

Innovative Application of Container Terminal Operation Improvement

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Abstract. The core business of container terminal operators is to complete the operation process of loading, unloading, collecting and carrying containers by optimizing the allocation and scheduling of resources such as berths, yards, quay bridges and yard bridges. These operations are not only the process of value realization, but also the process of energy consumption and environmental pollution. The scientific planning and scheduling of these operations directly affect the production efficiency and economic benefits of the container terminal. Through optimizing the allocation of the existing resources of the container terminal, giving full play to the combined efficiency and overall advantages of the terminal logistics system, finding a balance point between improving the operational efficiency, managing and controlling costs and meeting the needs of customers is a problem to be faced in the operation practice of the container terminal. Based on the analysis of the operation efficiency and service quality of the current container terminal logistics system, this paper puts forward the solution of innovative scheduling mode and optimization of ship unloading operation organization, and takes the improvement of clearing operation as an example to promote the lean management project of the container terminal, which provides an effective method for the efficient operation of the container terminal.

Keywords: container terminal operation, clearing operation, operation efficiency.

1. Innovation of Dispatching Mode

The logistics operation of container terminal can be regarded as a series of logistics cycles. In the logistics cycle, the export box carries out the port loading operation (the import box carries out the unloading and suitcase operation), but due to the constraints of the logistics operation process and mechanical resources, the phenomenon of queuing often occurs at each logistics node. If the waiting time of the container in a logistics node is too long, the completion time of the operation instruction of the container will increase significantly, which will undoubtedly form a bottleneck that hinders the whole logistics operation. This leads to the imbalance of the terminal resource operation load. One logistics node (yard bridge or quay bridge) is idle and waiting due to the lack of cards, while the other logistics node (quay bridge or quay bridge) is slow in operation and will cause the cards to queue and wait. Therefore, the key to improve the overall efficiency of the terminal logistics system is to improve the scheduling work and make the container run smoothly according to the operation cycle of the container terminal. If we can break the boundary between each logistics link, integrate the whole operation process together, use the theory and thought of concurrent engineering, optimize the allocation of mechanical resources, and allocate them to the containers to be loaded and unloaded alternately, so that the last logistics operation node can enter the next logistics operation node seamlessly after the completion of operation, that is, the adjacent operation nodes overlap with each other. In this way, it can reduce the waiting time of container in each logistics node, avoid the formation of operation bottleneck, achieve the goal of improving the efficiency of terminal logistics operation, and make the overall optimization of terminal logistics operation system. [1]

In the production practice of container terminal, the dispatching post can improve the overall efficiency of terminal logistics operation system in terms of innovative dispatching mode. At present, the container terminal still adopts the previous "extensive push-pull" scheduling mode. The real-time control of production operations depends on the experience of dispatchers, and the scheduling scheme is not scientific and reasonable. Different job organization ideas of scheduling implementers often have great differences in scheduling effect.

In order to achieve the smooth and efficient operation of terminal logistics as a whole, scientific management methods should be used to give full play to the enthusiasm of dispatching managers and eliminate the disadvantages of subjective and random dispatching mode. In the operation preparation stage, based on the conclusion of the analysis of the historical data of the operation of the ship and the storage yard, the problems that may occur in a certain period in the future will be comprehensively considered. According to the operation plan and requirements, the allocation of operation resources, ship specifications and other data, the corresponding plans will be made for different production and operation conditions.

In the implementation stage, due to the full consideration of various aspects in the early stage, it can optimize the operation sequence to the maximum extent and grasp the connection of each operation link; follow up the operation progress in real time and pay attention to process control, so that the process factors (safety, efficiency, quality and cost, etc.) are always under control; make targeted and flexible dynamic adjustment according to the actual situation or customer requirements. In the post assessment stage, use the job monitoring data to compare and analyze the influence of the scheduling organization scheme on the job effect, formulate the periodic rectification scheme, and form the working mechanism of assessment plus rectification. In addition, we should give full play to the role of information system in decision support of production scheduling, and truly form a new set of dynamic, integrated, information and flat scheduling mode. [2]

2. Thinking of Optimization of Ship Unloading Organization

Because of the particularity of the production operation of the container terminal, simply improving the operation of a certain link cannot improve the overall operation efficiency of the terminal, which needs to be considered comprehensively. In theoretical research and wharf operation practice, more attention is paid to the influence of loading operation on the overall operation efficiency. With the increasing throughput of the container terminal year by year, the site resources become increasingly scarce. Optimizing the unloading operation can not only realize the reasonable turnover of containers in the terminal, ensure the balance of air and land transportation operations, but also better meet the higher requirements of the shipping company for the terminal operation efficiency. During the unloading operation, the following situations often occur: the central controller finds that the unloading site is not enough, and the temporary new opening site will not only affect the efficiency of unloading, but also affect the subsequent container lifting operation. This situation is caused by the lack of a unified and standardized operation standard for ship unloading operation, which is related to both the macro site planning of the site plan and the real-time control of the central controller in ship unloading operation. Therefore, it is necessary to establish a set of integrated and unified ship unloading ideas from site planning to central control dispatching, and strengthen the standardization and standardization of ship unloading site planning.

There are two common ways to organize the unloading operation of container terminals, one is the unloading organization oriented to the operation line, the other is the unloading organization thinking of stacking containers of different types and container companies (B / L No.) respectively. The advantages and disadvantages of ship unloading organization can be evaluated from two aspects of ship unloading efficiency and subsequent service quality of suitcase. Obviously, the unloading organization thinking facing the operation line can realize the clear correspondence from the ship to the stacking area of the storage yard and improve the efficiency of the unloading operation. However, due to the type distribution of containers in the unloading yard is disorderly and scattered, it will bring difficulties to the mechanical scheduling during the lifting operation. While the unloading organization ideas such as the differentiated packing type and the container company (B / L No.) can bring convenience to customers and save costs for the terminal itself, the same type of containers will enter the yard stacking area at the same time during the unloading operation, resulting in congestion, resulting in poor operation of the operation line and reduced operation efficiency.

At present, most of the container terminals have adopted the automatic operation system for daily operation management. The automatic scheduling module of the system can well solve the problem

of logical judgment of container type and congestion in the stacking area of the yard, and can dynamically schedule the container according to the importance of the operation, the waiting time, the distance between tasks and other factors. After receiving the unloading instruction, the system will automatically make two levels of logical judgment. First of all, judge the type of container and the container company, and decide which type of stacking area the container will enter; then, schedule the cards according to the number of unloading instructions of each stacking area corresponding to the yard bridge, and assign the current cards to the stacking area with the least unloading instructions, which is the alternating location finding function of the cards. This ship unloading scheduling mode can be considered the requirements of ship unloading efficiency and subsequent service quality of suitcase. It can not only disperse the operation amount of site machinery, improve the efficiency of ship unloading, but also facilitate subsequent suitcase operation, which solves the problem of the past Ship Unloading Organization thinking. [3]

3. Lean Management Project of Site Clearing Operation

Container area sorting is an important work in the daily yard operation management of container terminal. It refers to the centralized consolidation of scattered containers to reserve space for subsequent air and land transportation operations. The sorting of the box area includes stacking, site clearing, transfer box and other miscellaneous operations not belonging to loading and unloading, and the completion of this work requires cooperation in all aspects from planning to scheduling. On the basis of mastering the dynamic situation of the ship, the site Planner shall make a targeted packing plan for the next day and night, formulate indicators and regularly supervise and evaluate them; the central controller shall strengthen the execution, coordinate and arrange the driver, machinery and other operation positions, and strive to ensure the quality assurance to complete the plan. It seems that the consolidation of the container area cannot create benefits for the container terminal, but if it is not well implemented in the operation practice, it will restrict the improvement of the handling capacity and operation efficiency of the terminal.

Clearing operation is the necessary work after the completion of the daily loading operation of the container terminal, which often cannot be completed regularly and quantitatively due to the lack of attention, which has an impact on the subsequent air and land transportation operations. Next, we will promote the lean management project of container terminal and improve the overall operation capacity with the goal of improving the clearing operation.

1. Current site clearing problems

The implementation rate of single shift clearance plan is only 75%, which has a certain gap with the annual decomposition target of the Department, affecting the subsequent site plan and air and land transportation operations.

2. Improvement objectives

The implementation rate of single shift clearance plan reached 85%.

3. Project promotion plan

Formulate the implementation schedule of lean management project to improve the clearing rate of single shift, as shown in Table 1.

Table 1. Schedule of lean management project promotion to improve the fulfillment rate of single shift clearance plan

Overall goal	Target decomposition		tool	Completion deadline
Improve the fulfillment rate of single shift clearance plan	Definition	line improvement obj	Gantt chart	March week 1
		deadline for compl		
	measure	collecting data	Flow chart	2nd and 3rd week of
		draw current flowcha		
	Analysis	out the influencing fa	hbone diagr	March 4th week
		cess capability analy		
	Improvement	Develop solutions	Flow chart	Week 1 and 2 of Apr
		reate a new flowcha		
	mentation and c	y process implementa		Week 3 and 4 of Apr
		Project control		

4. Measurement and Analysis

The statistical data of two-week ship clearance operation were analyzed, and four problems were found in personnel, machinery, methods and objective conditions: (1) personnel: poor implementation of system process, lack of documents circulation and filing, and poor communication and coordination among all posts; (2) machinery: insufficient site bridge, insufficient collection card; (3) methods: loopholes in system process, unreasonable site plan, and assessment not in place; (4) objective conditions: there are many exit boxes. According to the measurement and analysis, draw the fishbone diagram that affects the improvement of the fulfillment rate of the single shift clearance plan, as shown in Figure 1.

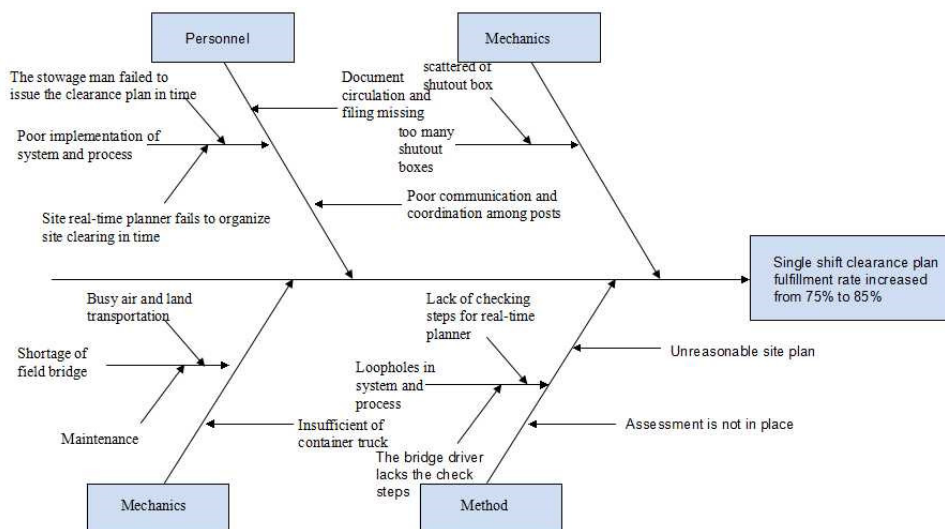


Fig. 1 Fishbone diagram affecting the improvement of the fulfillment rate of single shift clearance plan

5. Improvement and Implementation

Based on the measurement and analysis of the data of the ship clearing operation, the improvement plan is made from four aspects: (1) increase the check steps that the site real-time planner and the site bridge driver lack in the current process; (2) ensure that the documents are in place and filed completely; (3) strengthen the training and assessment of the system process; (4) strengthen the communication and coordination among all posts. A new site clearance flow chart is drawn as shown in Figure 2.

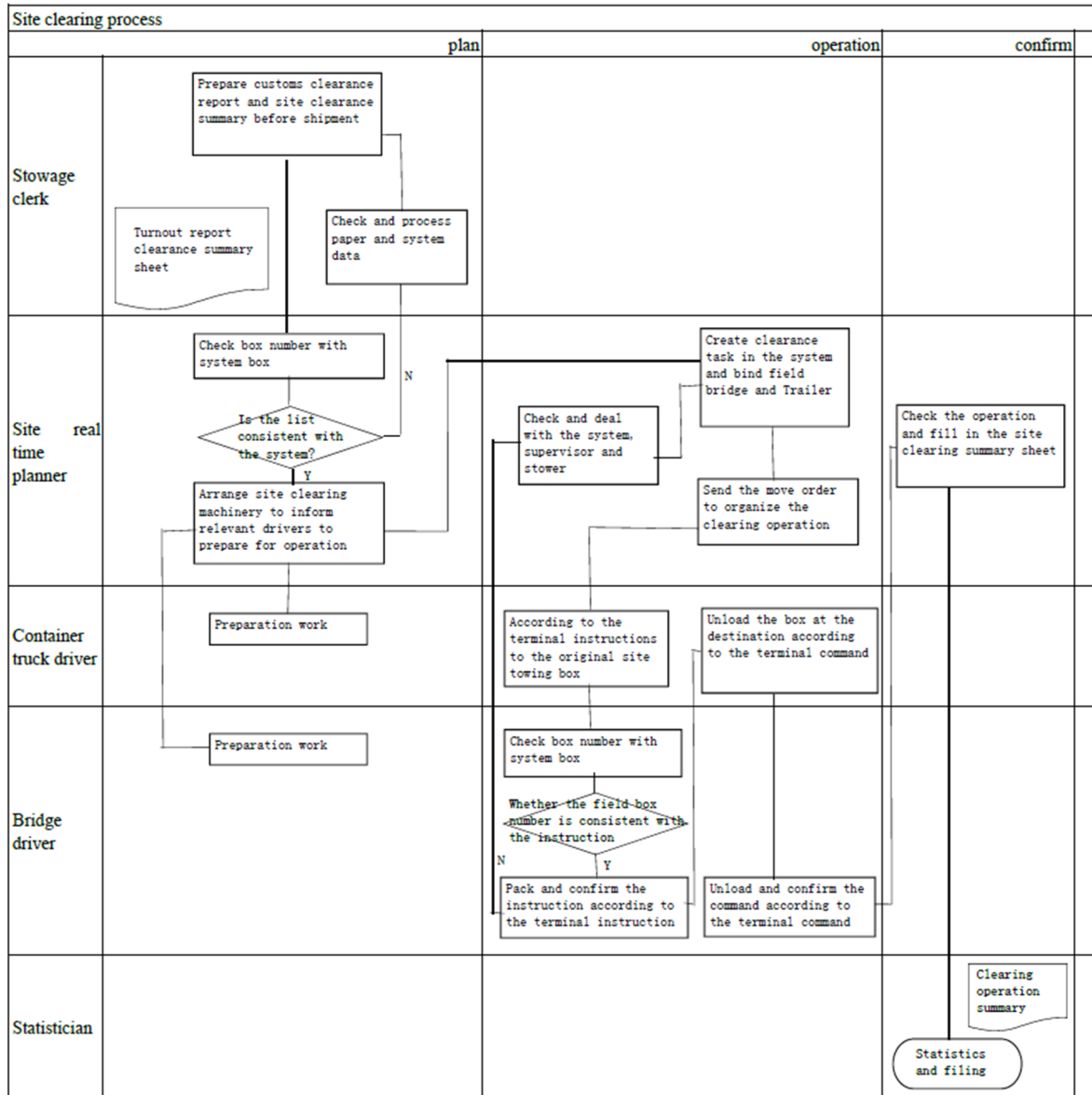


Fig 2. Site clearing operation flow chart

In order to cooperate with the implementation of the new process, draw up a new summary sheet of single ship clearing operation of container terminal, to facilitate the circulation and filing of documents, as shown in Table 2.

Table 2. summary sheet of single ship clearing operation of container terminal

Summary sheet of clearing operation for single vessel of container terminal						
Ship / voyage:		Planner:			Dispatching time:	
Field	Quantity of containers on site for shutout				Remarks	
	20'	40'	≥45'	Dangerous goods		
Destination site	Quantity of work boxes for site clearing				Real time planning	Remarks
	20'	40'	≥45'	Dangerous goods		
Collect person:					Completion time:	

Two weeks after the implementation of the project, a total of 568 natural containers were issued for the single ship clearance plan, and 490 natural containers were planned to be completed for the single shift, with a fulfillment rate of 86.3%.

6. Conclusion

Based on the analysis of the problems in the production practice of the container terminal, this paper puts forward two improvement plans, i.e. the innovative scheduling mode and the optimization of the unloading operation organization. The lean management project of the clearing operation is promoted by applying the lean production idea, which creates conditions for the improvement of the overall efficiency of the container terminal. The innovation of scheduling mode and lean management project need continuous optimization and adjustment in operation practice, and there is still a lot of work to be done in reasonable allocation of various production factors to improve overall efficiency and meet customer needs. To adapt to the new normal of economic development, it is necessary for container terminal operators to pursue throughput and efficiency, focus on improving quality and efficiency, innovate management methods, coordinate air and land transport operations, enhance the core competitiveness of the terminal, and make new breakthroughs in development.

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