OPTIMIZATION OF PRODUCTION LINE BY USING MAYNARD OPERATION SEQUENCE TECHNIQUE

CHANDAN KUMAR

Professor

Department of Mechanical Engineering

Noida Institute of Engineering and Technology

Gr. Noida, U.P, India

ABSTRACT

This paper presents a methodology developed for standardization in the process activities by using Maynard's Operation Sequence Technique and minimization of unproductive activities among the workers in the production line. Optimization of productivity could be achieved by M.O.S.T technique. Thus, this research will use Maynard Operation Sequence Technique (MOST) as the time study method. All this initiated by performing study on the manual operators' activities. This case study was conducted at YACCA SPORTS MEERUT. From this study, standard time and optimum utilization of man power could be achieved. The necessary changes were suggested in the workplace. This methodology can be used for standardization of time in any manufacturing organization.

KEYWORDS: MOST, Optimization, Production line, TMU

1. INTRODUCTION

MOST is the measurement technique that can be easily implemented and practically maintained to estimate the standard time and also improve methods which maximize the resource utilization. It was originally developed by H. B. Maynard & Company Inc. and has three versions Basic MOST for the activities between 20 sec to 2 min, Mini MOST for the activities shorter than 20 sec, and Maxi MOST for the activities above 2 min. MOST focuses on three types of object movements Such as General Move, Control Move, and Tool Use which are briefly explained hereunder. Establishing New Operation Time in YACCA sports.

1.1 BASIC MOST

The Basic MOST system is the most common and practical work measurement system used in industries. Since the objects or materials follows General move sequence model of Basic MOST system is used by the researcher to measure the time required to perform activities by all the selected respondents in their respective sections.

PARAMETERS OF BASIC MOST GENERAL MOVE SEQUENCE MODEL:

The parameters are the series of letters representing various activity elements required presented in tabular form in the next sub section.

TABLE1: PARAMETERS USED IN GENERAL MOVE

Representation	A	B	G	P
Description	Action Distance	Body Motion	Gain Control	Placement

Action Distance (A): This parameter is used to analyze all the movements of operator related to hands or feet for either loading or unloading of the material.

Body Motion (B): This parameter is used to analyze the body motion of the operator like bend, arise, sit or stand while performing activity.

Gain Control (G): This parameter is used to analyze the complete control of the material before moving the material to another place.

Placement (P): This parameter analyzes the material placement, alignment, adjustment with pressure.

Phases of Basic MOST General Move sequence Model: Movement of the object through air occurs in three phases as under shown in phases of object movements for Basic MOST General Move Sequence Model.

Step	Production processes	Existing Time (sec)
1	Making outer frame	90.72
2	Gluing back frame	28.08
3	Polishing	22.68
4	Attaching outer frame with inner ply	68.76
5	Rubbing of outer frame with sand paper	33.48
6	Painting of the outer frame	38.88
7	Drilling holes at each corners	25.2
8	Putting the net at each corners	75.6
9	Coating the final finished carom board	26.28
	Total	409.68

Table 2: Phases of object Movement for Basic Most General Move Sequence Method

GET			PUT			RETURN
A	B	G	A	B	P	A

a) **First Phase– GET:** It is the action that is performed by the worker to reach to the object combination with the body motion and gain control of the object. The A parameter indicates the distance the hand or body must travel to reach the object. The B parameter indicates the body motion while performing the action and the G parameter indicates the control gained by the worker on the object.

b) **Second Phase- PUT:** This phase indicates the action to move or place the object to another location. Parameter A and B indicates the same function as mentioned in first phase (GET) to place the object at required place. The parameter P indicates the way in which the object is placed at the desired place.

c) **Third Phase- RETURN:** This phase indicates the distance travelled by the worker to return to the work place after the object is placed at the desired place.
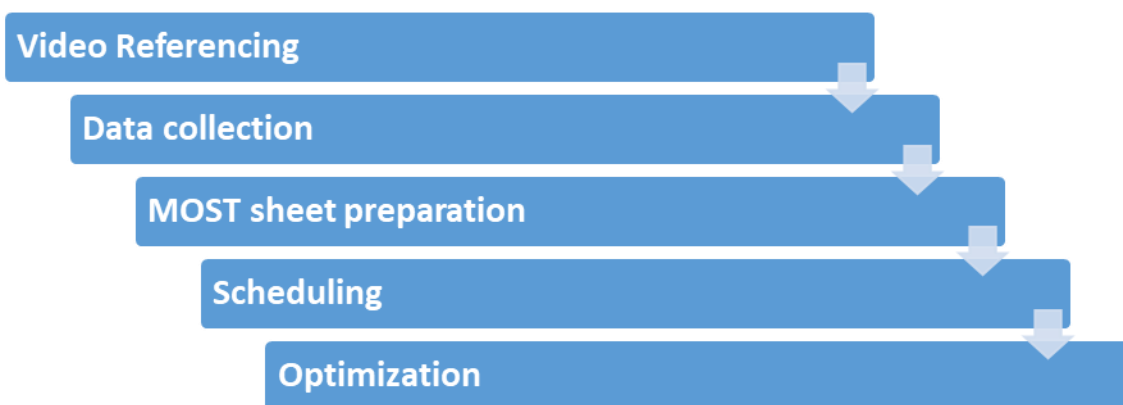
2. METHODOLOGY

FIG 1: Procedure of Basic MOST

The Steps that are involved in the above figure are as follows:
i. Company visit
ii. Video recording of the different processes in production line.
iii. Taking the video as reference for indexing process in excel sheet.
iv. Preparing the excel sheet

v.   Doing scheduling process in order to eliminate the unnecessary movements.
vi.   Optimizing the current the processes

TABLE 3: SHOWING THE INDIVIDUAL RESULT OF INDEXING PROCESS

Table 4: Existing process Summarized for MOST

OUTER FRAME MAKING	Action Distance	Body Motion	Grasp	Action Distance	Body Motion	Placement	Action Distance
Workman sitting on the ground	0	10	0	0	0	0	0
Picking 2 wooden parts and placing them on ground	1	0	1	1	0	3	0
Picking the hammer in right hand from the ground	1	0	1	1	0	0	0
Picking the nails in the left hand	1	0	1	0	0	0	0
Placing the nails at the corner	1	0	0	1	0	6	0
Hammering nails at the 1 corner of the wooden parts on upper side	1	0	0	1	0	3	0
Putting the hammer on the ground	1	0	0	1	0	1	1
Grabbing the frame	1	0	1	0	0	0	0
Now rotating the frame to 2 corner of the frame	1	0	0	1	0	1	1
Picking the hammer in right hand from the ground	1	0	1	1	0	0	0
Picking the nails in the left hand	1	0	1	0	0	0	0
Placing the nails at the corner	1	0	0	1	0	6	0
Hammering the nails at the corner	1	0	0	1	0	3	0
Putting the hammer on the ground	1	0	0	1	0	1	1
Now rotating the frame to 3 corner of the frame	1	0	1	1	0	3	0
Picking the hammer in right hand from the ground	1	0	1	1	0	0	0
Picking the nails in the left hand	1	0	1	0	0	0	0
Placing the nails at the corner	1	0	1	1	0	6	0

Hammering nails at the corner	1	0	0	1	0	3	0
Putting the hammer on the ground	1	0	0	1	0	1	1
Grabbing the frame	1	0	1	0	0	0	0
Now rotating the frame to the 4 corner of the frame	1	0	1	1	0	3	0
Picking the hammer in right hand from the ground	1	0	1	1	0	0	0
Picking the nails in the left hand	1	0	1	0	0	0	0
Placing the nails at the corner	1	0	1	1	0	6	0
Hammering the nails at the corner	1	0	0	1	0	3	0
Putting the hammer on the ground	1	0	0	1	0	1	1
Grabbing the frame	1	0	1	0	0	0	0
Turning the whole frame to bottom side	1	0	1	1	0	3	1
Picking the hammer in right hand from the ground	1	0	1	1	0	0	0
Picking the nails in the left hand	1	0	1	0	0	0	0
Placing the nails at the corner	1	0	0	1	0	6	0
Hammering nails at the 1 corner of the wooden parts on upper side	1	0	0	1	0	3	0
Putting the hammer on the ground	1	0	0	1	0	1	1
Grabbing the frame	1	0	1	0	0	0	0
Now rotating the frame to 2 corner of the frame	1	0	0	1	0	1	1
Picking the hammer in right hand	1	0	1	1	0	0	0
Picking the nails in the left hand	1	0	1	0	0	0	0
Placing the nails at the corner	1	0	0	1	0	6	0
Hammering the nails at the corner	1	0	0	1	0	3	0
Putting the hammer on the ground	1	0	0	1	0	1	1
Now rotating the frame to 3 corner of the frame	1	0	1	1	0	3	0

Picking the hammer in right hand from the ground	1	0	1	1	0	0	0
Picking nails in the left hand	1	0	1	0	0	0	0
Placing the nails at the corner	1	0	1	1	0	6	0
Hammering the nails at the corner	1	0	0	1	0	3	0
Putting the hammer on the ground	1	0	0	1	0	1	1
Grabbing the frame	1	0	1	0	0	0	0
Now rotating the frame to the 4 corner of the frame	1	0	1	1	0	3	0
Picking the hammer in right hand from the ground	1	0	1	1	0	0	0
Picking the nails in the left hand	1	0	1	0	0	0	0
Placing the nails at the corner	1	0	1	1	0	6	0
Hammering the nails at the corner	1	0	0	1	0	3	0
Putting the hammer on the ground	1	0	0	1	0	1	1
Grabbing the frame with two hands	1	0	1	0	0	0	0
Lifting the frame with two hands	1	0	0	1	0	0	0
Putting the outer frame on the other frames	1	0	0	1	0	1	0
				Total	252	**2520**	**90.72 S**

Outer Frame Making	Action Distance	Body Motion	Grasp	Action Distance	Body Motion	Placement	Action Distance
Workman sitting on the ground	0	10	0	0	0	0	0
Picking 2 wooden parts and placing them on ground	1	0	1	1	0	3	0

Picking the hammer in right hand from the ground	1	0	1	1	0	0	0
Hammering nails at the 1 corner of the wooden parts on upper side	1	0	0	1	0	3	0
Putting the hammer on the ground	1	0	0	1	0	1	1
Grabbing the frame	1	0	1	0	0	0	0
Now rotating the frame to 2 corner of the frame	1	0	0	1	0	1	1
Picking the hammer in right hand from the ground	1	0	1	1	0	0	0
Picking the nails in the left hand	1	0	1	0	0	0	0
Placing the nails at the corner	1	0	0	1	0	6	0
Hammering the nails at the corner	1	0	0	1	0	3	0
Putting the hammer on the ground	1	0	0	1	0	1	1

Now rotating the frame to 3 corner of the frame	1	0	1	1	0	3	0

Picking the hammer in right hand from the ground	1	0	1	1	0	0	0
Hammering nails at the corner	1	0	0	1	0	3	0
Putting the hammer on the ground	1	0	0	1	0	1	1
Grabbing the frame	1	0	1	0	0	0	0
Now rotating the frame to the 4 corner of the frame	1	0	1	1	0	3	0
Picking the hammer in right hand from the ground	1	0	1	1	0	0	0
Hammering the nails at the corner	1	0	0	1	0	3	0
Putting the hammer on the ground	1	0	0	1	0	1	1
Grabbing the frame	1	0	1	0	0	0	0
Turning the whole frame to bottom side	1	0	1	1	0	3	1
Picking the hammer in right hand from the ground	1	0	1	1	0	0	0
Picking the nails in the left hand	1	0	1	0	0	0	0
Placing the nails at the corner	1	0	0	1	0	6	0
Hammering nails at the 1 corner of the wooden parts on upper side	1	0	0	1	0	3	0
Putting the hammer on the ground	1	0	0	1	0	1	1
Grabbing the frame	1	0	1	0	0	0	0
Now rotating the frame to 2 corner of the frame	1	0	0	1	0	1	1
Picking the hammer in right hand from the ground	1	0	1	1	0	0	0
Picking the nails in the left hand	1	0	1	0	0	0	0
Placing the nails at the corner	1	0	0	1	0	6	0
Hammering the nails at the corner	1	0	0	1	0	3	0
Putting the hammer on the ground	1	0	0	1	0	1	1
Now rotating the frame to 3 corner of the frame	1	0	1	1	0	3	0

Picking the hammer in right hand	1	0	1	1	0	0	0
Picking nails in the left hand	1	0	1	0	0	0	0
Placing the nails at the corner	1	0	1	1	0	6	0
Hammering the nails at the corner	1	0	0	1	0	3	0
Putting the hammer on the ground	1	0	0	1	0	1	1
Grabbing the frame	1	0	1	0	0	0	0
Now rotating the frame to the 4 corner of the frame	1	0	1	1	0	3	0
Picking the hammer in right hand from the ground	1	0	1	1	0	0	0
Picking the nails in the left hand	1	0	1	0	0	0	0
Placing the nails at the corner	1	0	1	1	0	6	0
Hammering the nails at the corner	1	0	0	1	0	3	0
Putting the hammer on the ground	1	0	0	1	0	1	1
Grabbing the frame with two hands	1	0	1	0	0	0	0
Lifting the frame with two hands	1	0	0	1	0	0	0
Putting the outer frame on the other frames	1	0	0	1	0	1	0
					Total TMU	220	**2200**

Table: 5: Modified time after process application based on MOST

3. RESULT

By applying the MOST the standard time can be deployed in the most efficient way. Thus an anticipated decrease in the total time for completion of production of a single piece was 35.28 sec.

The total decrease in time by MOST study is: = (409.68-374.4)/409.68*100

The total decrease in time by MOST study is 8.61%

SO Previously In a day of 8 hours of working in the factory total 70 boards were made and now after applying the MOST 76 boards can be made. Total increase in the productivity is 8.57%.

CONCLUSION

The above study clearly shows that the man hours can be better calculated by the application of MOST study. There are different methods that determine production cycle time for manual processes. However, none of these methods satisfies all needs in determining different specific processes of an industry. YACCA, the carom manufacturing factory in Meerut, has looked for a specific predetermined time standard (PMTS)

by evaluating different alternatives. The result of an empirical study with the aim of defining a specific PMTS that covers all station shop processes in that carom company.

The proposed method on the production line improves the productivity by 8.57% by reduction in total time by 8.61%.

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