

## ANALYSIS OF STANDARD TIME DETERMINATION IN ORDER TO INCREASE U-DITCH PRODUCTION RESULTS AT PT. THE CHARM OF ARNOS BETON GRESIK

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### Abstract

This study aims to determine the standard time required in one work cycle of U-DITCH concrete production so that it can meet and increase production targets and identify things that can be improved to increase operational efficiency and productivity. This study uses a work sampling method with calculations of cycle time, normal time, and standard time. Sampling of work using random numbers and field observations was carried out for 14 days. Based on the data processing that has been done, it can be seen that it is 73%, as well as a cycle time of 8.21 minutes/ Unit and normal time with an adjustment level of 1.5933 gets a time of 13.08 minutes/ Unit. The number of productive minutes is 5,518.8 minutes with the number of outputs that have been completed for 14 days of 672 Units. The standard time with a slack factor of 46% gets a result of 683.31 hours/ Unit and a standard output of 73 Units is obtained for 1 day.

**Keywords:** Production Targets, Standard Time, U-DITCH

## INTRODUCTION

Production and operations activities are key elements in a company's operations. The sustainability of a company is greatly influenced by the effectiveness of its production and operational activities. In the context of very tight industrial competition, especially in the manufacturing sector, competition between companies is increasing. Therefore, every company needs accurate measurements related to labor and time in every aspect of their production. This measurement includes all production activities within the company. The results of this measurement are used to provide information about the performance of work plan implementation, which will later enable the company to make necessary adjustments in production planning and control. Evaluation of operational and production efficiency in a company is carried out based on the time required to complete a particular product or service. The ideal time to complete a task under normal working conditions is called the worker's standard. This standard reflects the average time required by a worker to complete a particular activity under normal working conditions. It is also important to consider the time required by employees to complete their tasks efficiently, to measure productivity and the added value generated. The more efficient employees are in carrying out their tasks, the more productive they are, and the higher the added value that can be added to the products produced.

As a company engaged in precast concrete production, PT. Pesona Arnos Beton Gresik is committed to providing high-quality products and the best service for its customers. With its experience, technology, and dedication, this company continues to play an active role in supporting sustainable infrastructure development in Indonesia. PT. Pesona Arnos Beton Gresik is a construction company founded in 2016. This company is located on JL. Raya Kedamean, Gresik Regency, East Java. The company's main focus is the manufacture of U-DITCH. U-Ditch is a type of precast concrete that is often used in construction projects, especially for drainage and irrigation channels. With experience and commitment to providing quality products and good service to customers, PT. PESONA ARNOS BETON aims to be a reliable partner in the construction industry in the region.



**Figure 1**  
**U-Ditch Product**

Source: PT. Pesona Arnos Beton

PT. Pesona Arnos Beton Gresik is experiencing a problem, namely that the factory's production volume of U-Ditch products is still not in line with the target set. This is because the factory does not have enough raw materials according to what is needed. Therefore, to achieve the production target and also eliminate losses incurred by the factory, a standard time is applied to find out how long the product takes to make. The following is a table of PT U-Ditch production quantities. The charm of Arnos Beton Gresik:

**Table 1**  
**Total U-DITCH Production PT. The Enchantment of Arnos Beton Gresik May 2024**

No	Date	Production Targets	Production Value
1	01/05/2024	50	45
2	02/05/2024	50	47
3	03/05/2024	50	52
4	04/05/2024	50	48
5	05/05/2024	50	44
6	06/05/2024	50	53
7	07/05/2024	50	49
8	08/05/2024	50	44
9	09/05/2024	50	45
10	10/05/2024	50	46
11	11/05/2024	50	58
12	12/05/2024	50	44
13	13/05/2024	50	55
14	14/05/2024	50	42
<b>Amount</b>		<b>700</b>	<b>672</b>

Source: PT. Pesona Arnos Beton 2024

In overcoming the lack of U-DITC production targets at PT. PT. Pesona Arnos Beton Gresik may consider using the work sampling method. This method is a random observation technique of work or activities carried out by workers in a certain period. Based on the research results of Taufiqur Rachmandari, Esa Unggul University, Department of Industrial Engineering, entitled Using the Work Sampling Method to Calculate Standard Time and Soap Chip Sack Production Capacity at PT. S.A. This research aims to determine the standard time required in one soap chip bag work cycle so that the production capacity can be determined. In this research, the work sampling method was used to calculate standard time, and objective methods were used to determine the adjustment factor. Several steps to obtain the standard time for one soap chip bag work cycle, namely: carrying out preliminary measurements, testing data uniformity, testing data adequacy, determining adjustment factors, determining allowance factors, and calculating cycle time and normal time. From the results of the research carried out, it was found that the standard time required to work on 1 pallet of bags of soap chips (25 sacks @ 25kg) was 1633.13 seconds, or the equivalent of 27.22 minutes. Meanwhile, the production capacity that can be produced depends on the number of hours in the existing shift. For shifts I and II with working hours of 7 hours, the capacity can reach 16 pallets, equivalent to 400 sacks. Meanwhile, for shift III with 6 hours of working hours, the capacity can reach 14 pallets, equivalent to 350 sacks. Using the work sampling method that has been carried out in previous research is very suitable for determining standard times to increase production at PT. The Charm of Arnos Beton Gresik. PT. Pesona Arnos Beton Gresik was able to gain better insight into the time required in the U-DITCH production process, as well as identify areas where improvements could be made to increase operational efficiency and productivity.

## **REVIEW OF LITERATURE**

### **Workload**

The workload is the difference between workers' abilities and the work demands they have to face. The differences are so large that the work cannot be completed according to the targets that have been set. Workload Analysis (WLA) is a strategy that can be used to calculate the amount of workload caused by the activities carried out. Measuring workload

aims to obtain data regarding the level of effectiveness and efficiency of a job based on the amount of work that must be completed (Anisa & Prastawa, 2019).

### Measuring Working Time

Measuring working time is an activity carried out to determine the amount of time an operator needs to carry out a reasonable job and to design the best work system. The results of work measurements can be used to carry out production planning by obtaining standard time and standard work output. Measuring working time is related to efforts to determine the standard time required to complete a job. Measuring working time is related to efforts to determine the standard time needed to complete a job. Standard time is the time needed by a worker who has an average level of ability to complete work (Rahayu, 2020).

### Work Sampling

Work sampling is a technique for conducting a large number of observations of the work activities of machines, processes, or workers/operators. Work measurement using the work sampling method is classified as a direct performance measurement, as is measurement using the downtime method, because the measurement must be carried out directly at the workplace to be studied. The difference between the work sampling method and stopping hours is that the observer does not have to be constantly at the work site but instead observes at randomly determined times. This work sampling method was developed based on the law of probability, therefore, observations of an object do not need to be carried out thoroughly but rather by using samples taken randomly (Ramadhani, 2020). In the work sampling method, allowance is something that must be determined first in order to standardize the work method used. By knowing idle times, the main aim of this activity is to try to reduce activities that are classified as "Non-productive" activities to the smallest percentage. This can be done by improving work methods, proper allocation of machine or human loads, and so on.

$$N' = \frac{K^2.P.(1-p)}{(S.P)^2} \dots\dots\dots(1)$$

### Standard Time

Standard time is the time needed to carry out or complete an activity or work by a reasonable workforce in normal situations and conditions. When calculating standard time, allowances are used. This benchmark time is the average time workers can complete their work (Panjaitan et al., 2021). This includes down time given by considering the situation and conditions of the work being carried out (Munte et al., 2023). Standard time or standard time

is required, especially for planning specific labor requirements (labor scheduling), estimating the cost of paying employees, planning production and budgeting, planning systems, giving bonuses to excellent employees, and indications of how much output the operator can produce (Montororing, 2018). Determination of standard time is obtained as follows:

$$Standard\ Time = \frac{TT \times WT \times RF}{\sum Yi} \times \frac{100\%}{100\% - All} \dots\dots\dots(2)$$

**Cycle Time**

Cycle time is the time required to make one unit of product at a work station. The formula for calculating average cycle time is as follows:

$$Ws = \frac{\sum Xi}{N} \dots\dots\dots(3)$$

**Performance Rating**

Performance rating is a technique to equate the observation time of an operator in completing a job with the time required by a normal operator to complete the job. Determining the performance rating uses the Westinghouse method. The four factors that influence the rating value are skill, effort, working conditions, and consistency (Suradi, 2022).

**Normal Time**

Normal time is the time required by an operator with average skills to carry out activities under normal conditions and speed. The normal time calculation is influenced by the performance rating. Normal time is an indication that explains that an operator is well qualified and the work completion time is in accordance with the standard time for the work operation element, however, in carrying out work, an operator cannot work continuously throughout the day without any interruption at all. Special time needs and requirements such as personal needs breaks to unwind, and other reasons beyond their control can cause an operator to stop working hours. Production process disruptions can be grouped into personal allowance, fatigue allowance, and delay allowance based on an operator's free time requirements. Based on this explanation, standard time is normal working time with loose time. The formula for calculating normal time is as follows:

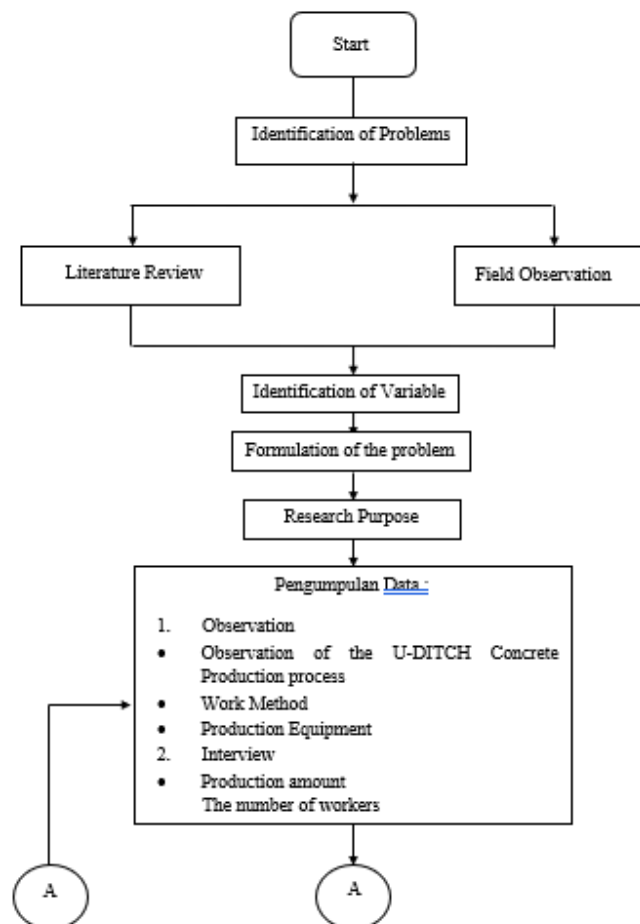
$$Wn = \frac{(\%working) \times (\text{total observation time}) \times (\text{mean PR})}{\text{total output during observation}} \dots\dots\dots(4)$$

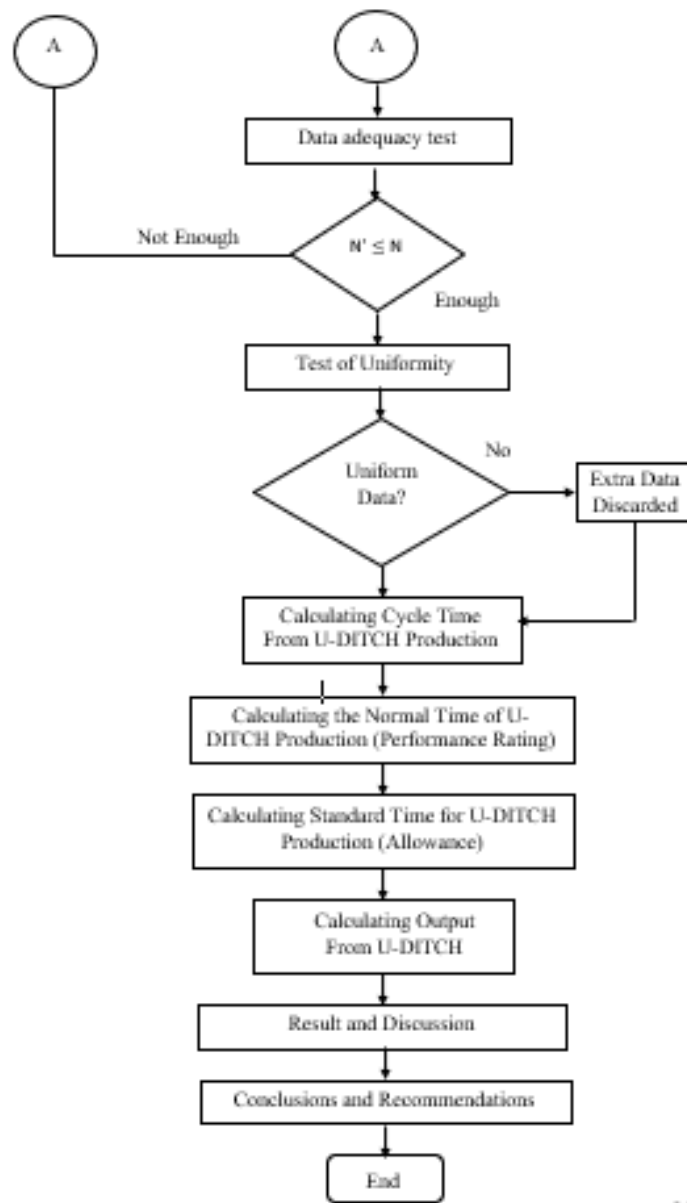
## Allowance

Allowances in this research use the Westinghouse method which can help assess worker equality, which is derived from expert assessments of four factors, namely skills, effort, consistency, and working conditions (Firda Lutfia & Syarif Hidayat, 2018).

## RESEARCH METHOD

The initial stage of this research is the collection of quantitative research data, namely production data of PT. Pesona Arnos Beton Gresik in May 2024, work method data, production equipment data, and number of workers. After the data is collected, the next stage is the data adequacy test and data uniformity test. Furthermore, calculating the U-DITCH production cycle time, calculating the normal U-DITCH production time, and calculating the U-DITCH production output. To facilitate and understand the flow of this research, a flow diagram is presented in the picture below:





**RESULTS AND DISCUSSION**

**Table 2**  
**Recap of Work Sampling Data Observations May 2024**

Day	Frequency Observed in May				
	Productive	Non-Productive	Amount	Production Targets Amount	U-DITCH Production Output
1	38	12	50	50	45
2	37	13	50	50	47
3	37	13	50	50	52
4	33	17	50	50	48

5	35	15	50	50	44
6	40	10	50	50	53
7	36	14	50	50	49
8	36	14	50	50	44
9	37	13	50	50	45
10	38	12	50	50	46
11	38	12	50	50	58
12	36	14	50	50	44
13	37	13	50	50	55
14	36	14	50	50	42
Amount			700	700	672

Source: Primary Data

From Table 2 recap of the May 2024 work sampling observation data, it can be seen that many outputs do not meet the target. So that we get the results of a recap of direct observation data regarding the results of the employee's work process when carrying out production for 14 days.

**Table 3**  
**PT Employee Work Stations. The Charm of Arnos Concrete**

Work Station	Name	Job	Detail
1. Collection of raw materials	Eko	Take sand, cement, and small stones	Take all the raw materials required for U-DITCH production and ensure the quality.
2. Mixer	Darmono	Mixing Materials and Cleaning Machine Tools	Mixing ingredients according to specified proportions and cleaning tools and machines after use.
3. Has 1	Agus	Transferring Dough to Printing Machine	Transfer the mixed dough to the molding machine and ensure correct placement.
4. Has 2	Anta	Moving and Cleaning Dried U-DITCH Products	Move the dried U-DITCH product to storage and clean the product.

Source: Primary Data

To calculate the productive percentage of workers, a calculation using the equation is used. With the following calculation results.

$$\text{Day 1 P1} = \frac{38}{50} = 0,76$$

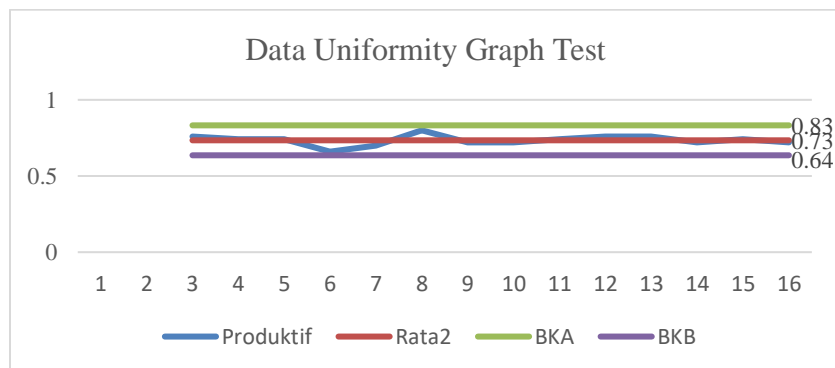
$$\text{Day 2 P2} = \frac{37}{50} = 0,74$$

$$\text{Day 3 P3} = \frac{37}{50} = 0,74$$

$$\begin{aligned}
 \text{Day 4 P4} &= \frac{33}{50} = 0,66 \\
 \text{Day 5 P5} &= \frac{35}{50} = 0,7 \\
 \text{Day 6 P6} &= \frac{40}{50} = 0,8 \\
 \text{Day 7 P7} &= \frac{36}{50} = 0,72 \\
 \text{Day 8 P8} &= \frac{36}{50} = 0,72 \\
 \text{Day 9 P9} &= \frac{37}{50} = 0,74 \\
 \text{Day 10 P10} &= \frac{38}{50} = 0,76 \\
 \text{Day 11 P11} &= \frac{38}{50} = 0,76 \\
 \text{Day 12 P12} &= \frac{36}{50} = 0,72 \\
 \text{Day 13 P13} &= \frac{37}{50} = 0,74 \\
 \text{Day 14 P14} &= \frac{36}{50} = 0,72 \\
 \bar{P} &= \frac{0,76 + 0,74 + 0,74 + 0,66 + 0,7 + 0,8 + 0,72 + 0,72 + 0,74 + 0,76 + 0,76 + 0,72 + 0,76 + 0,72}{14} = 0,73 \\
 \bar{P} &= \frac{50 \times 14}{14} = 50
 \end{aligned}$$

Work sampling used random numbers and observations were carried out for 14 days. Of the 9 working hours per day, starting from 07.00 to 16.00, 50 visits were made to observe worker productivity and activities.

$$\begin{aligned}
 BKA &= \bar{P} + 3 \sqrt{\frac{\bar{P}(1-\bar{P})}{n}} \\
 &= 0,73 + 3 \sqrt{\frac{0,73(1-0,73)}{50}} = 0,83 \\
 BKB &= \bar{P} - 3 \sqrt{\frac{\bar{P}(1-\bar{P})}{n}} \\
 &= 0,73 - 3 \sqrt{\frac{0,73(1-0,73)}{50}} = 0,64
 \end{aligned}$$



**Figure 3**  
**Data Uniformity Graph Test**

Calculation of the data uniformity test showed that the BKA was 0.83 and the BKB was 0.64, because the data from productivity for 14 days did not exceed the BKA and BKB it was not out of control, the data was declared uniform. To calculate the data adequacy test, calculations, and equations are used with the calculation results  $P = 95\%$ ,  $K = 2$  dan  $S = 0,005$ .

$$\begin{aligned} \bar{P} &= \frac{\sum P_1 + P_2 + \dots + P_{14}}{\sum P} \\ &= \frac{38+37+37+33+35+40+36+36+37+38+38+36+37+38}{(12+13+13+17+15+10+14+14+13+12+12+14+13+14)+(38+37+37+33+35+40+36+36+37+38+38+36+37+38)} \\ &= \frac{514}{700} = 0,73 \\ N' &= \frac{K^2(1-P)}{S^2P} \\ &= \frac{2^2(1-0,73)}{0,05 \times 0,73} = 600 \end{aligned}$$

From the calculation above, it can be seen that the average work productivity is 0.73. A minimum number of observations was obtained 600 times, so it is known that  $N' < N$ , namely 600, is smaller than 700, so the data used is sufficient. So, no more visits are needed because the number of visits made is sufficient.

- Total number of observations for 14 days

$$N = n_1 + n_2 + n_3 + \dots + n_{14}$$

$$N = 50 + 50 + 50 + 50 + 50 + 50 + 50 + 50 + 50 + 50 + 50 + 50 + 50 + 50 = 700$$

Where = n is the total observations in 1 day

- Number of productive activities

$$= \bar{P} \times N$$

$$= 0,73 \times 700 = 511$$

Where =  $\bar{P}$  is the average productive percentage in 14 days

Where = N is the total observation for 14 days

- Number of minutes of observation

$$= \sum \text{Day} \times \sum \text{Time Work} \times 60$$

$$= 14 \times 9 \times 60 = 7.560 \text{ minutes} / 126 \text{ in hours}$$

- Number of productive minutes

$$= \bar{P} \times \text{Number of product}$$

$$= 0,73 \times 7.560 \text{ minutes}$$

$$= 5.518,8 = 91,9 \text{ hours}$$

Where =  $\bar{P}$  is the average productive percentage in 14 days

- The amount of output produced during the 14 days of observation

Day 1 = 45 U-DITCH

Day 2 = 47 U-DITCH

Day 3 = 52 U-DITCH

Day 4 = 48 U-DITCH  
Day 5 = 44 U-DITCH  
Day 6 = 53 U-DITCH  
Day 7 = 49 U-DITCH  
Day 8 = 44 U-DITCH  
Day 9 = 45 U-DITCH  
Day 10 = 46 U-DITCH  
Day 11 = 58 U-DITCH  
Day 12 = 44 U-DITCH  
Day 13 = 55 U-DITCH  
Day 14 = 42 U-DITCH +

Total =  $\frac{672 \text{ U-DITCH}}{14 \text{ hari}} = 48 \text{ U-DITCH}$

From the calculation above, a conclusion can be drawn, namely that the total observations for 14 days were 700 times, the number of productive activities of workers for 14 days was 511, and the number of minutes of observation carried out was 7,560 minutes. The number of productive minutes was 5,518.8 minutes or 91.9 hours. The number of U-DITCHs completed over 14 days was 672 U-DITCHs, an average of 48 U-DITCHs were obtained during the observations.

To determine the total cycle time, a calculation using the equation is used with the following results:

$$\begin{aligned} WS &= \frac{\text{Number of productive minutes}}{\text{Number of U-DITCH}} \\ &= \frac{5.518,8}{672} = 8,21 \text{ minutes/U-DITCH} \end{aligned}$$

From the calculation above, it can be seen that the packing cycle from 1 U-DITCH to the next U-DITCH without any allowance obstacles takes 8.21 minutes/U-DITCH.

<b>Keterampilan</b>	<b>Usaha</b>
+ 0,15 AI Super Terampil	+ 0,10 AI Berlebihan
+ 0,13 A2	+ 0,12 A2
+ 0,11 BI Unggul	+ 0,10 BI Unggul
+ 0,08 B2	+ 0,08 B2
+ 0,06 CI Baik	+ 0,05 CI Baik
+ 0,03 C2	+ 0,03 C2
0,00 D Rata-rata	0,00 D Rata-rata
- 0,05 EI Kurang	- 0,04 EI Kurang
- 0,10 E2	- 0,08 E2
- 0,16 FI Buruk	- 0,12 FI Jelek
- 0,22 F2	- 0,22 F2
<b>Kondisi</b>	<b>Konsistensi</b>
+ 0,06 A Ideal	+ 0,04 A Sempurna
+ 0,04 B Unggul	+ 0,03 B Unggul
+ 0,02 C Baik	+ 0,01 C Baik
0,00 D Rata-rata	0,00 D Rata-rata
- 0,03 E Kurang	- 0,02 E Kurang
- 0,07 F Jelek	- 0,04 F Jelek

**Figure 4**  
**Rating Factor Table**

With adjustment factor P1 which refers to Figure 3 Table of adjustment factors P2 which refers to Figure 4 Objective Adjustment Table with results and adjustments as follows:

Keadaan	Lambang	Penyesuaian	
<u>Anggota Badan Terpakai</u>			
- Jari	A	0	
- Pergelangan tangan & jari	B	1	
- Lengan bawah, pergelangan tangan dan jari	C	2	
- Lengan atas, lengan bawah dan seterusnya	D	5	
- Badan	E	8	
- Mengangkat beban dari lantai dengan kaki	E2	10	
<u>Pedal Kaki</u>			
- Tanpa pedal atau satu pedal dengan sumbu dibawah kaki	F	0	
- Satu atau dua pedal dengan sumbu tidak dibawah kaki	G	5	
<u>Penggunaan Tangan</u>			
- Keadaan tangan saling bantu atau bergantian	H	0	
- Kedua tangan mengerjakan gerakan yang sama	H2	18	
<u>Koordinasi Mata dengan Tangan</u>			
- Sangat sedikit	I	0	
- Cukup dekat	J	2	
- Konstan dan dekat	K	4	
- Sangat dekat	L	7	
- Lebih kecil dari 0.04 cm	M	10	
<u>Peralatan</u>			
- Dapat ditangani dengan mudah	N	0	
- Dengan sedikit kontrol	O	1	
- Perlu kontrol dan penekan	P	2	
- Perlu penanganan dan hati-hati	Q	3	
- Mudah pecah dan patah	R	5	
<u>Berat Beban (Kg)</u>			
- 0.45	B-1	<u>Tangan</u> 2	<u>Kaki</u> 1
- 0.90	B-2	5	1
- 1.35	B-3	6	1
- 1.80	B-4	10	1
- 2.25	B-5	13	1
- 2.70	B-6	15	3
- 3.15	B-7	17	4
- 3.60	B-8	19	5
- 4.05	B-9	20	6
- 4.50	B-10	22	7
- 4.95	B-11	24	8
- 5.40	B-12	25	9
- 5.85	B-13	27	10
- 6.30	B-14	28	10

**Figure 5**  
**Objective Adjustment Table**

$$W_n = W_s \times R_r$$

$$\text{Adjustment Table} = R_1 = P_1 \times P_2$$

- Adjustment P1

Skills = Excelent (A2) = +0,13

Work = Good (C2) = +0,02

Working Conditions = Fair (E) = -0,03

Consistency = Good (C) = +0,01

Total = +0,13

$$P1 = 1+0,13$$

$$= 1,13$$

• Adjustment P2

Part of the body used	= D	= 1
Foot pedal	= F	= 0
Use of hands	= H	= 18
Hand-eye coordination	= J	= 2
Equipment	= O	= 3
Burden	= B-7	= <u>17</u>
Total	= 41	= 0,41

$$P2 = 1 + 0,41$$

$$= 1,41$$

Hence The Adjustment Factor

$$R1 = P1 \times P2$$

$$= 1,13 \times 1,41$$

$$= 1,5933$$

Hence The Normal Time

$$Wn = Ws \times Rr$$

$$= 8,21 \times 1,5933$$

$$= 13,08 \text{ minutes/U-DITCH}$$

From the calculation above, it can be seen that the normal time calculation with a total adjustment factor Rr of 1.5933, gets a total normal time value of 13.08 minutes/U-DITCH.

To calculate standard time, calculations using the equation are used. The allowance factor refers to the results of the allowance factor calculation and standard time calculation as follows:

Energy Expended	= 20%
Work Attitude	= 5%
Work Movement	= 6%
Eye Fatigue	= 4%
Temperature Conditions	= 5%
Atmospheric Conditions	= 3%
Environmental Conditions	= <u>3%</u>
Amount	= 46%

$$Standard\ Time = \frac{TTXWTXRF}{\Sigma Yi} \times \frac{100\%}{100\% - Allowance}$$

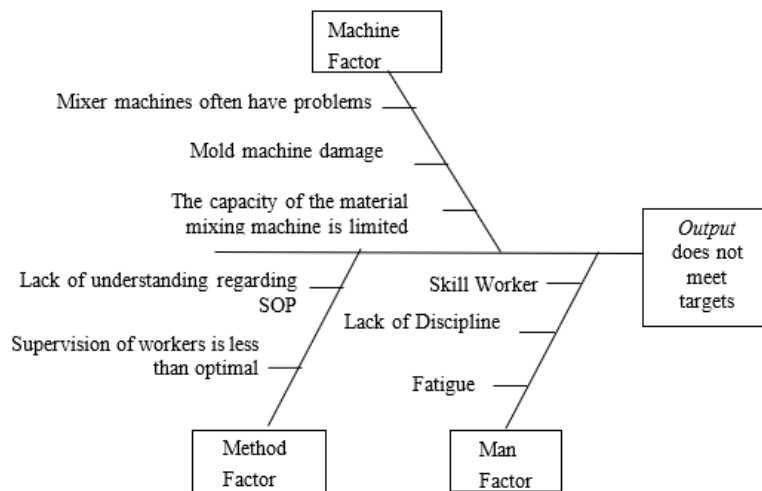
$$= \frac{126 \times 91,9 \times 1,5933}{50} \times \frac{100\%}{100\% - Allowance}$$

$$= \frac{18553.9142}{27}$$

$$= 683,31 \text{ jam/U-DITCH}$$

$$\text{Output Standar} = \frac{1}{WS} = \frac{1}{683,31} = 0,073 \text{ U-DITCH/hours}$$

From the calculation of the standard time to complete a task with a total volume of 50 units, based on the data provided, it is around 683.31 hours/U-DITCH. This calculation combines total time, working time, rating factor, total operator volume, and allowance to provide an estimate of the time required for each task unit completed by the operator. After that, a standard output of 0.073 U-DITCHt/hour was obtained.



**Figure 6**  
**Fishbone Diagram**

From the Fishbone diagram analysis, it can be seen that the machine factor is one of the main obstacles to optimal U-DITCH production output. Problems such as mixer machine damage, mold machine damage, and limited material mixing machine capacity can cause delays and decrease production efficiency. Apart from that, human factors also play an important role, such as lack of work skills, low discipline, and fatigue.

Method factors also have an influence, especially in terms of lack of understanding of standard operating procedures (SOP) and lack of supervision. To overcome this, companies need to establish a routine maintenance schedule, provide training to technicians and employees, ensure the availability of spare parts, and improve understanding and supervision of SOPs. With these steps, the company can increase production efficiency and ensure maximum U-DITCH production results.

## CONCLUSION

From research conducted during 14 days of observation at PT Pesona Arnos Beton Gresik, it was concluded that the U-DITCH productivity level was 73%, as well as a cycle time of 8.21 minutes/U-DITCH and normal time with an adjustment level of 1.5933. amounting to 13.08 minutes/U-DITCH. The number of productive minutes was 5,518.8 minutes with the total output completed over 14 days amounting to 672 U-DITCH. Meanwhile, standard time with a slack factor of 46% obtained a result of 683.31 hours/U-DITCH and a standard output of 0.073 U-DITCH/hour. Many factors influence the less-than-optimal productivity output of U-DITCH, among these many factors one of which is human factors, method factors, and machine factors. At least some or even all of it must be addressed immediately so that it does not become an obstacle to production output which makes U-DITCH results less than optimal.

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