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The Study on the Use of Heavy Equipment Reviewed from Productivity and Cost in the Long Segment Handling Project (Routine Maintenance, Periodic Maintenance, Improvement/Reconstruction) Handil Java - Guava (Dak)

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ABSTRACT

In large-scale projects, the use of heavy equipment has an important role in determining the success of the project. Road construction is influenced by many factors, one of which is the use of heavy equipment, which requires accurate planning.

This research is focused on the productivity and cost of heavy equipment used in the project, such as *wheel loaders, dump trucks, motor graders, vibratory rollers and water tank trucks*. Observations and direct interviews in the field are carried out for the necessary data. Data analysis was carried out using a calculation method that included the type of work, heavy equipment productivity, and heavy equipment costs based on the Analysis of Unit Price of Work in PUPR Government Regulation No. 8 of 2023.

The results of the analysis of heavy equipment productivity in aggregate foundation layer work, from field data were obtained that the productivity *of Wheel Loader* reached 115.45m3/hour, *Dump Truck* reached 1.52 m3/hour, *Motor Grader* reached 132.35 m3/hour, *Vibratory Roller* reached 69.60 m3/hour and *Water Tanker Truck* reaching 69.43 m3/hour. From the cost analysis of the upper layer of foundation work, the results of the field data show that the cost of renting equipment reaches Rp2,180,155.70/hour, the total productivity of the unit of equipment is Rp388.36 m3/hour, the unit price of work is Rp354,748.49/m3. In the analysis that has been carried out, it is found that there is a difference in heavy equipment productivity and cost based on field data compared to supply data.

Keywords: *Heavy Equipment, Productivity, Cost*

1. INTRODUCTION

The use of heavy equipment in construction projects is an important element because in every construction project heavy equipment is needed to help the running of a project with various functions, types, shapes and brands. In the construction of these construction projects, the use of heavy equipment affects the financial value and continuity of work in the project. Therefore, the selection of heavy equipment must be the main point for the success and smooth construction.

During the work of the Class A Aggregate Foundation Layer in this project, there were obstacles faced, namely, every Wednesday in the project there are morning market activities and the road that is currently being built is an access that several schools pass, besides that the path in this project is the main road used by the surrounding community so that the researcher is interested in discussing the productivity and cost of heavy equipment because the challenges in this project are so complex.

1. THEORETICAL FOUNDATIONS

Productivity is a measure of the ability of resources to be regulated and utilized to achieve optimal results. The real productivity of heavy equipment greatly affects the cost of tools per unit of work. For example, if the productivity of heavy equipment increases, the cost per m^3 or m^2 of work will decrease, thus having a positive impact on the overall project budget (Aprillia Rani Hamidah et al., 2023)

In construction projects, work is carried out efficiently if the use of heavy equipment is carried out optimally. Factors that affect include the costs incurred, and the production capacity of heavy equipment produced, so it is necessary to make observations so that the use of heavy equipment can be in accordance with the needs of the work to be carried out (Handayani, 2015)

The top foundation layer in this project uses a foundation layer with class A aggregate.(Ramdhani & Johari, 2021)

2. METHOD

The steps in processing data analysis by conducting a literature study from various literature on heavy equipment, then collecting and analyzing data on the use of heavy

equipment in the field, then analyzing the productivity of heavy equipment and the cost of renting tools used in the Class A Aggregate Foundation Layer work that has been determined is sourced from the Minister of PUPR Regulation No. 8 of 2023.

3. RESULTS AND DISCUSSION

Based on the results of the calculation analysis, a recapitulation of the productivity results of the tool is obtained as follows:

Table 1. Equipment Production Capacity Based on Field Data

It	Tool Type	Production Capacity
1	*Wheel Loader*	115.45 m³/h
2	*Dump Truck*	1,52m³/jam
3	*Motor Grader*	132.35 m³/h
4	*Vibratory Roller*	69.90 m³/h
5	*Water Tanker Truck*	69.43 m³/h

Table 2. Tool Coefficients Based on Field Data

No	Tool Type	Coefficient
1	*Wheel Loader*	0,0087 jam/m3
2	*Dump Truck*	0,6563 jam/m3
3	*Motor Grader*	0,0076 jam/m3
4	*Vibratory Roller*	0,0144 jam/m3
5	*Water Tanker Truck*	0,0144 jam/m3

Table 3. Equipment Rental Cost Based on Field Data

No	Tool Type	Equipment Rental Cost
1	*Wheel Loader*	Rp 505,670,25/hour
2	*Dump Truck*	IDR 463,209.92/hour
3	*Motor Grader*	IDR 484,143.91/hour
4	*Vibratory Roller*	IDR 311,378.41/hour
5	*Water Tanker Truck*	IDR 415,753.22/hour

Table 4. Total Unit Price of Work Based on Field Data

No	Component	Coefficient (h/m3)	Unit Price (Rp/Hour)	Total Unit Price (Rp/m3)

		Tool		
1	*Wheel Loader*	0,0087	Rp 505.670,25	IDR 4,379.80
2	*Dump Truck*	0,6563	Rp 463.209,92	Rp 303.998,81
3	*Motor Grader*	0,0076	Rp 484.143,91	IDR 3,657.98
4	*Vibratory Roller*	0,0144	Rp 311.378,41	IDR 4,473.83

Based on the results of the calculation analysis, a comparison of calculations from supply data and field data was obtained.

Table 4. 14 Production Capacity Comparison

No	Tool Type	Production Capacity		Information
		Offer Data	Field Data	
1	*Wheel Loader*	99.15 m²/jam	115.45 m³/h	Offers<Field
2	*Dump Truck*	1.57 m²/jam	1,52 m³/jam	Offers>Field
3	*Motor Grader*	183.09 m²/hour	132,35m³/jam	Offers>Field
4	*Vibratory Roller*	51.35 m²/jam	69.90 m³/h	Offers<Field
5	*Water Tanker Truck*	0 m³/jam	69.43 m³/h	Offers<Field

Table 4. 16 Tool Coefficient Comparison

No	Tool Type	Tool Coefficient	
		Offer Data	Field Data
1	*Wheel Loader*	0,0101 jam/m3	0,0087 jam/m3
2	*Dump Truck*	0,6382 jam//m3	0,6563 jam/m3
3	*Motor Grader*	0,0055 jam/m3	0,0076 jam/m3
4	*Vibratory Roller*	0,0195 jam/m3	0,0144 jam/m3
5	*Water Tanker Truck*	0 jam/m3	0,0144 jam/m3

Table 4. 17 Comparison of Equipment Rental Costs

No	Tool Type	Equipment Rental Cost		Information
		Offer Data	Field Data	

1	*Wheel Loader*	IDR 551,142.53/hour	Rp 505,670,25/hour	Offers>Field
2	*Dump Truck*	IDR 838,511.88/hour	IDR 463,209.92/hour	Offers>Field
3	*Motor Grader*	IDR 564,587.57/hour	IDR 484,143.91/hour	Offers>Field
4	*Vibratory Roller*	IDR 360,472.25/hour	IDR 311,378.41/hour	Offers>Field
5	*Water Tanker Truck*	Rp 0/hour	IDR 415,753.22/hour	Offers<Field

Table 4. 18 Comparison of Total Unit Price of Work

Total Unit Price of Work		Information
Offer Data	Field Data	
IDR 605,843.87/m3	IDR 354,748.49/m3	Offers>Field

4. CONCLUSION

Based on the research and analysis that has been carried out, the following conclusions can be drawn:

1. The involvement of manpower and heavy equipment is indispensable in construction projects. The types of heavy equipment used in the Upper Foundation Layer work are, Wheel Loader for material loading, Dump Truck for material transportation, Motor Grader for stretching materials, Vibratory Roller for compacting aggregates, and Water Tanker Truck to reduce dust generated during the compaction process while helping to accelerate material hardening.
2. Based on the results of the analysis of heavy equipment productivity in the upper layer of foundation work, from the field data it was obtained that the productivity *of*

Wheel Loader reached 115.45 m3/hour, *Dump Truck* reached 1.52 m3/hour, *Motor Grader* reached 132.35 m3/hour, *Vibratory Roller* reached 69.60 m3/hour and *Water Tanker Truck* reached 69.43 m3/hour. From the results of the cost analysis in the field, the results were obtained on the cost *of Wheel Loader* of Rp 505,670.25/hour, *Dump Truck* of Rp 463,209.92/hour, *Motor Grader* of Rp 484,143.91/hour, *Vibratory Roller* of Rp 311,378.41/hour, and *Water Tanker Truck* of Rp 415,753/hour.

3. In the calculation of the unit price of work in the offer of class A aggregate foundation layer work, it is also larger than the field data with a difference of IDR 251,095.37/m3 This difference is caused by several factors, such as different tool specifications, the use of different formulas (Permen PUPR No.8 of 2023), tool cycle time, tool efficiency, field conditions, and tool conditions.

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