo cranes and crane vessels is not debatable [1-3]. The crane vessels and support vessels equipped with cargo cranes are the main, and in certain cases the only technical means of ensuring works on a sea oil field. The nature of the performed works exposes special requirements to crane vessels and support vessels of subsea operation. Lower in Fig. 1, the loading capacity of the crane vessels working of the Caspian Sea is shown. The nature of operation and load of cranes, causes the necessary quantitative structure of crane vessel. In Fig. 2, the number of crane vessels of the Caspian Sea on crane load capacity are given. With development in a sea oil field of the subsea equipment [2], there was a need for development of such types of vessel as "Subsea Construction Vessel" (SSCV). Using methods of the system optimized design with use of the database (DB) of relatives to destination of vessels [4-8] it is offered to count at initial design stages the main dimension of SSCV proceeding from parameters of the used cargo cranes.

When developing the main dimension of SSCV, with use of parameters of cargo cranes, such important parameters as the load capacity of the crane and depth of immersion of a hook are taken into account. Below, in Fig. 3-6 using the database of the crane vessels working of the Caspian Sea dependences of parameters of cargo cranes are reflected. In Fig. 3, the dependence of load capacity of the crane arm reach is reflected.

In Fig. 4, the dependence of cargo capacity of the crane on height of raising of a hook above sea level is reflected. Lower in Fig. 5, the dependence of loading capacity and depth of immersion of a hook is reflected. Feature of the ship cargo cranes used on a sea oil field is existence of the main and auxiliary hook. Using the database of crane vessels, the dependence (see Fig. 6), the main and auxiliary hook of cranes was that gives the chance at initial design stages, in the presence of the size of the main rise to define preliminary value of auxiliary rise.

Using dependence, (see Fig. 7), received from the database of crane vessels, it is possible to determine previously at initial design stages the displacement, required for operation of the cargo crane, of the designed vessel.

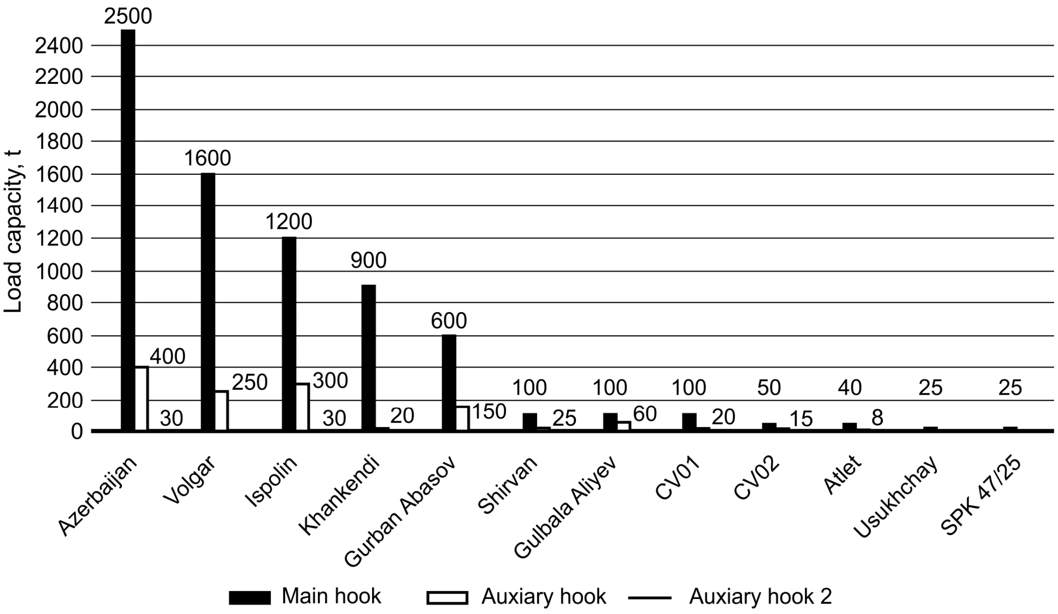

Fig. 1. Crane load capacity

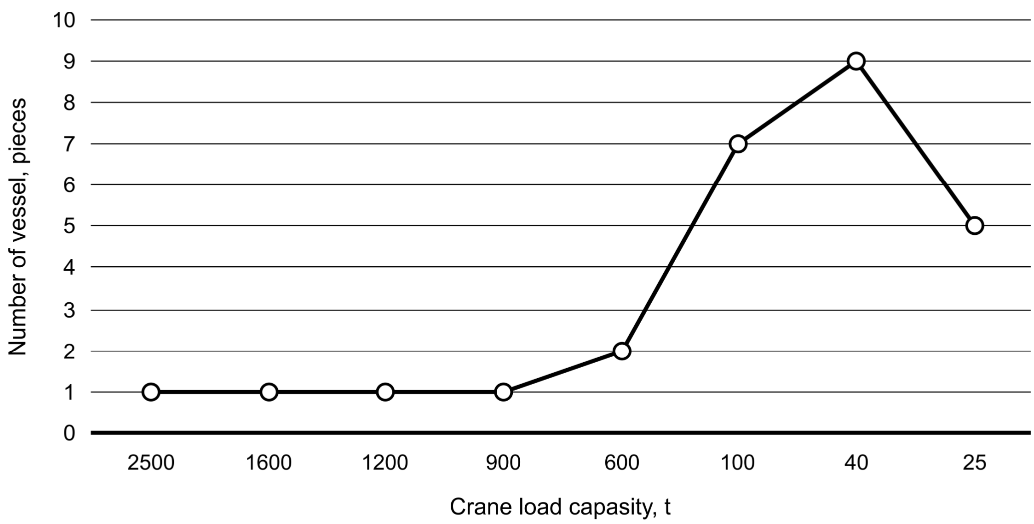

Fig. 2. The number of crane vessels of the Caspian Sea on crane load capacity

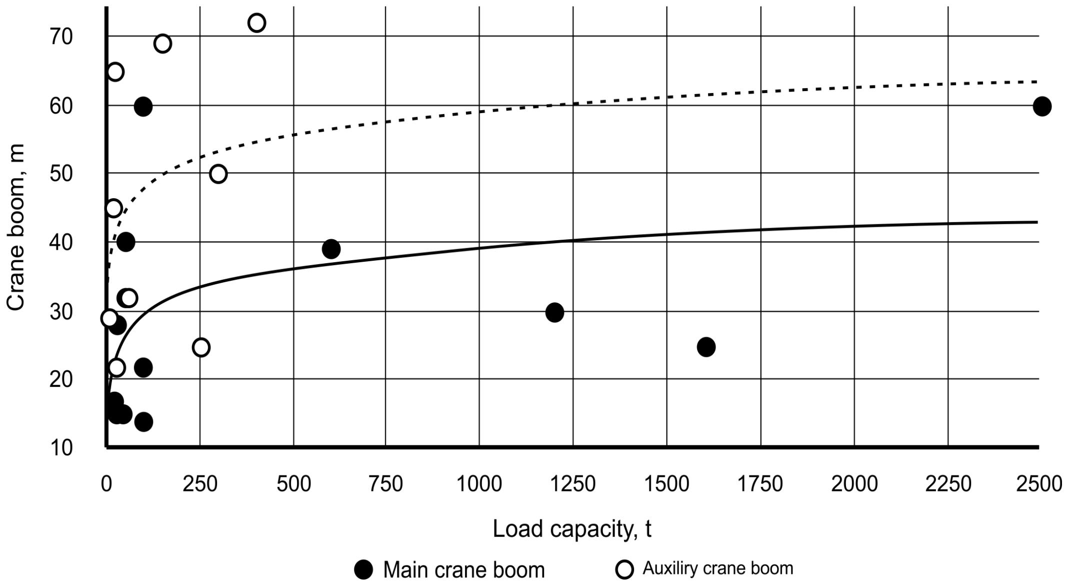

Fig. 3. Dependence of load capacity and crane boom reach

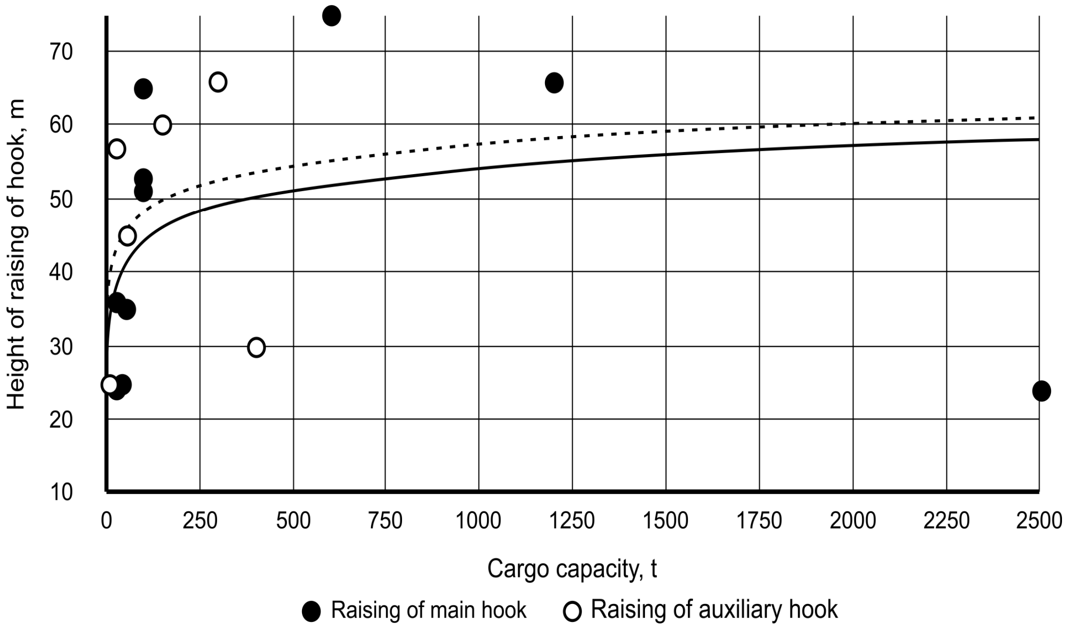

Fig. 4. Dependence of load capacity and height of hook raising

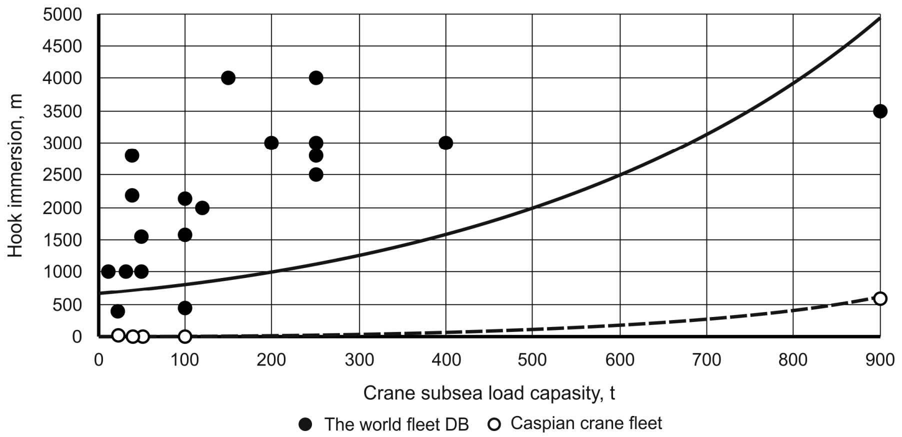

Fig. 5. Dependence the load capacity and hook immersion

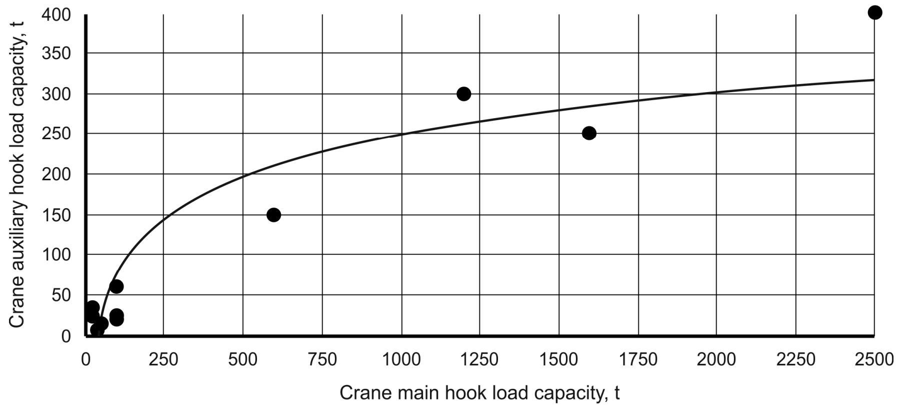

Fig. 6. Dependence of the crane main and auxiliary hook

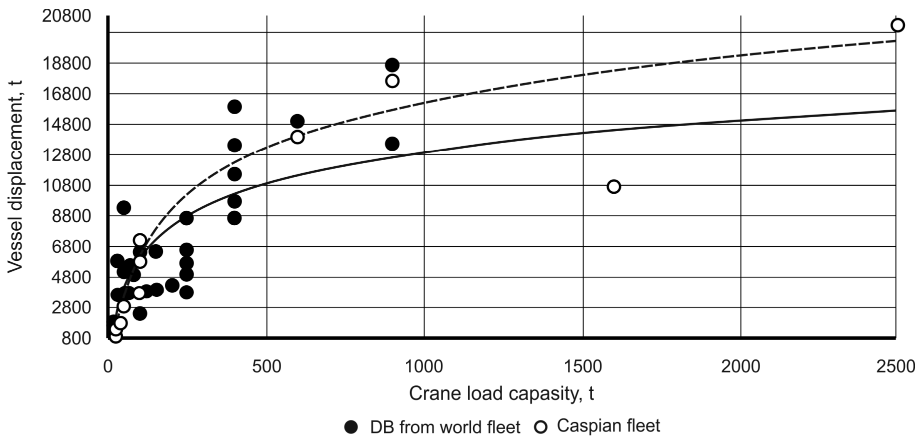

Fig. 7. Dependence the vessel displacement and crane load capacity

Method of selecting the main dimensions of a vessel based on the parameters of cargo cranes. Using the nomogram [9] (see Fig. 8) developed by the author, for definition of the main dimension of SSCV at initial design stages, the main dimension, proceeding from key parameters of the cargo crane as a first approximation are chosen. In this case, the crane load capacity is selected or specified, the hook immersion depth is obtained from Fig. 5.

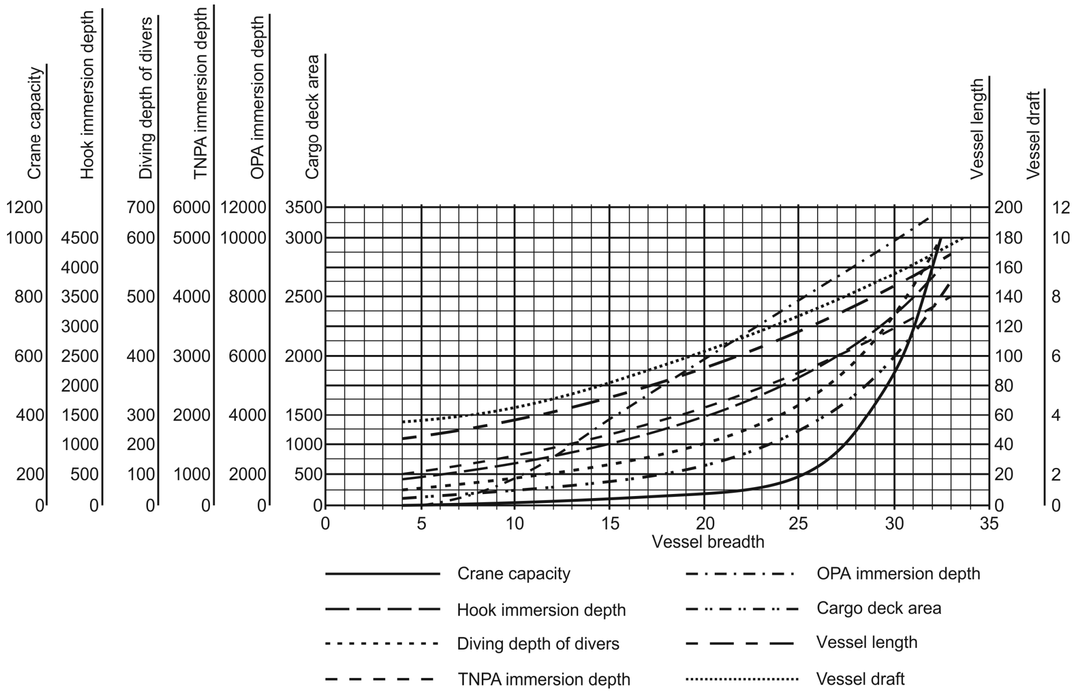

Fig. 8. Nomogram the main dimension definition of SSCV [9]

Determination of the main dimensions according to the nomogram is carried out in the following sequence [9]:

1. The vessel width is selected based on the required technological and design parameters reflected in the vertical scales on the left side of the nomogram:

- the required value of the technological or design parameter specified in the vessel design conditions (specified on the left side of the nomogram) is selected;
- a horizontal line is drawn until it intersects with the curve of the corresponding name;
- a vertical line is drawn downwards from the point of intersection of the horizontal line and the corresponding curve until it intersects with the horizontal scale;
- the point of intersection of the vertical line and the horizontal scale indicates the desired vessel width.

2. The largest value of the vessel width is selected:

- having carried out actions for all the technological and design parameters required for a specific vessel design, independently of each other, we obtain a group of width values for the designed vessel;

- from the obtained width values, the largest one is selected for the designed vessel.

3. The length of the vessel is selected:

- from the selected value of the vessel's width on the horizontal scale, draw a vertical line to the intersection with the vessel's length curve marked in red;

- from the point of intersection of the vertical line and the vessel length curve, a horizontal line is drawn to the right to the vertical scale on the right side of the nomogram reflecting the vessel length;

- the point of intersection of the horizontal line and the vertical scale of the vessel length reflects the length of the designed vessel.

4. The vessel draft is selected:

- from the selected value of the vessel width on the horizontal scale, a vertical line is drawn to the intersection with the vessel draft curve;

- from the point of intersection of the vertical line and the vessel draft curve, a horizontal line is drawn to the right to the vertical scale on the right side of the nomogram reflecting the vessel draft;

- the point of intersection of the horizontal line and the vertical scale of the vessel draft reflects the draft of the designed vessel.

Formation of the main dimension of subsea construction vessel on the chosen parameters of cargo cranes. Long-term operation of crane vessels on a sea oil field of the Caspian Sea and the prospect of development of marine and subsea facilities assumes need of revision of a number of load capacity of the used crane equipment.

Thus in Fig. 9, the difference between cargo capacity of groups of relatives on the load capacity of the crane vessels reflected in table 1 was reflected. Considering Fig. 9, the big gap between vessels in groups 1 and 3 is obvious. Thus, between vessels of group 1, consisting of the crane vessel «Azerbaijan» (897 project) and SSCV of Khankendi (MTD150SCV project), the difference in 1600 t is visible. Between the vessels of group 3 consisting of crane vessel «Gurban Abasov» (R-2098 project) and Shirvan (KS-100 project) the difference in 500 t is visible. It leads to the fact that at small excess of mass of freight for cranes with the minimum load capacity in group, there is a need of attraction of the vessel with the maximum load capacity in group. On an example of crane vessels «Azerbaijan» or «Gurban Abasov».

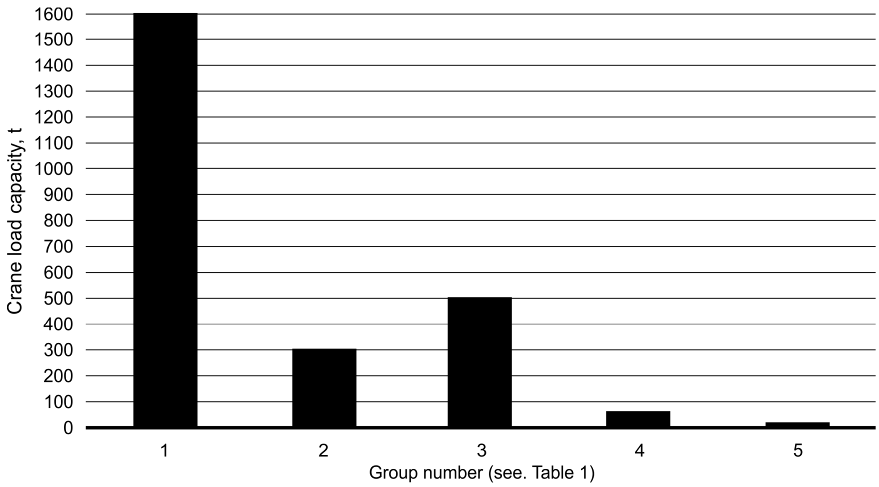

Fig. 9. Crane vessel load capacity different

Considering told above it is offered, to develop two SSCV with cargo cranes of 1600 t. and 300 t. shown in table 1, (items 6 and 7).

Table 1

Difference in load capacity of selected groups of cranes in operation and offered

Group N	Vessel name	Crane load capacity, t	Different of load capacity, t
1	Azerbaijan	2500	1600
	Khankendi	900	
2	Khankendi	900	300
	Gurban Abasov	600	
3	Gurban Abasov	600	500
	Shirvan	100	
4	Shirvan	100	60
	Atlet	40	
5	Atlet	40	15
	Usukhchay	25	
6	The offered vessel Tip I	Main hook	1600
		Auxiliary hook	600
7	The offered vessel Tip II	Main hook	300
		Auxiliary hook	150

Having entered listed above offered SSCV with the corresponding cranes, the diagram of load capacity of ship cranes (see Fig. 10), will look more optimum.

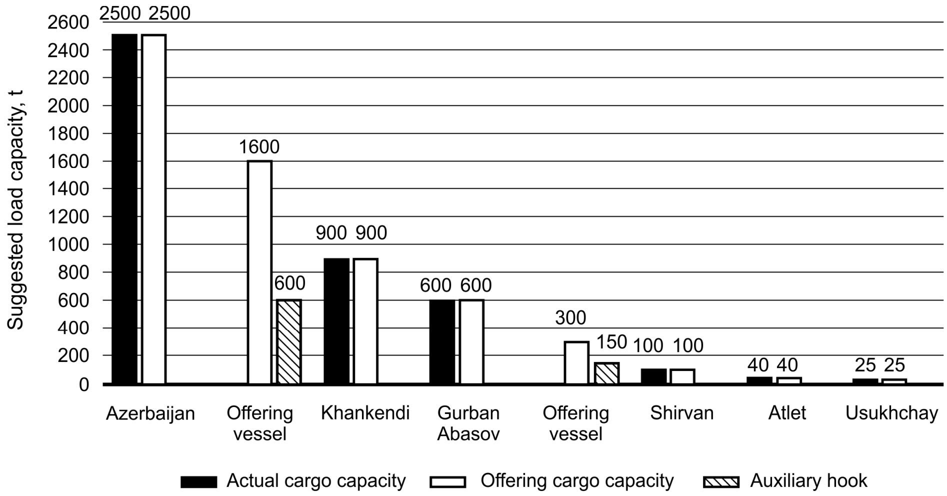

Fig. 10. Suggested load capacity of vessel cranes

Table 2

Main parameters of the offered SSCV cargo cranes

Offered SSCV main dimension		
The offering vessel type	I	II
Length, m	180	130
Width, m	34	28
Draft, m	10	7
Displacement, t	24500	10800
Block coefficient, Cb	0.4	0.45
Main parameters of the main cargo crane hook		
Main hook load capacity, t	1600	300
Auxiliary hook load capacity, t	300	150
Main hook crane boom, m	40	35
Auxiliary hook crane boom, m	55	45
Main hook rise, m	50	45
Auxiliary hook rise, m	55	50
Depth of immersion hook, m	-	250
Main parameters of auxiliary cargo crane hook		
Main hook load capacity, t	600	150
Auxiliary hook load capacity, t	200	100
Main hook crane boom, m	35	25
Auxiliary hook crane boom, m	50	40
Main hook rise, m	50	40
Auxiliary hook rise, m	45	45
Depth of immersion hook, m	400	150

Considering that the kind of work of SSCV, consists in the joint work of the technological equipment installed on it (mobile drilling complex, pipe-laying or cable-laying equipment), hardware and diving complexes, they leave their mark when creating the main dimensions of the proposed SSCV. At subsequent stages of the study, it is supposed to consider the influence of the installed mobile technological equipment and complexes on the main dimensions of the SSCV.

The scientific novelty of work consists in a method of definition of the main dimension of SSCV with use of the cargo crane parameters, relying on the dependences received from the created database of relatives to destination of vessels.

Conclusion. The analysis of ship cargo cranes used in the Caspian Sea basin was carried out taking into account the number of crane vessels by crane load capacity. With use of the database of crane vessels and SSCV, dependences of load capacity of the crane and a crane boom, height of rise and immersion of a hook were developed. Also, dependences of the main and auxiliary raising of hooks, load capacity of the crane and required displacement of the vessel are developed.

The method of the choice of the main dimension of SSCV in parameters of the cargo crane with use of the nomogram was described.

The SSCV types with optimal cargo cranes for the Caspian Sea basin were proposed. The main dimensions of the SSCV and the main parameters of the proposed cargo cranes were selected.

Proposed subsequent studies on the topic are described.

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