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Standard Time Measurement Of Erection & Dismantling Of Tubular Scaffold Vs Modular Scaffold To Design Work Method

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Abstract: The large demand for the use of scaffolding is a problem for contractors, especially for profitability and work productivity. If the selection of the type of scaffolding is not in accordance with expectations both in terms of working time and wage costs for scaffolding workers, as well as safety factors which are also important in the selection of the type of scaffolding will cause cost overruns. One of the efforts made is to replace conventional methods to be more scientific, namely measuring the standard time in the installation and dismantling of scaffolding, so that the standard work time is obtained as a reference for the work method used. Measurements were made of two types of installation and dismantling, namely tubular scaffolding and modular scaffolding. Setting standard time using performance rating and allowances that were adjusted to workplace conditions.Based on the measurements, it was found that the standard time for installation and dismantling of tubular type scaffolding they were 2 hours 7 minutes and 39 minutes respectively, while for modular scaffolding they were 25 minutes and 8 minutes respectively.

Keyword: Scaffold, Standard Time, Work Method, Measurement, Performance Rating, Allowances.

INTRODUCTION

One of the important components in the work of a project, especially in the construction sector and other sectors is scaffolding, because this work tool is very multi-functional and safer and more effective than other work tools for working at heights and also as a support (false work). (Martono, 2019).

By looking at the large volume of scaffold use, this becomes a separate problem for the company/contractor, especially for work efficiency and productivity if the selection of the type of scaffolding is not in accordance with expectations, both from the time of work, the number of scaffolding workers (scaffolders), and the strength of the scaffold (live load) as well as safety factors which are also very important in choosing the type of scaffolding. Often a

material provider vendor or a subcontractor of scaffolding material rental services fail/uncompete in project tenders due to high price offers and long processing times. One of the efforts made is to replace conventional methods with more modern ones for time efficiency and of course low costs (Setiawan, 2020).

PT. Smartech Elevasi Indonesia is a material supplier and scaffolding material rental in the construction and industrial/manufacturing sectors. The company, which was founded in January 2019 in Bogor, is the official distributor of the scaffolding material importer PT. Hallysafe Indonesia and also has material workshops for scaffolding equipment rental. PT. Smartech Elevasi Indonesia also sometimes loses/failures almost 50% of the total bids and in the tender competition for a project or an annual work contract for the rental of scaffolding materials which, according to the author's analysis, is due to the high cost offered due to the implementation time and the inefficient number of workers (Setiawan, 2020).

LITERATURE REVIEW

Stopwatch Time Study

Stopwatch Time Study is the measurement of time is the work of observing and recording the good working time of each element or cycle by using time measuring devices such as stop clocks, observation sheets, pencils or pens, observation boards (Sutalaksana, 2006). The step to determine are :

1. Calculating the Standard Deviation of the Sub-group Mean Price Distribution)
2. Determine Upper Control Limit (UCL) and Lower Control Limit (LCL)
3. Determine Data adequacy

Determining Standard Time

If the test measurements have been carried out, i.e. all the data obtained have the desired uniformity, and the amount has met the desired levels of accuracy and trusted, the data uniformity and the adequacy of the amount of measurement data, as per the time measurement procedure, and are in accordance with the procedure. (Rizani, 2020)

1. Calculation of cycle time (Ws) through the stages with the equations below;

$$W_s = \frac{\Sigma \chi_i}{N}$$

(Xi and N show the same meaning as what has been discussed)

2. Calculating Normal Time (Wn)
   The formula was :

$$W_n = W_s \times p$$

   Where p is the performance rating factor. This factor is taken into account if the meter believes that the operator is working at an unnatural speed so that the time calculation results need to be adjusted or normalized first. The goal is to get a reasonable average cycle time. If the worker works reasonably, the adjustment factor = 1. If the worker works too slowly, then to normalize the measurement must give a price of $p < 1$. And vice versa if it is considered to work too fast, then $p > 1$
3. Calculating Standard Time (Wb)

   Wb = Wn (1 + i)

   Where i is the allowance or allowance given to workers to complete their work in addition to normal time. This allowance is given for three things, namely, personal needs, relieving

fatigue and possible disturbances that cannot be avoided by workers, generally allowances are expressed in percent of normal time (Wn).

Scaffolding

According to the Indonesian Minister of Manpower, Scaffolding is a "Plateform Building that is temporarily built to support labor, materials and tools in any construction work including maintenance and demolition" [4]

(Palmer 2004:105), Scaffolding is:

"Scaffold means any temporary elevated platform (supported or suspended) and its supporting structure (including points of anhorage), used for supporting employees or materials or both" [5]

Types of Scaffolding

Many types of scaffolding depicted on picture 1.

1. Tube & Coupler Scaffolding

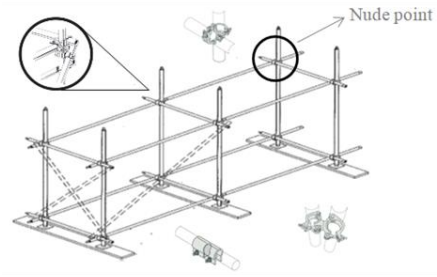
   Scaffolds where the structure is made of metal tubes that are assembled in such a way with clamps as fasteners.

2. Frame Scaffolding

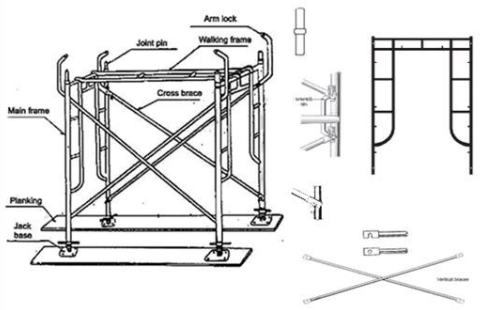
   Frame Scaffolding is a scaffolding in which some of the material components have been designed/formed by welding techniques and the component sizes and assembly methods have been determined.

3. Pre-Fabrication Scaffolding (Ring-Lock)

   Pre-fabrication Scaffolding (Ring-Lock) is a type of scaffold developed from Tube & Coupler Scaffolding, it's just that for the fastener / clamp it is replaced with the Colar System



Tube & Coupler Scaffolding



Frame Scaffolding

Pre-Fabrication Scaffolding (Ring-Lock)

Picture 1 Type of Scaffolding

METHODS

This type of research was quantitative and qualitative descriptive research, because this research prioritizes analytical data that can be measured mathematically, statistically, and computationally. Likewise, it was called qualitative research, because this research also analyzes subjective data as supporting data to support the results of this study.

Measurements for each type of scaffold were carried out 10 (ten) times of observation and measurement, either installation or dismantling. Measurements are carried out on Mei 28^{th} – 30^{th} , 2021 & June 12^{th} – 18^{th} , 2021

Objective of this research is to measure and compare time standard of working method in erection and dismantling Tube & Coupler and Pre-fabrication scaffolding structure, Independent Scaffolding model, Medium Duty (2x4x4 square meter), out door and daylight.

RESULT AND DISCUSSION

Result

Tables 1, 2, and 3 show the calculation process starting from measuring the skilful time, finding the performance rating and determining the allowance based on the reference table. While the summary results of the calculation of standard time can be seen in table 4.

Table 1. Cycle Time for Tube & Coupler Scaffold

Measurement of	Erection time	Dismantling time	Total
I	4293,25 sec	1231,76 sec	5525,01 sec
II	4313,62 sec	1452,44 sec	5766,06 sec
III	4310,81 sec	1361,73 sec	5766,06 sec
IV	4348,84 sec	1282,07 sec	5672,54 sec
V	4378,9 sec	1412,62 sec	5791,52 sec
VI	4404,12 sec	1469,62 sec	5873,74 sec
VII	4458,37 sec	1384,21 sec	5842,58 sec
VIII	4404,74 sec	1418,75 sec	5822,58 sec
IX	4411,03 sec	1268,23 sec	5679,26 sec
X	4533,20 sec	1282,63 sec	5815,83 sec
Amount	43856,8 sec	12094,4 sec	57572,1 sec
Average	4385,68 sec	1209,44 sec	5757,21 sec

Table 2. Performance Ratting for Tube & Coupler Scaffolder

No	Factor	Scaffolder 1		Scaffolder 2		Scaffolder 3	
1	Skill	C2	+0,03	C2	+0,03	D	0,00
2	Effort	B2	+0,08	C1	+0,05	B2	+0,08
3	Work Condition	D	0,00	D	0,00	D	0,00
4	Consistency	C	+0,01	C	+0,01	C	+0,01
Tambahan		P = 1	0,12	P = 1	0,06	P = 1	0,09
P value of Scaffolder		P = 1,12		P = 1,09		P = 1,09	
Average P. Rating		(1,12 + 1,09 + 1,09) / 3 => p = 1,10					

Hence the Normal Time (Wn) of erection of Tubular scaffold: Wn = 4385, 68 x 1, 10 = 4824, 25 seconds.

Table 3. Allowance for Tube & Coupler Scaffold

Activity	Factor		Allowance
	Personal Needs		Male
Erection and dismantling of tubular	Manpower required	Sedang	15
	Work Position	Standing on two feet	2,5

scaffolding	Work Motion	Working with Hands above the head	7
	Eye Fatigue	Continuous Gaze With Changing Focus	12
	Temperature	High	20
	Atmosfer Condition	Good	0
	Environment Condition	If Influencing Factors Can Lower Quality	2
Total			58,5

Hence Standard Time (Wb) of erection of Tubular scaffold: Wb = 4824, 25 + ((58,5/100) x 4824, 25)) = 4824, 25 + (0, 58 x 4824, 25) = 4824, 25 + 2798, 07 = **7622, 32 second = 127, 03 minute = 2 hours 7 minutes**

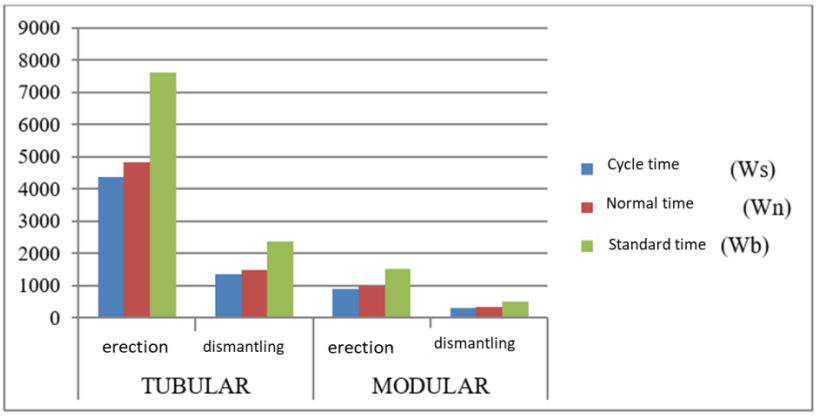
Table 4. Summary of StandardTime (Wb) for Erection and Dismantling of Tubular Scaffolding and Modular Scaffolding

SCAFFOLD	TUBULAR		MODULAR	
	Erection	Dismantling	Erection	Dismantling
Cyle time (Ws) (sec)	4385,68	1356,4	884,63	284,2
Normal Time(Wn) (sec)	4824,25	1492	990,79	318,3
Standard Time (Wb)	7622,32	2357,36	1506	483,71
	2 h 7min	39 min	25 min	8 min

Analysis

In picture 2 shown for the green color beam (standard time indicator) the tube & coupler scaffold erection indicator is very prominent compared to the other standard time indicator. this shows that the three scaffolders working at speeds above the normal time (wn) and above the average time/ cycle time (ws). According to the author's analysis, this happens because:

1. The three scaffolders are experienced and trained in the installation of tube & coupler scaffolding.
2. There are several stages of work elements (Work Instruction) the work passed by the three scaffolders, such as weighing the overall leveling of the pipe only on the base lift, working only on results, not considering quality.
3. The three scaffolders in addition to carrying out the work effectiveness of the Work Team Process Map theory, they also apply the Right Hand and Left Hand Map theory principles in several work processes.



Picture 2. Comparing Cycle Time, Normal Time and Standard Time for Two Scaffold

CONCLUSION

From the data collection process and the calculation process for determining the standard time of the two types of scaffolding, it was obtained erecting and dismantling modular scaffolds is faster than erecting and dismantling tubular scaffolds.

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