

Analysis and Countermeasure Research on Plan Issues of Heavy Lift Crane Pontoon Project

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Keywords: Project plan, Delayed, Heavy Lift Crane Pontoon.

Abstract. In recent years, global offshore market suffers a decline. Especially the market of deep-sea oil research service, it's more difficult in the low oil price environment. The unit budget of new project is constantly decreased. It's higher than ever before for the requirement of shipyard. Enhancing the control of project planning must be faced by shipyard and the reasonable project planning is the basis of everything. This article employs PERT analysis method to qualify heavy lift crane pontoon project planning for R Company, the conclusion is too optimistic and subjective for the project planning and hard to complete the project on schedule, sow the seeds of delay delivery and penalty.

Introduction

Project planning management [1] has been widely used in offshore projects [5], but in many cases, the project plan is unreasonable, resulting in the project cannot be completed as planned. This article is based on an entire project plan as the object of study, the current stage of the typical project planning issues to study. Through the quantitative analysis of the project plan management [6], provide the offshore project management proposals. This case is a large-scale offshore Heavy Lift Crane Pontoon Project of R Company. Since the project plan is compressed very tightly, all the expected time in the planning process is as much as possible when the optimistic completion time is used, and the penalty for the deferred delivery of the project is laid foreshadowing. In this article, PERT analysis [2, 3, 4] is used to analyze the implementation time of each sub-item in the project plan and to evaluate the comprehensive evaluation of each sub-program. Through the analysis of the critical path chart, the relative order of the various activities is found, and the possible time for each activity is judged. Clarify the order between the various, logical and potential problems to judge.

Analysis of Project Plan

Plan of Project Construction Process

4000t Heavy Lift Crane Pontoon in the actual construction will be built with subsection, and then on the berths to assembly. The pontoon is divided into Mid Pontoon, Fore Pontoon, Aft Pontoon and Superstructure, and each part is divided into a number of small sections. In the design stage, each segment will be divided into separate design and design drawings. The production department shall carry out the sub-construction according to the segmented drawings, carry out the main structure construction and some pre-outfitting and painting work. After the completion of the small section of the composition of the segmented, and then on the berths to assembly. After that will launching and commissioning.

Project Plan

Project tasks dissolution is the first thing for making project plan [1, 6] and then define the relevant business scope, and take the process according to the prepare situation of corresponding resources

and the order. The project is planned to be very compact at all times as much as possible in the planning process. By using the WBS analysis method [8], we can easily show the initial plan for the company's arrangement in figure 1.

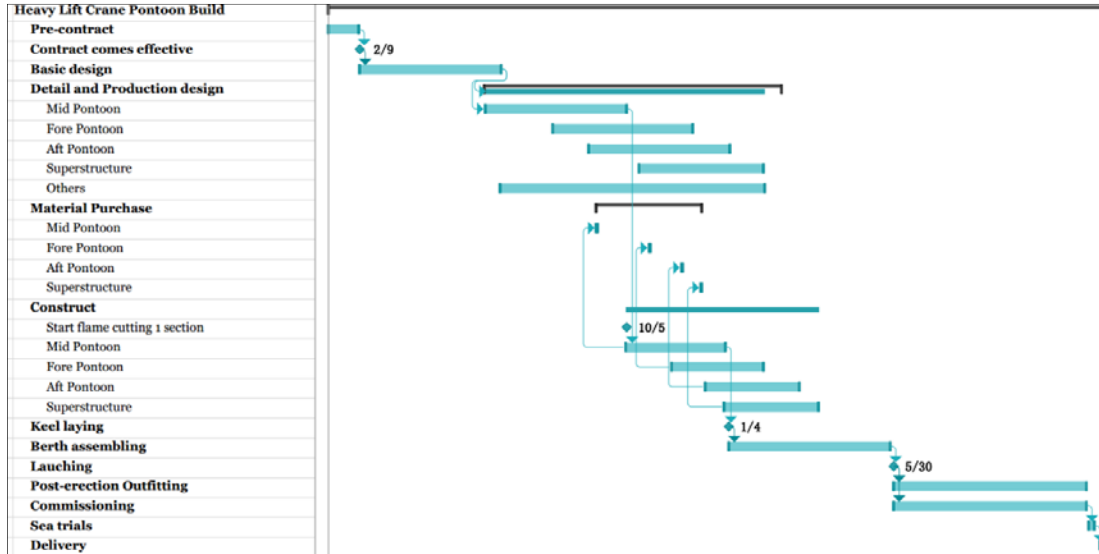


Figure 1. Project plan.

Analysis of Critical Path

The key path of the project is: Pre-contract→Basic design→Detail and Production design (Mid Pontoon)→Mid Pontoon construction→Berth assembling→Commissioning→Sea trial→Delivery. The planning analysis here will try to consider the possibilities [6].

The Analytical Method of Project Plan

PERT analysis [2, 3, 4] is used here. First, assume that the entire project execution time, subject to the principle of β Division, in accordance with the relevant similar project experience, evaluate the time for each stage of the planning, including the shortest possible time of the sectional implementation, the project planning time and the maximum possible time value during the execution of the item is calculated by a weighted average of a desired time value. In this case, the selection of each parameter needs to take into account the relevant risk factors, according to previous similar project experience, to provide a more reliable time estimate, such as the project process rework, weather caused by downtime, a variety of resource constraints lead to the schedule restrictions and other risks should be taken into account. In the planning cycle analysis, the three time, estimated as a unified time, the formula is as follows:

$$Te = (To + 4Tm + Tp) / 6.$$

(1)

“ Te ” means the average duration of the project sub-item; “ To ” means the minimum duration of the project sub-item; “ Tp ” means the longest duration of the project sub-item; and “ Tm ” means the planned duration of the project sub-item.

Specific Plan Analysis

The main process parameters are selected as follows:

Pre-contract, mainly for the review of the contract, the price negotiation and the price of the approved, and the latter business process. The schedule is 20 days, there may some different possibilities based on the actual process:

$$To_1 = 18 \text{ days}; \quad Tm_1 = 20 \text{ days}; \quad Tp_1 = 30 \text{ days}.$$

Basic design, during the actual project implementation process, because the parties of the project did a lot of works before the contract signed, the deviation of the basic design cycles estimation is relatively small, the corresponding value is as follows:

$$To_2 = 80 \text{ days}; \quad Tm_2 = 90 \text{ days}; \quad Tp_2 = 105 \text{ days}.$$

Detail and Production design (Mid Pontoon), Mid Pontoon is the first part of the start and closing, is an important part of the key path. This part is referred to the basic design and the requirements of the owners of the refinement. In the actual implementation process, there will be subject to a variety of related conditions, such as the procurement of equipment constraints. There is a certain degree of uncertainty in the implementation process, the quality of the drawings must be ensured, and there may be relevant uncertainties in the course of implementation. So the value is as follows:

$$To_3 = 85 \text{ days}; \quad Tm_3 = 90 \text{ days}; \quad Tp_3 = 120 \text{ days}.$$

Mid Pontoon construction, section construction is the core of the shipyard, which involves all aspects. From the completion of the design to the procurement of raw materials, the deployment of various resources in the construction process must also consider the relationship between the actual construction process in a variety of uncontrollable factors, such as into the winter, if the temperature is too low, cannot paint work. Will also bring the corresponding delay, the uncertainty existed at this stage. The original plan is relatively compact. The specific value is as follows:

$$To_4 = 62 \text{ days}; \quad Tm_4 = 65 \text{ days}; \quad Tp_4 = 90 \text{ days}.$$

Berth assembling and the platform resources are one of the core resources of each shipyard, and its use plan is strictly limited. During the course of the project, the platform cycle is compressed as much as possible. Specific values is as follows:

$$To_5 = 95 \text{ days}; \quad Tm_5 = 100 \text{ days}; \quad Tp_5 = 130 \text{ days}.$$

Commissioning, which is the installation and sweep of the equipment before the project is delivered. In this section, the errors and delays in the early stages are exposed at this stage and there is a great deal of uncertainty [7]. According to history project experience, in order to ensure the corresponding closure of the node cycle and the platform cycle, in the early unfinished pre-outfitting and the corresponding error changes, will be put into this stage. In this process, the owners will make a lot of amendments and rectification, there are significant uncertainties. The specific value is as follows:

$$To_6 = 110 \text{ days}; \quad Tm_6 = 124 \text{ days}; \quad Tp_6 = 180 \text{ days}.$$

Sea trials, under normal circumstances, the estimated trial run for five days. If smoothly, you can compress to three days, but if there is a problem, the trial run may be carried out again, the specific value is as follows:

$$To_7 = 3 \text{ days}; \quad Tm_7 = 5 \text{ days}; \quad Tp_7 = 10 \text{ days}.$$

With the Eq. 1, we could calculate the sub-item of Te is as follows:

$$\begin{aligned} Te_1 &= (To_1 + 4Tm_1 + Tp_1)/6 = 21.3333 \text{ days}, & Te_2 &= (To_2 + 4Tm_2 + Tp_2)/6 = 90.8333 \text{ days}, \\ Te_3 &= (To_3 + 4Tm_3 + Tp_3)/6 = 94.1667 \text{ days}, & Te_4 &= (To_4 + 4Tm_4 + Tp_4)/6 = 68.6667 \text{ days}, \\ Te_5 &= (To_5 + 4Tm_5 + Tp_5)/6 = 104.1667 \text{ days}, & Te_6 &= (To_6 + 4Tm_6 + Tp_6)/6 = 131 \text{ days}, \\ Te_7 &= (To_7 + 4Tm_7 + Tp_7)/6 = 5.5 \text{ days}. \end{aligned}$$

Total duration $Te = Te_1 + Te_2 + Te_3 + Te_4 + Te_5 + Te_6 + Te_7 = 515.6667$ days. As the original planned duration of 493 days, compared to the average time difference $T = Te - Tm = 515.6667 - 493 = 22.6667$ days. According to the contract, if the original plan is postponed, the high penalty will be occurred. And if after 22 days of contract delay time, the owner will face to abandon the pontoon. The variance is calculated by the following formula:

$$\sigma^2 = (Tp - To)^2 / 6^2. \quad (2)$$

With the value of Tp and To , we can calculate the sub-item of variance as follows:

$$\begin{aligned} \sigma_1^2 &= (Tp_1 - To_1)^2 / 6^2 = 4, & \sigma_2^2 &= (Tp_2 - To_2)^2 / 6^2 = 17.3611, \\ \sigma_3^2 &= (Tp_3 - To_3)^2 / 6^2 = 34.0278, & \sigma_4^2 &= (Tp_4 - To_4)^2 / 6^2 = 21.7778, \\ \sigma_5^2 &= (Tp_5 - To_5)^2 / 6^2 = 34.0278, & \sigma_6^2 &= (Tp_6 - To_6)^2 / 6^2 = 136.1111, \\ \sigma_7^2 &= (Tp_7 - To_7)^2 / 6^2 = 1.3611. \end{aligned}$$

Total variance $\sigma^2 = \sigma_1^2 + \sigma_2^2 + \sigma_3^2 + \sigma_4^2 + \sigma_5^2 + \sigma_6^2 + \sigma_7^2 = 248.6667$. The probability of the project completion is in table 1 and figure 2.

Table 1. Project completion probability

Total duration	Te=515.6667 [days]		$\sigma = 15.7692$ [days]	
	Scope	Probability	From	To
T	$\pm 1\sigma$	68.26%	499.9	531.4
T	$\pm 2\sigma$	95.46%	484.1	547.2
T	$\pm 3\sigma$	99.37%	468.4	562.9

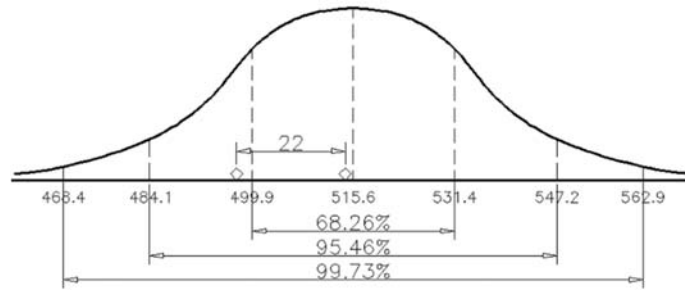


Figure 2. Project completion probability.

As shown above, the probability of completion in 493 days is as $(1 - 68.26\%)/2 = 15.87\%$. The probability of completion during the penalty period is 34.13%. So the arrangement of the original project is unreasonable, there is a great probability cannot be completed on time, there is a big risk.

Summary

Through the previous analysis, we know that the arrangement of the original project is unreasonable, which may cause a great loss for the R company. And this means the R company can no longer trust in several part-time program specialists when they need a plan for projects like this one. Since the layout of the project plan is a rigorous scientific process, the process of planning needs to take into account all aspects. We not only need to consider the implementation of the critical path, but also the resources owned by the project. At the same time, we must use reasonable WBS analysis to pick out the real critical path before the entire project plan can be arranged.

In the process of project plan making, the project plan was exposed to resource constraints. So we could never ignore the actual situation of existing resources. In the actual implementation process, it is very difficult to obtain resources other than the expected resources. In this way, many companies will find that they have a difficult time accomplishing the project, which may cause a bankrupt. Based on this research, I can conclude that there are many things for companies like R to do during the follow-up project planning and adjustment of the company:

Improve the professionalism of the project plan, as well as the interdisciplinary learning ability. Project planning is not just a simple analysis and arrangement of WBS, it has a very high understanding requirement of the relevant knowledge and resources. Existing professional planners who pass several part-time jobs do not qualify for the knowledge reserve of such a large project. In the actual implementation process, a planning team composed of experts from various departments needs to accurately analyze and judge each path.

Strengthen the reservation and use of the project plan margin. Through the historical data and the planned changes that have occurred in the study, you can find the corresponding plan to adjust the implementation of a certain regularity, and the various departments of the actual implementation of the relevant capacity.

In short, the shipbuilding enterprises need to continue through the accumulation of knowledge, and ultimately to the project plan to accurately determine. Provide the reference for the new project and make it more reasonable.

Acknowledgement

The authors gratefully acknowledge the financial support of the national natural science foundation, China (No. 51435009).

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