Proceedings of the
International Conference on Mechanical Engineering 2009
(ICME2009) 26- 28 December 2009, Dhaka, Bangladesh

ICME09-RT-46

TIME STUDY OF A FURNITURE INDUSTRY: A CASE STUDY AT NAVANA FURNITURE INDUSTRY

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ABSTRACT

Manufacturing industries are now facing challenges with its competitors and day by day competition is escalating. To deal with these challenges, they have to improve their production efficiency, reduce operations time and incurred cost for each operation. They need to regulate over their production process to continue their production schedule, workforce planning, estimating labor cost, budgeting and time standard for operating a job. To execute all of these efficiently time study is one of the crucial operation need to perform. This paper focuses on developing a time study for a reputed furniture industry. The objective is to establish a time standards for carrying out specified job and thus helping the company in scheduling.

Keywords: Time study, Layout design, Cycle time.

1. INTRODUCTION

Analysis of operations required to produce a manufactured article in a factory, with the aim of increase efficiency. Each operation is studied minutely and analyzed to set up a benchmark time and it will helpful for production schedule, forecasting etc.

The first effort at time study was made by F. W. Taylor in the 1880s. He published his famous article "The Principle of Scientific Management" which involved getting the best person for each job and trained them to do it in the best possible way. In the early twentieth century Frank and Lillian Gilbreth developed a more systematic and sophisticated method of time study for industry taking into account the limits of human physical and mental capacity and the importance of good physical environment[1]. One problem of time study is the Hawthorne Effect where it is found that employees change their behavior when they know that their being measured. Work Study has conducted in many sectors. One of the hallmarks of leading-edge organizations – be they public or private – has been the successful application of performance measurement to gain insight into, and make judgments about, the organization, and the effectiveness and efficiency of its programmers, processes, and people[2]. To improve productivity and efficiency this technique has been widely used. It is suggested that these techniques are applicable to libraries and librarians and will become increasingly useful as the problems of increased work loads become more severe [3]. Work study is widely used for garments sector in Bangladesh. Time and motion study is used in radiotheraphy[4]. It is also used to reduce accidental cause [5]. A case study on purchasing is also performed by R. Schmelzlee[6].

Though Time Study in furniture industry is not performed yet so the focus of the study is on furniture industry. In Bangladesh furniture industry is growing day by day. They are designing new and new product in every minute. Sometimes they don't know how much time it will take to manufacture the product, they are not sure whether they can accomplish their order within time. The endeavor of this study is to make a clear idea of how much time it will take to manufacture the product. Manufacturer will get a clear idea about the required time to manufacture. This will reduce uncertainty of the industry and planning and scheduling will be trouble-free.

2. TIME STUDY: PURPOSE AND PROCEDURE

The technique of random sampling used for analysis of the time spent for rendering each phase of various professional work or services performed by worker of service man is known as time measuring or needed time to perform a work. Organization develops time standards in a number of ways. Most common work measurements are Stopwatch time study, historical time study, predetermined data and work sampling. Among them stopwatch time study is used most frequently. The basics steps in a time study are

- Define the task to be studied and inform the worker will be studied
- Determine the number of cycles to observe

- Time the job and rate the worker performance
- Compute the standard time

Besides the above there are strategies on time study which makes it more efficient. These are:

- Develop a block of time study
- Schedule weekly review and updates
- Priotarize assignment
- Develop a alternative study places free from distractions
- Note every single "Dead Time"
- Review studies and reading just before which was done on previous day
- Schedule special time for critical operations

Time Study will help a manufacturing company to understand its production, investigate the level of individual skill, planning and production control system etc.

3. CASE STUDY:

Time study for any furniture industry is very much crucial. The laminated Board (LB) Section of a furniture industry consist of some heavy machines like Auto Panel Saw (APS), Sliding Saw Machine (SSM), Double End Tenoning Machine (DETM), Straight Edge Banding Machine (SEBM), Multiboring Machine (MB), Router Machine (RM), Profile Edge Banding Machine(PEBM) etc. Laminated Board is processed through these machines in various stages. Time Study for each machine is carried out in almost with the same process. The basics time required for each machines are:

- Material loading time
- Machine operation time
- Material unloading time

Material loading time consists of the following things:

- Grasp
- Hold
- Positioning
- Gauge set up time

Machine operation time consists of the following:

- Feed
- Machine operation (depends on cutter travel speed, travel length.)

Material unloading time consists of the following:

- Hold
- Release

3.1 Auto Panel Saw and Sliding Saw Machine:

Loading Time:

Let,

Initial set up time = S_i sec

Initial material loading time = L_i sec

Average intermediate material loading time = L_m sec

So observed time for a single board input

= $(S_i + L_I + L_M \times m)$ sec **... (1)**

Where $n =$ no. of intermediate loading

If boards are to be input for N no. of time in a whole lot, then, observe Time,

$OT(l) = N(L_I + L_M \times m) + S_i$ sec **... ... ... (2)**

Normal Time, $NT = OT \times PR$ sec **... ... ... (3)**

Allowance factor, A= sum (delay time, personal time, rest time, fatigue time)/Working hour

So Standard Loading Time, $SLT = \frac{NT}{1+A}$ **... ... ... (4)**

Unloading Time:

Let,

Average observe unloading time = $OT(u)$ sec

Normal time for unloading = $= OT \times PR$ sec

So Standard Time for material unloading,

$$SUT = \frac{NT}{1+A}$$

Total Machining Time,

$MT = N \times (7q_1 + 8q_2 + 9q_3 + 10q_4 + 13q_5)$ .. .. **(5)**

Here, q_1, q_2, q_3, q_4, and q_5 are no of operations for range 50-200, 200-900, 900-1500, 1500-1800, 1800-2440 from table-1 respectively

.$N =$ No of board input required for one lot

Total time to complete a whole lot= $SLT + SUT + MT$ **... ... ... (6)**

3.2 Double End Tenoning (DET):

If the running speeds of the belt of DET remains constant s m/min and the length passed through it is d mm, then the operation time for one side input

$= \left(d \times \frac{0.001}{s}\right) \times 60$ Sec **… … ... (7)**

Initial loading time, $LT =$ (machine set up + gauge set up + dimension measurement) time

Standard loading time, $SLT = LT \times \frac{PR}{1+A}$ ... ... **(8)**

For single side tenoning of lot size N:

Total Standard Time

$= \left(d \times \frac{0.001}{s}\right) \times 60 \times N + SLT$ ... ... **(9)**

But for double side tenoning, it is a matter of considering the difference between the two consecutive stoppers and the distance d becomes fixed depending upon the dimension to be tenoning.

First time tenoning will be same as single end tenoning

$= \left(d \times \frac{0.001}{s}\right) \times 60 \times N + SLT$ ... ... **(10)**

During Second time tenoning,

Total Standard Time

$= \left(d \times \frac{0.001}{s}\right) \times 60 \times N + SLT$ ... ... **(11)**

3.3 Straight Edge Banding Machine (SEB):

Standard time equation for Straight Edge Banding Machine is same as DET. Here one extra operation is performed and it is to cut the band in each cycle.

Let Time required for this operation $= T_a$ sec

Standard Intermediate Set Up and Loading Time

$= SIT$ sec

Then the Standard Time for a dimension of $d_1 \times d_2$

And lot size of N will be

$= \left[\left\{\left(d_1 \times \frac{0.001}{s}\right) \times 60 + T_a\right\} \times N + SLT\right] + \left[\left\{\left(d_1 \times \frac{0.001}{s}\right) \times 60 + T_a\right\} \times N + SIT\right]$ sec

..... (12)

3.4 Multiboring Machine (MB):

Standard Time depends upon number of workers performing the job.

For two workers:

Standard Time

$= LT + MSUT + MT + (k-1) \times SIT$ ... ... **(13)**

For three workers:

Standard Time

$= \frac{LT}{2} + MSUT + MT + (k-1) \times SIT$ ... ... **(14)**

Here

$k =$ How many operations are performed on a single board?

= 1 for single operation

= 2 for double operations

$LT =$ Standard Loading Time

$MSUT =$ Machine Set Up Time

$MT =$ Machining Time

$SIT =$ Standard Intermediate Set Up and Loading Time

Time Study for other machines: Router Machine (RM), Profile Edge Banding Machine (PEBM) etc is same as Straight Edge Banding Machine (SEB) that is previously described.

After completing the time study of each machine it is required to measure the necessary time for assembly, cleaning, packaging. Doing all of these the required time of completing a lot of products can easily be calculated. Using this time study required operation time for existing product has been performed. And the result shows the feasibility of this time study conducted at NAVANA FURNITURE.

4. CONCLUSION:

Time Study revealed that it has an immense influence over factory planning. The product order usually differs in terms of quantity, material requirement, due date, processing variations, processing time difference and set up time variations. So if the industry seeks to foretell that whether they can meet up customer demand within days or not then this time study will be awfully supportive to them. If the company desires to receive orders from random clients then this study will assist them to check whether they can receive those orders or not. The intension of scheduling is to use of resources in a time frame. Planning department can use this study for trial and error schedule development to get an idea of what different arrangement would involve. Thus a tentative surgery schedule may reveal in sufficient allowance for surgery that takes longer than expected and can be revised accordingly.

The job shop scheduling is somewhat difficult. This requires two basics issues: how to distribute the workload among work centers and what job processing sequence to use. The time study can be used for preparing Gantt charts, assignment method by linear programming, sequencing.

This study can be used to maintain and ensuring the desired rate of output, time management of work shifts and overtime, material handling management, reliability in case of supply delivery, proper inventory management and proper utilization of time and space, to reduce bottleneck, over processing and over production. Further studies can be carried out to enhance its reliability. Company who seek to grow their reputation and

goodwill by sound timing of orders delivery should use this time study.

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Table 1: Operation time for Auto Panel Saw for different travel length

Dimension Range (mm)	Operation Time (observation 1)	Operation Time (observation 2)	Operation Time (observation 3)	Recommended operation time to be taken (sec)
50-200	6.5	6	7	7
200-900	7	7.5	8	8
900-1500	7.5	8.5	9	9
1500-1800	9	10	8	10
1800-2440	12	11.5	13	13

Table 2: Sample calculation of required time for completing an Executive Table

Comp	No/Pdt	Required time to complete operation at each machine (sec)											
		APS (sec)	DET (sec)	DET-1 (sec)	DET-2 (sec)	Router + band (sec)	SEB (sec)	PE (sec)	MBM (sec)	Assembly (sec)	Cleaning (sec)	packaging(sec)	Total (sec)
Top	1	41.43	23.75				18.86		108		8	37.5	237.59
Top bit	2	5.595	26.50				18.58			34	16	37.5	138.46

Side	2	26.22	26.29					86.86	74.4		16	37.5	267.27
panel	1	32.24	20.79				10.85				8	37.5	109.39
Total	6	105.5	97.38	0	0	0	48.58	86.86	182.4	34	48	150	752.71