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Research of Park Cargo Handling and Technologies for Processing of Containers in Seaports

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Abstract: The increase in efficiency of cargo transportation and its processing at transport terminals requires a rational allocation of resources, transport and handling equipment. Container transportation stabilizes the work of all the key players in this process. It is proposed to simulate the processes of the transport system, describing their probability and simulation models and on the basis of the results of the study to synthesize the logistic ways of transportation and handling of cargo containers that meet the criteria of quality and efficiency. The technological process of reloading of large containers with overhead cranes passes under option ship-loader-vehicle-richstraker-warehouse-railway. A task of optimal processing of containerised cargo using the facility of mass service is currently being formalised. Several analytical models simulating process in stationary regime allow to link the qualitative indicators with economic indicators. A number of solutions to problems such as selecting an optimal number of berths an determine an optimal production program for a container terminal being introduced.

Key words: Cargo container shipping · Logistics · Simulation

INTRODUCTION

Formation of the transport and logistic cluster in Kazakhstan is directly connected with the development of the port of Aktau where the arrangement of a container terminal is expected to ensure the transportation of export and import of goods in international traffic and the support of international relations. Future development of the sea port is directly connected with the improvement of the reconstruction modernization operated at the ports of loading and unloading equipment, which now has the physical breakup by 50-70%. Renewal of cargo handling equipment with new models, it is practically impossible because of the lack of investment in this regard. Therefore, the task of the modern period of development of seaports is to optimize existing processes, the use of new schemes mechanization of loading and unloading operations, reducing costs and increasing profits seaports [1].

Use of containers creates the possibility of introduction of new technology delivery. The use of these technologies reduce the time of cargo delivery to the customer, its safety, the use of effective technology of "door to door", the use of high-handling equipment and the reduction of tariffs for transportation of containers is an element of transport services, the ability to transport different types of cargo, including forest.

Along with the rapid development of container transport, the introduction of transfer and unloading systems for continuous transport of up to 70% of cargo operations at sea and river ports run Multipurpose Reloading Complex mechanization scheme with crane cargo operations, mainly cranes. In the whole package park gantry cranes up to 90% are gantry cranes with articulated boom system [2].

Fleet structure gantry cranes for the past 17 years has not changed. Renewal of gantry cranes carried mainly by crane "second-hand" from foreign countries, especially from the Russian Federation. To assess the state of the problem is sufficient to note some of the key indicators of the industry [3].

Wear of park of portal cranes exceeds 96% [4]. Service life of individual cranes reached 40-50 years, which is several times higher than the standard boundary service life. In most ports of the system of preventive

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maintenance passed in eliminating crashes. Repair costs extremely worn valves commensurate with the cost of acquiring new cranes. Increased road accidents, the technical condition of the gantry cranes, especially in small and medium-sized ports, has reached the level of the beyond. Rates of aging fleet of cranes industry has long outpaced the pack.

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In recent years there has been a steady increase in turnover. However, reducing the cost of handling virtually reduced, which directly affects the increase of tariffs. It is connected with shortcomings of technological processes, productions of loading and unloading works.

In the last 15 - 20 years of foreign ports introduce modern technology with mobile cranes and vehicles, overhead loaders. That’s why we suggest replacing the bridge on gantries cranes. The best option would be to use the new scheme of mechanization with new cranes and redevelopment of open container yard. Transportation of cargo vessel is then loaded on a bridge loading cranes roll trailers and then transported to destination, the warehouse [6]. The advantage of this valve is the ability to move along the quay, the presence of lifting remote console, which promotes uniform loading and unloading of the ship, as well as high load capacity exceeding 40 tones, which facilitates loading and unloading of large containers [7, 8].

Main Part: Technological process overload of large containers with overhead cranes is under option Vessel - a loading crane - vehicle - Truck - Warehouse- railway transport (Figure 1).

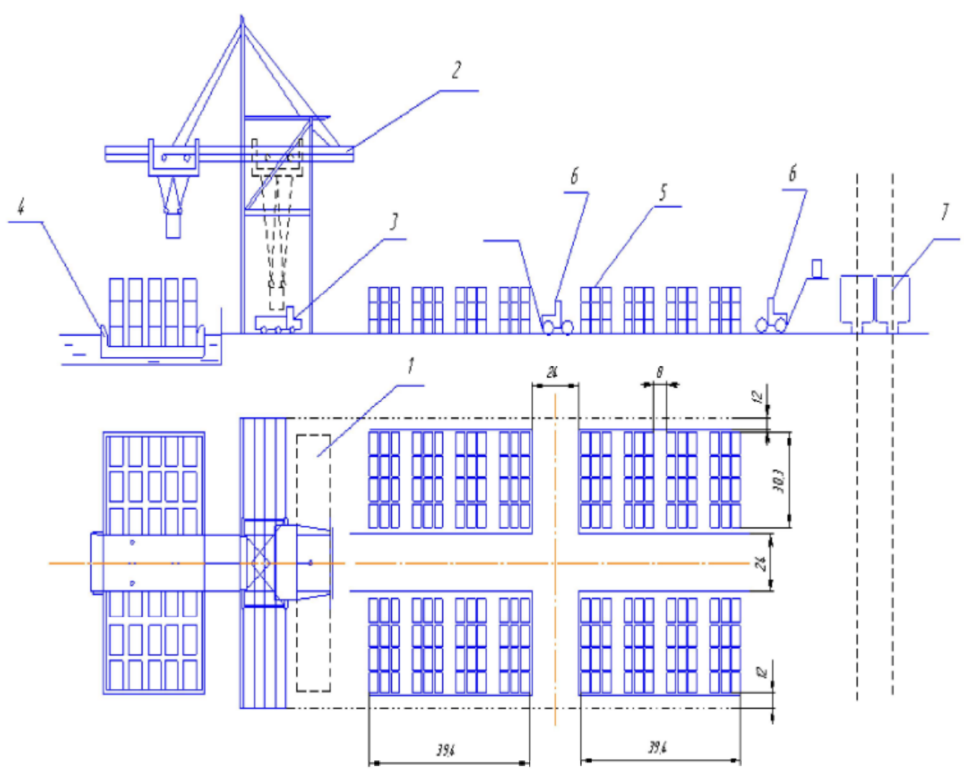

Fig. 1: The projected technological scheme of mechanization with use of a bridge loading crane. 1 area of transportation of containers, 2-bridge loading crane, 3-beater-trailer, 4 -vessel, 5 warehouse KK, 6-richstraker, 7-railway cars

Table 1: Operational analysis of operation of the portal crane and bridge loading crane

Name of the operation	The content of works in operation	Ways of operation	Profession of workers
Transport	Entrance to the ship crane	Mechanized	Recorder, the crane operator
Control and accounting	Lowering the boom in the side of the ship	Gantry crane, bridge excavator (42t)	Crane driver
Cargo	Slinging cargo	Autoslinging	Docker
Auxiliary	Hoisting of cargo	Gantry crane, bridge howl excavator (42t)	Crane driver
Movement	Turning the console	Gantry crane, bridge-hand excavator (42t)	Crane driver
Installation	Installation on roll treler	Gantry crane, bridge excavator (42t)	Crane driver
Movement	Transportation to the warehouse	Roll trailer	Driver
Unloading	Unloading roll trailer	Autoloader	Driver
Installation	Installation in a pile	Autoloader	Driver
Cargo	Slinging cargo	Autoslinging	Docker
Movement	Transfer to the railway platform	Autoloader	Driver
Additional	Bridles	Autoslinging	Docker

Duration of a cycle of a bridge loading crane makes 5 minutes

Duration makes a cycle of the portal crane 8 minutes

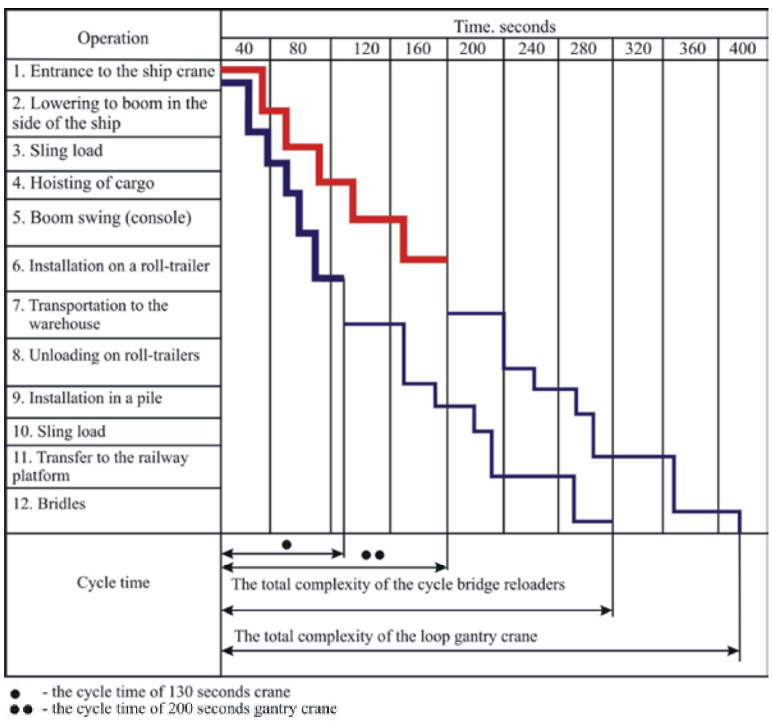

Fig. 2: Line graph "cycles of the cranes in the baseline and project options"

The main elements of the process is presented in the following sequence: Download large containers from the upper deck of the vessel lumen and the hold is quay container cranes with automatic spreader [8, 9].

Performed unloading roll-trailer with a forklift reach stackers equipped with automatic spreader and then set in a pile.

The export of goods from the warehouse by truck to rail loading platform.

After spending out functional analysis of a gantry crane and bridge loader (Table 1.), We can conclude that in the base case cycle time is 8 minutes with 4 overloads. Design calculations showed reduced cycle time of 3 minutes and with 4 overloads due to the introduction of a bridge loader. As time of a cycle decreases, there is productivity increase.

Thus, if the basic option performance was 1670 ton/day. [10] transhipment of containers, the proposed version of it is:

$$P = \frac{3600 \cdot G_{gross\ weight} \cdot K_{mt} \cdot K_{mc}}{t_c \cdot K_{comb}}$$, tons/day

where
$G_{gross\ weight}$ - crane load-lift capacity
t_c- cycle time tap
K_{comb}- coefficient of combining operations;
K_{mt}- coefficient utilization of machine time;
K_{mc}- coefficient utilization of the machine capacity

Cycle time:

$$t_c = t_s + t_b + \left(4 \cdot \frac{h_h}{V_n} + \frac{2l_t}{V_t} + \frac{2l_{cr}}{V_{cr}}\right) \cdot K_{comb}$$, min

where
t_s- time slings, sec;
t_b- time bridles containers, sec;
h_h- the average height (lowering) of cargo, m;
l_t- average road trolley, m
l_{cr}- the average movement of the crane path, m
V_n, V_t, V_{cr}- nominal speed hoist, trolley and crane, m/s

$$t_c = 6 + 6 + \left(4\frac{12}{0,5} + \frac{2 \cdot 42}{0,5} + \frac{2 \cdot 40}{0,62}\right) \cdot 0,3$$ =130 sec=2,2 min

$$P = \frac{3600 \cdot 32 \cdot 0,8 \cdot 0,61}{300 \cdot 0,8}$$ =234 t/h=3276 t/day.

CONCLUSION

The carried-out economic calculation revealed decrease in prime cost of an overload for 15% in design option, goods turnover by 1,3 times increased. As a result of external actions for optimization of reloading works on the terminal technical and economic and financial performance of seaport improved. The design option is optimum on this cargo terminal. The project is optimum on this cargo terminal.

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