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Research paper



Application of The MODAPTS Method with Innovative Solutions in The Cement Packing Process

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Abstract

The Modular Arrangement of Predetermined Time Standard (MODAPTS) is a medote for analyzing performance in performing work by monitoring the operator's movement in the workplace. MODAPTS will record the movement of each carrier in the workplace. This research will reveal a number of common features of MODAPTS and its applications in the packing process at the cement plant in particular to reduce the waste of working time that causes the production target is not achieved. This Cement Packing process becomes the chosen workplace because it requires manual work where there is continual movement of the body. The suggested improvement is in the form of determining movement activities, terminal activities, and Auxiliary Activities for each operator based on the standard time and the normal time available. Based on the results of this study obtained innovative solution that can be used as a safe, easy, and efficient working procedure resulting in increased work productivity.

Keywords: *MODAPTS, Operator's Movement, Movement Activities, Terminal Activities, Standard Time, Normal Time*

1. Introduction

Modular Arrangement of Predetermined Time Standard (MODAPTS) is a method proposed by Chris Heyde in 1966, provided a system that is easy to learn and easy apply [1]. It is used to analyze work performance by monitoring operator's movement in the workplace. MODAPTS records workplace or operator's movement in order to: simplify and facilitate work in workplace, detect and eliminate unnecessary movement, and performance analysis [2-6]. MODAPTS is a system for measuring work without using a stopwatch. This method is based on analyzing the movement of the body required to perform a task or job. This method is very accurate and rapidly analyzes a workable system that can be applied to the measurement of production activities, non-cycle work environtmens and safety management. This method is often used for automotive manufacturing industry, government organization, shipping and transportation industry, and other industries that use manual movement. MODAPTS library is a collection of databases that contribute with work elements and working hours, so in the process a product designer can use the estimated work time so that no whole assembly time changes are needed, and this method can decrease re-estimation time [7]. The MODAPTS analysis translates assembly motions into element class codes and time values through video examination [8].

This research will reveal a number of common features of MODAPTS and its applications in the packing process at the cement plant in particular to reduce the waste of working time that causes the production target is not achieved. This Cement Packing process becomes the chosen workplace because it requires manual work where there is continual movement of the body. The suggested improvement is in the form of determining movement activities, terminal activities, and Auxiliary Activities for each operator based on the standard time and the normal time available. Based on the results of this study obtained innovative solution that can be used as a safe, easy, and efficient working procedure resulting in increased work productivity. The rest of this paper is organized as follows. In Section 2 we will provide related works with MODAPTS. In Section 3 we describe the methodology used in this research and in Section 4 we provide the statistical result in this research. Results and discussion are given in Section 5 and finally, we conclude the research in Section 6.

2. Related Works

MODAPTS method is not only simple, flexible and comprehensive in comparison with the other methods, but it is fundamentally reliable according to the reliability of the MODAPTS method. It is not necessary to have an expert's point of view duration and it is the other advantages of the method according to its time saving property [9]. The MODAPTS method has been used extensively to achieve employment productivity objectives within the human resource field [10]. In [10] used MODAPTS method with Principal Component Analysis (PCA) method for movement analysis. MODAPTS is defined as a procedure for improving productivity and establishing time standars as a result of the description and classification of the movement given to carry out a series of operations and provide predetermined amount of time predefined for each movement [11]. Industrial and commercial companies have accepted MODAPTS as a valid and useful method as a predeter-

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mined time system standard [8]. In the MODAPTS method, human movement is classified into 21 types, and is assigned a standard time number as a constant value for each existing movement [12].

3. Methodology

3.1. MODAPTS

Standard time calculation by MODAPTS method is done by summing the MODAPTS value and converting to standard time. One MOD value is equivalent to 0.129 seconds. The MODAPTS code can be seen in figure 1 whereas the MODAPTS code table can be seen in table 1.

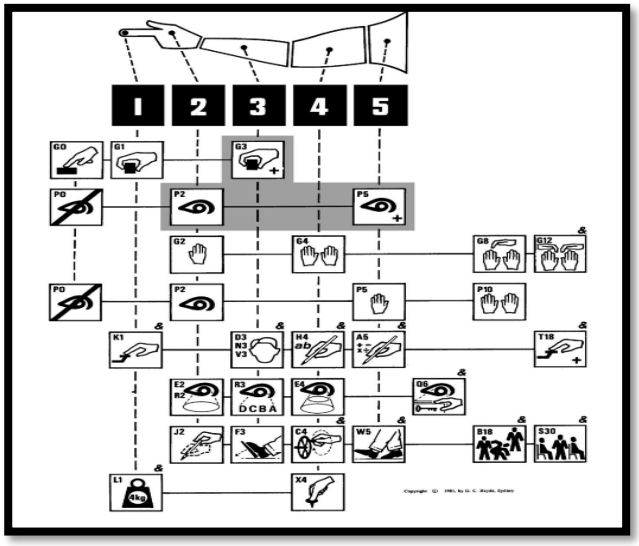


Fig. 1: The MODAPTS Code

Table 1: The MODAPTS Code

Classification	No	Activity	Symbol	MOD	Explanation	Remark
Movement Activities	1	Finger	M1	1	Movement from the knuckle	2,5 cm
	2	Hand	M2	2	Movement from the wrist hand or palm must move	5 cm
	3	Forearm	M3	3	Movement from the elbow. Wrist must move	15 cm
	4	Whole arm	M4	4	Movement from the shoulder. Elbow must move	30 cm
	5	Extended arm	M5	5	Movement from the shoulder fully to the left, right, or across the body. Shoulder must move.	40 cm
Terminal Activities	6	Grasp	G0	0	Acquire contact	
	7	Grasp	G1	1	Acquire Simple Grasp	
	8	Grasp	G2	2	Grasping around axis	
	9	Grasp	G3	3	Evaluate feedback	Conscious
	10	Grasp	G11	11	Movement of fingertips	Conscious
	11	Put	P0	0	Simply Place	
	12	Put	P2	2	Put with Feedback	Conscious
	13	Put	P3	3	Sensual feedback is required	Conscious
	14	Put	P5	5	Put with Feedback	Conscious
	15	Weight	L1	1	Load factor (added to put activities when the object being handles is heavy)	
	16	Sight	E2	2	Eye Fixation, eye travel	Independent
	17	Judgement	D3	3	Momentary Decision	Independent
	18	Press	A2	2	Pressure movement lower than 2 kg	Independent
	19	Press	A4	4	Pressure movement higher than 2 kg	Independent
Auxiliary Activities	20	Walk	W5	5	Walk one step or rotate	
	21	Regrasp	R2	2	Regrasp small thing	Independent
	22	Regrasp	R4	4	Regrasp large thing	Independent
	23	Step	F3	3	Hill on the ground and step or release	
	24	Rotate	C4	4	Moving in a circular path	
	25	Bend	B17	17	Bend and elevate waist	
	26	Bend	B8	8	Sequential B17 movements	
	27	Sit and Stand	S30	30	This includes both the up and down movements	
	28	Attention	N3	3	Attention to Dangerous Activities	

3.2. Conceptual Research Framework

The Conceptual Research Framework can be seen in Figure 2.

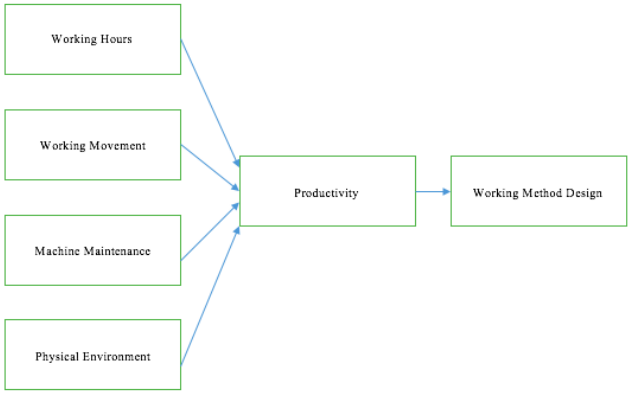


Fig. 2: Conceptual Research Framework

According to the method of research, this type of research is a descriptive study that seeks to investigate the efficiency of production by conducting a detailed study of the use of time and the behavior of workers in the production process. Major movements in work are observed, recorded, and analyzed. Generalization and interpretation of the time used and the major movements that occur, so drawn a conclusion about the movements required in the

work, unnecessary movements that can be inhibited as well as suggestions in order to improve work and increase work efficiency.

4. Statistical Result

4.1. Data Operator

The observed operators are 8 persons, have sufficient work experience and are willing to work fairly during the observation. The Data of Cement Carrier Operator can be seen in Table 2.

Table 2: Operator Data

Operator Name	Carrier Age
Packer A	
Operator 1	30 Months
Operator 2	25 Months
Operator 3	27 Months
Operator 4	29 Months
Packer B	
Operator 5	28 Months
Operator 6	35 Months
Operator 7	25 Months
Operator 8	27 Months

4.2. Standard Time for Each Operator

In this study we will observe the standard time of each operator based on their movement in doing the work. The following will present the standard time of operator 1 which can be seen in Table 3. The same will be done for Operators 2 to 8.

Table 3: Standard Time for Operator 1

No	Operator Movement	Modapts Code	Weight Factor	Mods Calculation	Mods	Time (Seconds)
1	Turn on the packer machin	M5A2	1	5x1	9	1,161
				4x1		
		E2	1	2x1	2	0,258
2	Spin	C4	1	4x1	4	0,516
3	Walking (2 steps)	W5	1	5x2 (step)x1	10	1,29
4	Picked up a bag of cement	M3G1	1	3x1	4	0,516
		E2	1	2x1	2	0,258
5	Spin	C4	1	4x1	4	0,516
6	Walking forward (2 steps)	W5G1	1	5x2 (step)x1	11	1,419
				1x1		
7	Place the bag of cement on the packer machine	M3P3	1	3x1	6	0,774
			1	3x1		
		E2	1	2x1	2	0,258
8	Standing (wating for a fully loaded cement)	S30	1	30x1	30	3,87
Total Mods					84	10,836

4.3. Allowance Time for Each Operator

Allowance Time for each operator can be seen in Table 4.

Table 4: Allowance Time for Each Operator

	Factor	Allowance Interval (%)	Allowance (%)
A	The power is very light	6,0 – 7,5	7
B	Work attitude stands on two legs	1,0 – 2,5	2,5
C	Work movement is rather limited	0 – 5,0	3
D	Eye fatigue constantly	2,0 – 5,0	5
E	High Temperature	0,0 – 5,0	5
F	The atmosphere is not good enough	5,0 – 10,0	10
G	Environmental Circumstances Repetitive work cycle	1,0 – 3,0	2
	Sub total		32
	Personal needs of men	0 – 2,5	2
	The inevitable obstacles		2,5
	Allowance Total		39

4.4. Standard Time for Each Opeator

For example we want to calculate standard time for operator 1.

Normal Time
= Total Mods x 0,129 Seconds
= (54 x 0,129 seconds) + Waiting Time
= 6,97 + 3 seconds = 9,97 seconds

Standard Time
= Wn x (Wn+l)
= 9,97 x (1+0,39)
= 13,86 seconds

Standard time for each operator can be seen in Table 5.

Table 5: Standard Time for Each Operator

Operator	Normal Time (Second)	Standard Time (Second)
Operator 1	10,84	15,06
Operator 2	10,97	15,24
Operator 3	11,09	15,42
Operator 4	11,22	15,60
Operator 5	11,09	15,42
Operator 6	10,97	15,24
Operator 7	11,09	15,42
Operator 8	10,97	15,24

Graph of Operator Time Cycle can be seen in Figure 3.

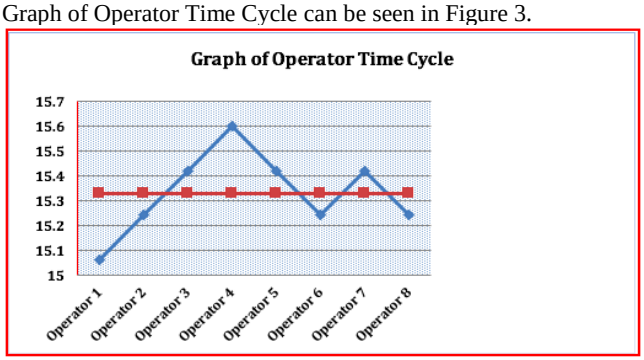


Fig. 3: Graph of Operator Time Cycle

5. Result and Discussion

Through this research can be seen which operators have achieved a good working time. The MODAPTS method is used to analyze the movement of each operator in the cement bagging process. Through this research is expected to increase work productivity through the application of standard work time is good.

6. Conclusion

Through this research can be seen that working time effect on work productivity and MODAPTS method is designed to find solutions such as reducing the application of the movement of each good operator. The resulting improvements will increase work productivity and work quality will rise and operators who leave work due to illness can be reduced.

References

[1] Heyde G C C (1966), *MODAPT Plus*. Heyde Dynamics Pty Ltd
[2] International MODAPTS Association, Inc. Kalamazoo, Ml: MODAPTS http://www.modapts.org/bylaws.htm, 25.05.2012
[3] Brnada S, Sabaric I & Kovacevic S (2010), Application of MODAPTS Method in The Warping Process. Proceedings of the 4th International Conference ERGONOMICS, 143-150
[4] Karger D W & Bayha F H (1987), *Engineering Work Measurement.* Industrial Press Inc., New York
[5] Hirano H (1996), *5 Pillars of The Visual Workplace.* Productivity Press Inc., Portland
[6] Kobayashi I (1996), *Material, Notes and Papers*. PPORF Development Institue, Japan
[7] Cho H J & Park J I (2012), Methodology of Estimating Assembly Cost by MODAPTS. International Journal of Information and Communication Engineering 6(3), 544-548
[8] Cho H J, Lee S & Park J I (2014), Time Estimation Method for Manual Assembly Using MODAPTS Technique in The Product Design Stage. International Journal of Production Research 52(12), 3595-3613
[9] Golpra H (2013), Estimation Duration of Projects Manual Tasks Using MODAPTS Plus Method. Int. J. Research in Industrial Engineering 2(1), 12-19
[10] Wu S, Wang Y, BolaBola J Z, Qin H, Ding W & Wen W (2016). Incorporating Motion Analysis Technology into Modular Arrangement of Predetermined Time Standard (MODAPTS). International Journal of Industrial Ergonomisc 53, 291-298
[11] Razmi J & Niyaee S (2008), Developing a Spesific Predetermined Time Study Approach: An Empirical Study in a Car Industry. Prod. Plan. Control Manag. Operations 19(5), 454-460
[12] Cho H J & Park J I (2014), Motion-Based Method for Estimating Time Required to Attach Self-Adhesive Insulators. Computer-Aided Des 56(11), 68-87