

# Planning for the Making of Scheduling Block Fore Peak 300 Feet Barge Using the Critical Path Method (CPM)

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**Abstract:** In the repair of a vessel, project management is essential to facilitate the distribution of tasks so that they are structured and aligned with the planned schedule. This research aims to redesign the scheduling of the fore peak block construction on a 300-foot barge, which is a critical component of the ship's structure. The study is motivated by project delays that occurred at a shipyard in the Riau Islands, where there was a difference between the planned duration of 88 days and the actual realization of 107 days. The method used is the Critical Path Method (CPM), which can identify the critical path in the work network, calculate the earliest and latest start and finish times (ES, EF, LS, LF), and determine float values. Data processing was carried out through S-curve analysis and man-hour evaluation. The calculation results of Man-hours show 1264 JO in the planning stage and 1552 JO in the actual stage, where the increase in man-hours impacted cost escalation. Therefore, rescheduling was performed, resulting in a reduced project duration of 93 days and a decrease in the number of critical paths from 11 to 8. The implementation of CPM has proven to improve the effectiveness of project control, making it a relevant and practical method in modern ship construction project management.

**Keywords:** Critical Path, Critical Path Method (CPM), Man-hour, Project Scheduling

## 1. Introduction

Barges are a type of ship with a flat hull or large floating box, used to transport cargo and pulled by tugboats. The barge itself does not have a propulsion system like a typical ship. In general, barges are used to transport large quantities of cargo such as timber, coal, and sand. The construction of a 300-foot fore peak barge requires special attention due to its large size. One of the most crucial aspects of the process of making a fore peak barge is the scheduling process (success in scheduling, manufacturing and designing the construction of the main structure). Proper scheduling ensures that the ship can operate safely and efficiently after completion. Therefore, the study of

planning, and the technology used in this scheduling process is very important. The global shipping industry is currently facing major challenges related to the efficiency of ship production and technology development. By using the latest methods in fabrication, assembly and design, the process. Effective and safe scheduling is the main goal of this study. Planning of new shipbuilding projects, any other activities and activities and total projects. It identifies relationships between activities that require priority, which shows a realistic time estimate for any activity. The CPM (*Critical Path Method*) method assumes that it has a time coefficient for each activity, assuming that the activity is known. One of the advantages of CPM based on Adedeji and Bello (2014) is that CPM is suitable for the formulation, scheduling, and management of various activities in all construction works, as it provides an empirically constructed schedule.

## 2. Methods

To obtain data that is in accordance with the title and relevance to the analysis carried out, the writing uses several data search techniques. Data sources were obtained from literature studies and other supporters. Literature study aims to complete and prepare the theoretical concepts needed during the Final Project. The data needed for this final project is secondary data and primary data. Secondary data is data obtained not from the first source or information collected from related companies, such as data on the main size of the 300 Feet Barge, Timeline Schedule data for the manufacture of 300 Feet Barges. Then for primary data, namely data obtained through field surveys and interview results from people who play a role in the process of processing the research object, namely workers involved in the process of making the 300 Feet Barge. The data is used to obtain information on obstacles that occur during the shipbuilding process. The data is then used for scheduling analysis and calculation of people's hours needs.

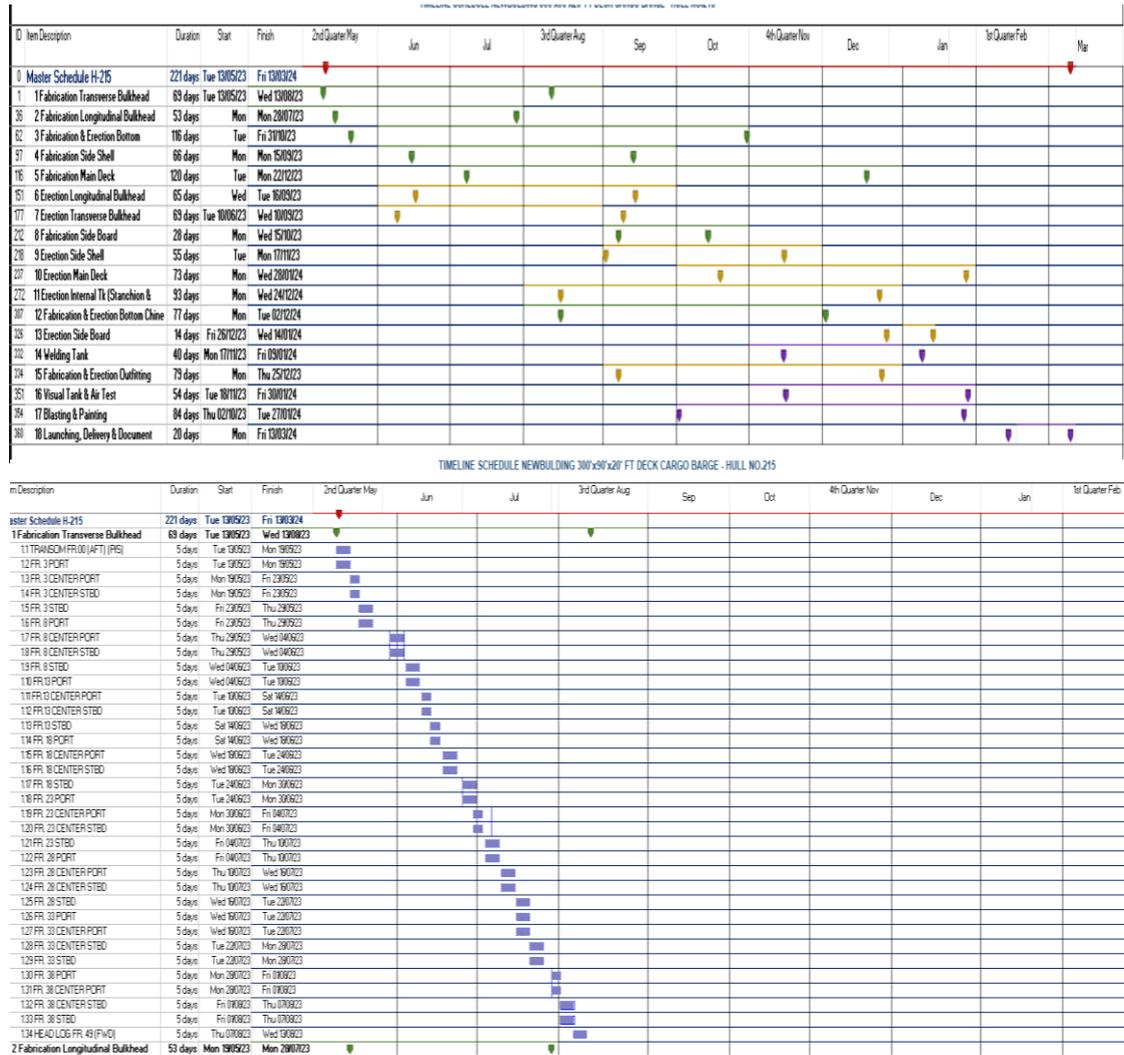


Figure 1. Timeline Schedule of 300 Feet Barge in Riau Islands Shipyard (Source: PPIC Shipyard in Riau Islands, 2024)

### 3. Results and Discussion

The data obtained from the Riau Islands Shipyard is processed to calculate The People's Hours. For its calculation are as follows:

a. Weight of Plan Activities

$$\begin{aligned} \text{Activity Weight} &= \frac{\text{activity price}}{\text{total price}} \times 100\% \\ &= \frac{Rp\ 16.000.000}{Rp\ 252.800.000} \times 100\% = 6,32\% \end{aligned}$$

To find the weight of the percentage of activities per day using the formula :

$$\% \text{ activity per day} = \frac{\text{activity weight}}{\text{duration of activity}} = \frac{6,32\%}{10} \text{ton/day} = 0,63\%$$

## b. Actual Activity Weight

$$\begin{aligned} \text{Activity Weight} &= \frac{\text{activity price}}{\text{total price}} \times 100\% \\ &= \frac{\text{Rp } 24.000.000}{\text{Rp } 310.400.000} \times 100\% = 7,73\% \end{aligned}$$

To find the weight of the percentage of activities per day using the formula :

$$\% \text{ activity per day} = \frac{\text{activity weight}}{\text{duration of activity}} = \frac{7,73\%}{15} \text{ ton/day} = 0,51\%$$

In Table 1 below, it is an explanation of the weight of each activity in the *Fore Peak* construction project. While green shows the plan and orange shows actual.

**Table 1.** Calculation of Cost, Person Hours and Activity Weight

No	Duration	Person Hour	Cost	Weight Percentage	Jobs
1	10 days	800	IDR 16,000,000	6,3%	Trans Bulkhead
	15 days	1200	IDR 24,000,000	7,7%	
	15 days	1200	IDR 24,000,000	9,5%	Long bulkhead
2	20 days	1600	IDR 32,000,000	10,3%	Side shell
	14 days	1120	IDR 22,400,000	8,9%	
3	15 days	1200	IDR 24,000,000	7,7%	Main deck
	16 days	1280	IDR 25,600,000	10.1%	
4	20 days	1600	IDR 32,000,000	10,3%	Fabrikas Bottom plate & Erection
	20 days	1600	32,000.000	12.7%	
5	20 days	1600	32,000.000	10,3%	Erection trans bulkhead
	8 days	640	12,800.000	5.1%	

	15	days	1200	24,000.000	7,7%	
	10	days	800	16,000.000	6,3%	Erection long bulkhead
7	10	days	800	16,000.000	5,2%	
	8	days	640	12,800.000	5,1%	Erection Side shell
8	10	days	800	16,000.000	5,2%	
	18	days	1440	28,800.000	11,4%	Erection Main deck
9	20	days	1600	32,000.000	10,3%	
10	18	days	1440	28,800.000	11,4%	Erection Internal TK
	20	days	1600	32,000.000	10,3%	
11	8	days	640	12,800.000	5,1%	Erection Bottom Chain & Fabrikasi
	10	days	800	16,000.000	5,2%	
12	3	days	240	4,800.000	1,9%	Outfitting main hole
	3	days	240	4,800.000	1,5%	
13	4	days	320	6,400.000	2,5%	Visual tank
	4	days	320	6,400.000	2,1%	
14	2	days	160	3,200.000	1,3%	Blasting painting underwater
	4	days	320	6,400.000	2,1%	
15	2	days	160	3,200.000	1,3%	Blasting painting hull
	4	days	320	6,400.000	2,1%	
16	2	days	160	3,200.000	1,3%	Blasting painting main deck
	4	days	320	6,400.000	2,1%	

The total weight of the block fore peak (W) is ± 325 tons, based on the equation of the calculation formula as follows:

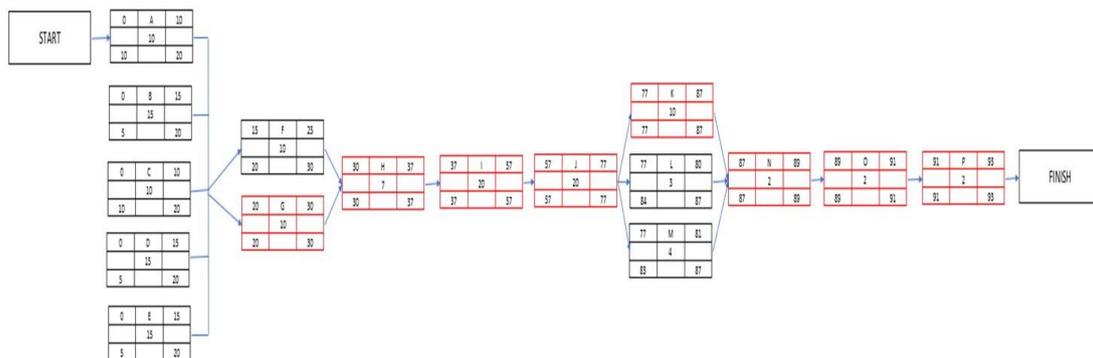
- Productivity plan =  $\frac{W}{T \times JTK} = \frac{325.000 \text{ kg}}{12640 \times 10} = 257,1203 \text{ kg/jo}$

$$\begin{aligned} \text{Productivity} &= 257,1203 \text{ kg/jo} \\ W &= 325.000 \text{ kg} \end{aligned}$$



**Table 2.** Rescheduling

No	Job Description	Start	Finish	Duration	
1	Fabrication	Trans bulkhead	15/05/2023	26/05/2023	10 day
		Long bulkhead	15/05/2023	02/06/2023	15 day
		Side shell	15/05/2023	26/05/2023	10 day
		Maindeck	15/05/2023	02/06/2023	15 day
		Bottom & Erection	15/05/2023	02/06/2023	15 day
		Trans Bulkhead	05/06/2023	16/06/2023	10 day
		Long Bulkhead	05/06/2023	16/06/2023	10 day
		Side shell	19/06/2023	27/06/2023	7 day
		Main deck	28/06/2023	25/07/2023	20 day
2	Erection	Erection internal Tk	26/07/2023	22/08/2023	20 day
		Bottom chine	23/08/2023	05/09/2023	10 day
4	Outfitting &fabrikasi	Mainhole	23/08/2023	08/08/2023	3 day
5	Visual tank	Visual tank	23/08/2023	09/08/2023	4 day
		Blasting painting underwarter Area	06/09/2023	17/09/2023	2 day
6	Blasting & painting	Blasting painting hull	08/09/2023	11/09/2023	2 day
		Blasting painting main deck	12/09/2023	13/08/2023	2 day



**Figure 3.** Network Rescheduling Diagram

**Table 3.** Total Rescheduling Floats

No	Simbol	EN	EF	LS	LF	FLOAT
1	A	0	10	10	20	10
2	B	0	15	5	20	5
3	C	0	10	10	20	10
4	D	0	15	5	20	5
5	A	0	15	5	20	5
6	F	15	25	20	30	5
7	G	20	30	20	30	0
8	H	30	37	30	37	0
9	I	37	57	37	57	0
10	J	57	77	57	77	0
11	K	77	87	77	87	0
12	L	77	80	84	87	7
13	M	77	81	83	87	6
14	N	87	89	87	89	0
15	O	89	91	89	91	0
16	P	91	93	91	93	0

In Table 3, the next is the calculation of *the float* or leisure time of each job by means of  $LS - ES$  or  $LF - EF$  to find out the critical work in rescheduling.

**Table 4.** Activities That Are Critical

No	Job Description	Symbol	Float
1	Eraction trans Bulkhead	G	0
2	Eraction side shell	H	0
3	Eraction Main deck	I	0
4	Eraction Internal TK	J	0
5	Eraction & Fabrikasi bottom chain	K	0
6	Blasting painting underwarter Area	N	0
7	Blasting painting hull	O	0
8	Blasting painting main deck	P	0

From the results of the rescheduling analysis, there is a difference between actual and rescheduled. The difference can be seen from the duration where in the actual activity of making a 300-foot barge occurred for 107 days and in the rescheduling to 93 days. Thus the critical path on the actual schedule with rescheduling is also different. In the actual schedule there are 11 jobs on the critical track and in the rescheduling there are 8 critical track jobs the fore peak making project is more controlled, this in the rescheduling there is a difference in duration so that the schedule is reduced by 14 days from the actual schedule.

## 4. Conclusion

The application of CPM rescheduling proved effective in optimizing the project **timeline**, improving control of critical activities, and producing a more achievable schedule compared to the original plan. These results highlight the importance of continuous schedule evaluation and adjustment using CPM to enhance time management and labor efficiency in shipbuilding construction projects. Here some conclusions :

1. In the planning schedule using the *Critical Path Method* (CPM) method, the duration or time of the project work is obtained for 88 days, while in actuality the duration of the work is 107 days, among the 16 works in *the actual* there are 11 critical line works during the construction of *the* block fore peak of the 300-foot barge.
2. In the calculation of people's hours in the planning of making *blocks fore peaks* , 1264 JO, and in the calculation of people's hours in actuality get a total of 1552 JO.
3. In the rescheduling using *the Critical Path Method* (CPM), the duration of 93 days has been obtained and there are 8 jobs that are on the critical path, on this critical path work activities are more controlled when compared to the initial planning which lasts 88 days which has critical path work.

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