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WORK ANALYSIS OF HYDRAULIC STATIC PILE DRIVER EQUIPMENT ON PILEFOUNDATION WORK IN TERMS OF TIME AND COST

(Case Study of the Physical Works Project and the Expansion of the Marabahan DistrictCourt Building)

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ABSTRACT

To make a building requires a strong foundation to withstand the load on it. the Physical Work Project, Renovation and Expansion of the District Court Building requires heavy equipment management in the form of piles, the piling method used is the Hydraulic Static Pile Driver. Thepile management is needed to find out the estimated working time on the entire building so that the implementation goes according to or does not exceed the planned project time. Therefore, it is necessary to analyze the efficiency of the piling tool. The results of the descriptive analysis in this study obtained the production value of the Hydraulic Static Pile Driver tool. The highest production value was 0.23 meters/minute, and the lowest value was 0.21 meters/minute. The time required to complete the project erection work based on the planning is nine weeks, while the realization in the field to complete it in seven weeks. The planned implementation cost to complete the erection work for this project is Rp. 2,073,360,000. Meanwhile, the cost of field realization is Rp. 2,481,150,000. this means that the implementation costs in the field are greater than the planning costs of Rp. 407,790,000 this was due to the addition of 828.00 m3 of pile procurement volume and 828 m3 of piling and handling work, and 138 nos of pile connections.
Keywords: Productivity, Hydraulic Static Pile Driver, Efficient

1 INTRODUCTION

A building is a physical form resulting from construction work integrated with a place of residence either above, below the ground, and in the water. Buildings are usually connoted with houses, buildings or all facilities, infrastructure or infrastructure in culture or human life in building civilization, such as bridges and their construction and design, roads, telecommunications facilities, and others. The Physical Work Project for the Renovation and Expansion of the Marabahan District Court Building is a renovation project for the Marabahan District Court building with a contract value of Rp. 6,682,311,660.20, which is located on Jl. Puteri Junjung Buih No. 77 - Barito Kuala(Kab.). This project uses piles as the foundation with the condition of the soil on the island of Kalimantan, which will has quite a lot of texture properties, will affect the type of construction of the building. In the process of using the piling method on the building's foundation., the piling method requires heavy equipment management in the form of piles as the main tool in the implementing of pile foundation work. The pile management is needed to find out the estimated working time on the entire building so that the implementation goes according to or does not exceed the planned project time. Therefore, it is necessary to analyze the efficiency of the piling tool. The pile management is needed to find out the estimated working time on the entire building so that the implementation goes according to or does not exceed the planned project time. Therefore, it is necessary to analyze the efficiency of the piling tool. The

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2 RESEARCH METHODS

Methodology This research was conducted by collecting data obtained from direct observation to the project/field. This research was conducted by explaining the stages ofdriving through the Hydraulic Static Pile Driver tool and processing the data at the stage to determine the productivity of the Hydraulic Static Pile Driver tool in the Physical Work Project for the Renovation and Expansion of the Marabahan District Court Building. The framework of the research method can be seen in Figure 3.1.

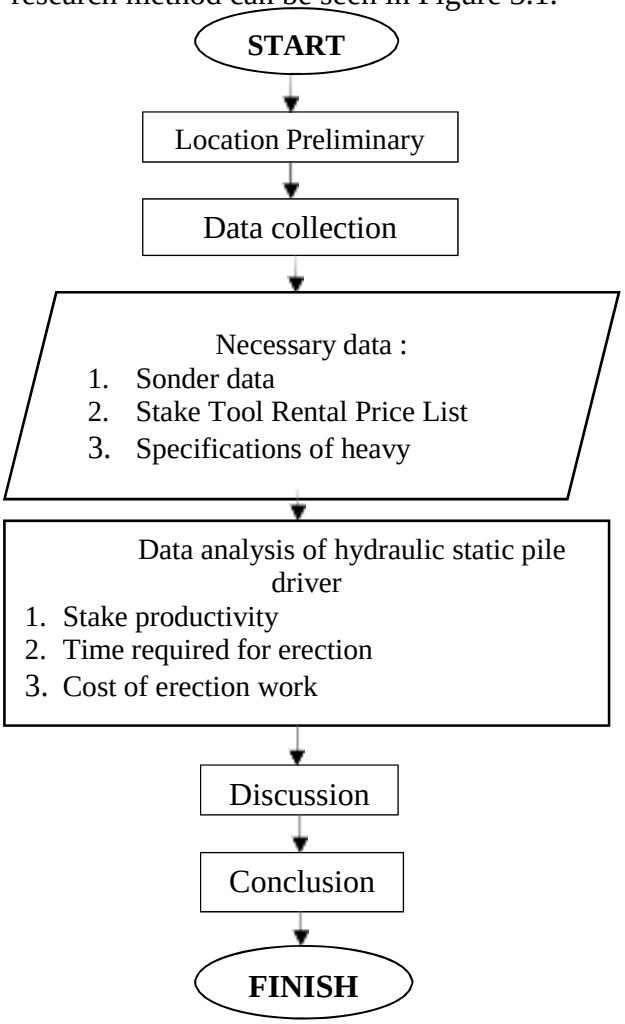


Figure 3.1 Research Method Flowchart

3 RESULTS AND DISCUSSION

3.1 Hydraulic Static Pile Driver Working Method

This tool consists of several sub-machines that each has different work functions. So that each sub-machine has its working method which, is then combined into a unified driving work method. The types of work are:

1. Move To The Point
2. Lifting Pile
3. Clamping & Piling
4. Joint Pile (Welding)
5. Cutting Pile.

These types of work have different durations of work, so it is necessary to analyze the method to obtain a duration of 1 cycle of 1 pile driving on a project.

3.1.1 Employment data

Name of Work Package : Physical Works Project and Expansion of Marabahan District Court Building. Physical Works Project and Expansion of the Marabahan District Court Building.

Area :4,968 m
Type of work :Construction Works
Work unit :The state court is angry
Activity Manager :PT. Suramadu Nusantara Engineering and PT. Indonesian Energy Defani (KSO)
Contract No. :W15.9/1614/PL01. 01/10/2020
Contract Price :Rp. 6,685,000,000.00
Sources of funding :APBN 2020
Implementation time :87 Calendar Days
Contract Date :04 OCTOBER 2020
Supervision Consultant: CV. Dayakarsa Madya ConsultantTraffic Volume

3.1.2 Tool Profile

Tool's name : Hydraulic Static Pile Driver
Producer :Tianwei Engineering Machinery Manufacturing Co.Ltd. China

Year 2012
Serial Number 201208320386
Type :ZYJ 15/120
Transport Capacity :120,000 Kg
Piling Speed : Fast :9.40 m/min
Moving Distance
Front back :2.00 – 2.40 m
Left right :0.55
mMoving Speed
Front back :
Left right :
Max Square Pile :300x300
mmMax Circle Pile :300mm
Lifting Weight :5 Ton
Lifting Pile Lengh :9 m
Rise Stroke :1.10
m
Total Weight :134
Ton

3.1.3 Pile Profile
a. Pile :

Bottom Segment 600mm x 250mm x 250mm
Middle Segment 1000mm x 250mm x 250mm
Middle Segment 1000mm x 250mm x 250mm
Upper Segment 1000mm x 250mm x 250mm

b. Concrete Quality :K500

3.1.4 Land Data

In the technical justification report by CV. DAYAKARSA MADYA Consultant (see attachment E.1.). It is said that based on the drilling test and SPT test, initially, the results of the field inspection carried out with the PPK and the Executing Contractor at a depth of 30 meters (P 7 Mpa / 44,821 Kg) the bearing capacity of the soil has not been able to bear and withstand the design load, so a "test pile" was held. and was found at a depth of 36 meters (P 20 Mpa / 128.060 Kg) which is considered capable of carrying the existing design load, so in this case, there was an additional depth of 6 meters

3.1.5 Calculation of Productivity of Lifting Pile Jobs

In this project, the lifting pile process takes 480 seconds per pile until the tip of the pile is inserted into the clamping tool, the pile that is lifted is a pile with a length of 10 meters. This data was obtained from interviews with the project contractor supervisor.
Known :
Lifting duration: 8 minutes = 480 seconds
Pole Length : 10 m = 1000 cm

$$\text{Durasi Pekerjaan} = \frac{\text{Volume Aktivitas (sat. vol)}}{\text{Produktivitas kerja (sat.}\frac{\text{vol}}{\text{waktu}}\text{)}}$$

$$= \frac{1000\text{cm}}{480 \text{ detik}}$$

=2,08 cm/second
= 125 cm/minute
LT = 8 minutes

3.1.6 Welding Work Productivity Calculation.

This work is carried out by one person with the time needed for 23.5 minutes the piles used are dimensions of 25x25 cm.
Known :

Table 3.1. Welding Job Data

The number of workers	Time required	Pile Dimension
one person	23.5 minutes	25x25cm

Find welding length =
Pile circumference x number of welding layers
= (0.25m x 4) x 2 layers
= 2 + 20% safe number (assumption)
= 2 + 0.4
= 2.4m
From this calculation, the welding length is 240cm, so the welding productivity is calculated as follows.
Known:
Welding Duration : 23,5 minutes = 1410 seconds
Number of Builders :1 person
Welding Length :240 cm

$$\text{Durasi Pekerjaan} = \frac{\text{Volume Æktivitas (sat.vol)}}{\text{Produktivitas kerja (sat.}\frac{\text{vol}}{\text{waktu}}\text{)}}$$

Work productivity = $\frac{1410}{240}$ = 0,17 cm/ detik

=10.2 cm/minute

After getting the productivity of welding work, then the productivity value is entered in the formula:

WT = $\frac{WL}{menitQL} = \frac{240}{10,2} = 24$

3.1.7 Calculation of Productivity of CuttingPile Jobs

The duration required for cutting / slapping concrete piles with dimensions of 25x25 cm with a hammer and carried out by two people is 15 minutes. This data was obtained from interviews with field supervisors.

Known :

Dimension Length : 25cm x 4 = 100cm

Number of Builders : 1 person

Duration : 10 minutes

Durasi Pekerjaan : jumlah orang = $\frac{\text{Volume Aktivitas (sat. vol)}}{\text{Produktivitas kerja (sat.}\frac{vol}{waktu}\text{)}}$

Produktivitas kerja $(sat.\frac{vol}{waktu}) = \frac{100\ cm}{(10\ menit : 1\ orang)}$

Produktivitas kerja = 10 cm/min

After getting the productivity of the cutting pile work, the productivity value is entered in the formula:

CPT = 10 (minutes) = $\frac{Cpl}{(Qcp)} = \frac{100}{10}$

3.1.8 Pailing Duration Calculation

Pailing machine speed itself is 9.40 m/min

with a pile length of 6m and 10m with the condition of the pile being in the Good category 0.75

Known :

Machine Speed = 9.40 m/minPile length = 10 meters

Tool condition = 0.75 (Good)

PT = $\frac{2s}{Vo.E} = \frac{2.10}{9,40 .0,75}$ = 2.836 min

3.1.9 Calculation of Per-Cycle DrivingDuration

connection and it is cut if there is any remaining pile that does not go into the ground.

The time for moving to the point is added when the total construction time of the pile has been calculated.

Table 3.2. Per-cycle Sampling Duration Data

Pile length (m)	lifting pile (LT) (minutes)	pailing (PT) (minutes)	Welding (WT) (minutes)	cutting Pile (Cpt) (minutes)
10	8	2,836	24	10

The driving duration formula using a hydraulic static pile driver is

CTP = LT + PT + WT + CPT

= 8 + 2.836.+ 24 + 10 = 47.84 min

3.1.10 Calculation of Production Capacity of Hydraulic Static Pile Driver Tool Pile

In accordance with what is known that the general productivity formula is Work productivity = $\frac{volume}{jumlah\ jam\ kerja}$

Known :

Pile Length: 10 meters

Sampling Cycle Results: 47.84 minutes

Q = $\frac{s}{CTP}$

= $\frac{10}{10,47}$ = 0,21 m/min m/min, so the productivity value is 0.21 meter/minute

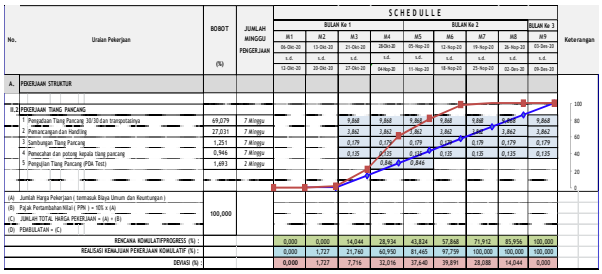
Table 3.3. Production Capacity of Hydraulic Static Pile Driver Tool Piling

no	pile type(m)	pile length (m)	driving cycle yield (CPT) (minutes)	productivity (Q) (minutes)
1	10m x 25m x 25m	10	47.84	0.21
2	6m x 25mm x 25mm	6	26.96	0.23

As we have seen, 1 driving cycle on the hydraulic static pile driver tool is when the tool lifts the pile and then

puts it on the pile, after that time is added if there is a pile.

From the recapitulation, the lowest production value is 0.21 meters per minute and the highest production value is 0.23 meters per minute. Due to considering the factors that affect work delays, the production value used is the longest production, which is 0.23 meters per minute. The production value is used to calculate the



overall driving duration for both the 6-meter and 10-meter pile profiles.

3.2 . Time difference analysis

3.2.1. Time Schedule

The work network in which each component of the activity has been given a period isthen analyzed and calculated as a whole and the project completion period is calculatedso that the master schedule and schedule for the implementation of work in the field can be known.

3.2.2. Weekly report

s curve is shown in red and the plan s curve is shown in blue. For the time difference, it can be seen that the realization is faster because the realization is completed in the 7th week while the plan is completed in the 9th week. So the difference in realization time is 2 weeks faster than the plan.

3.3 Analysis of the Budget Plan (RAB)

3.3.1. Budget plan

Calculation of the amount of costs required for materials, tools and wages, as well as other costs related to the implementation of the work or project. For work volume data obtained from the initial RAB Planning. As in the table below, Weekly report is a report that contains reports on progress or work weights (realization of work) on a weekly basis.

Table 3.4. Realization Weekly Report

Realisasi													
No.	Nama Pekerjaan	M2		M3		M4		M5		M6		M7	
		Volume	Bobot	Volume	Bobot	Volume	Bobot	Volume	Bobot	Volume	Bobot	Volume	Bobot
1	Pengadaan Tiang Pancang 30/30 dan transpotasinya	124	1,73	994	13,82	2.169	30,15	1.093	15,2	589	8,19		
2	Pemancangan dan Handling			1.143	6,22	1.521	8,28	913	4,97	1.391	7,57		
3	Sambungan Tiang Pancang					222	0,67	76	0,23	116	0,35		
4	Pemecahan dan potong kepala tiang pancang					13	0,09	17	0,12	28	0,19	80	0,55
5	Pengujian Tiang Pancang (PDA Test)											3	1,69
Total Bobot Mingguan			1,73		20,03		39,19		20,51		16,29		2,24

In the table above table 3.4. the volume and weight obtained where the weight results are entered into the time schedule which can be seen in Figure 3.1.

Figure 3.1. Time Schadule

In the time schedule picture, you can see the difference in work progress between the realization and the plan, where the realization

Table 3.5. Plan Budget Plan

Rencana					
no.	nama pekerjaan	satuan	volume	harga satuan	total harga
1	Pengadaan Tiang Pancang 30/30 dan transpotasinya	m'	4.140	345.000,00	1.428.300.000,00
2	Pemancangan dan Handling	m'	4.140	135.000,00	558.900.000,00
3	Sambungan Tiang Pancang	nos	276	75.000,00	20.700.000,00
4	Pemecahan dan potong kepala tiang pancang	nos	138	170.000,00	23.460.000,00
5	Pengujian Tiang Pancang (PDA Test)	nos	3	14.000.000,00	42.000.000,00
Total					**2.073.360.000,00**

Example of calculation to get the total plan price

Job name : Procurement of 25/25 Pile and its Transportation

Volume : 4,140 m

Unit price : Rp. 345,000

Total price per job

= Volume x Unit price

= 4,140 x 345,000.00

= 1,428,300,000.00

Total Price = total price of pile procurement + total cost of Piling and Hamdling + total pile connection + total price of breaking and cutting the pile head + testing of piles

= 1,428,300,000 + 558,900,000 +20,700,000.00 + 23,460,000.00 = 2,073,360,000.00

Table 3.6. Field Realization Budget Plan

Realisasi					
no.	nama pekerjaan	satuan	volume	harga satuan	total harga
1	Pengadaan Tiang Pancang 30/30 dan transpotasinya	m'	4.968	345.000,00	1.713.960.000,00
2	Pemancangan dan Handling	m'	4.968	135.000,00	670.680.000,00
3	Sambungan Tiang Pancang	nos	414	75.000,00	31.050.000,00
4	Pemecahan dan potong kepala tiang pancang	nos	138	170.000,00	23.460.000,00
5	Pengujian Tiang Pancang (PDA Test)	nos	3	14.000.000,00	42.000.000,00
Total					**2.481.150.000,00**

Example of Calculation of Total Realized Price
Job name : Procurement of 25/25 Pile and its Transportation
Volume : 4,968 m
Unit price : Rp.
345,000Total price per job
= Volume x Unit price
= 4,968 x 345,000.00
= 1,713,9600,000.00
Total Price = total price of pile procurement +total cost of Piling and Hamdling + total pileconnection + total price of breaking andcutting the pile head + testing of piles
1,713,960,000 + 670,680,000 + 31,050,000 +
23,460,000 + 42,000,000 = 2,481,150,000,0

3.3.2. Difference between Planned Budget Plan and Field Realization

The difference in the budget plan can be seenin the table below

Table 3.7. Difference between PlannedBudget and Actual

no.	uraia pekerjaan	Rencana				Realisasi				selisih		Keterangan
		satuan	volume	harga satuan	total harga	satuan	harga satuan	total harga	Volume	Biaya		
1	Pengadaan Tiang Pancang 30/30 dan transportasinya	m'	4,140	345,000.00	1,426,300,000.00	4,968	345,000.00	1,713,960,000.00	828,00	285,660,000.00	tambah	
2	Pemancangan dan Handling	m'	4,140	135,000.00	558,900,000.00	4,968	135,000.00	670,680,000.00	828,00	111,780,000.00	tambah	
3	Sambungan Tiang Pancang	titik	276	75,000.00	20,700,000.00	414	75,000.00	31,050,000.00	138,00	10,350,000.00	tambah	
4	Pemotokan dan potong kepala tiang pancang	titik	138	170,000.00	23,460,000.00	138	170,000.00	23,460,000.00		-	tetap	
5	Pengujian Tiang Pancang (PDA Test)	titik	3	14,000,000.00	42,000,000.00	3	14,000,000.00	42,000,000.00		-	tetap	
Total					2,073,360,000.00			2,481,150,000.00		407,790,000.00		

From the table above we can see the total difference in the cost of work is Rp. 407,790,000 due to the additional volume in the piling work as much as 828.00 m3 and in the piling and handling work at 828 m3 and the pile connection as much as 138 nos.
The addition of the pile volume is due to the piling work being planned at a depth of 30 meters, while the results of field inspections carried out with PPK and the Implementing Contractor are at a depth of 30 meters of soil bearing capacity.
has not been able to bear and withstand the design load, so a "test pile" was held and was found at a depth of 36 meters which was considered capable of carrying the existing design load.

4 CONCLUSION

Conclusion based on the results and the previous discussion, the following conclusions can be drawn:

4.1 Based on the results of the analysis, the productivity of the erection work on the physical work project and the expansion of the Marabahan state court building, the highest production value of the Hydraulic Static Pile Driver was 0.23 meters/minute or the equivalent of 14 meters/hour and the lowest value was 0.21 meters/minute. minutes or the equivalent of 12 meters/hour

4.2 The time required to complete the erection work of the physical work project and the expansion of the Marabahan court building based on the planning is 9 weeks, while based on the realization in the field to complete it is 7 weeks. Which means the implementation time in the field is 2 weeks faster than planned.

4.3 The planned implementation cost to complete the erection work of the physical work project and the expansion of the Marabahan state court building, the budgeted cost is Rp. 2,073,360,000. Meanwhile, the cost of work in accordance with the realization in the field is Rp. 2,481,150,000. Which means that the implementation costs in the field are greater than the planning costs of Rp. 407,790,000 this was due to the addition of 828.00 m3 of pile procurement volume and 828 m3 of piling and handling work and 138 nos of pile connections.

REFERENCES

Dewi Eva Puspita. (2020). Comparative Study of Work Efficiency of Diesel Hammer And Drop Hammer On Pile Foundation Work In terms of time and cost. (Lambung Mangkurat University).

Erlan – Trijet., 2011). Productivity of Piling Tools Against Time Analysis in East Flood Canal Works (case study of East Flood Canal Development (BKT)

Hakim AR – Akbar A. (2018) Analysis of the Hydraulic Static Pile Driver Productivity in the Construction of the Victoria Square Tower B Apartment, Tangerang, Banten. Journal of Theoretical and Applied Civil Engineering, 25(2),103-112.

https://doi.org/10.5614/jts.2018.25.2.3

Rochmanhadi (1992) Heavy Equipment andIts Use, Jakarta14 September 1998 :Foundation for

Joseph E. Bowles, PESE (1991) Analysis_and_Design_Foundations_volumes _2_bowles. Jakarta : Erlangga.

Rostiyanti, SF (2008). Heavy Equipment For Construction Projects. Jakarta: Rineka Cipta .

Sudjono, HS, W (1988) Bina Aksara Publishing Agency.

Sudjono, HS, W (1988) Bina Aksara Publishing Agency. (for universities and the public) volume 1, Surabaya: Sinar Wijaya.

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