

# Reduction in product cycle time in bearing manufacturing company

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**Abstract-** The reduction of cycle time has emerged as a fundamental element of new product development. Time study method is applied to measure standard time for the process. Time study is used for main purposes in ABC bearings Limited to monitor the production line. The time study techniques is applied under certain situation and the stopwatch time study is the best technique for manual production because human performance is not consistent from time to time. The stopwatch time study had been selected for the study because 70 percents of the production in ABC bearings Limited is handled manually by man power. Overall equipment effectiveness is also calculated to measure performance in one shift. The objective is to determine optimal levels of time and defect rate reductions along with the corresponding optimal levels of investments respectively, and the optimal production cycle time for each product.

## 1. INTRODUCTION

### 1.1 Background of study

Cycle time reduction time has emerged as a fundamental element in the strategy of product development. In fact, many companies now believe that their ability to introduce new products quickly and efficiently is essential to their long-term survival and profitability. For most organisations, reduction in cycle time of product development involves a significant change in development process thinking from the standardised development processes popularised in the 1980s to the more flexible procedures used today. The transition from stage gate development processes to more flexible development agendas has not necessarily been a smooth one. Often, the results have been far below expectations. Many companies have overlooked two other important dimensions: those activities that prevent delays (friction) in the development process; and those activities that define the scope of the final outcome (direction).

### 1.2 Problem statement

ABC bearings Ltd. used time study mainly to monitor the manufacturing or production of current projects. Overall equipment effectiveness [OEE] is also calculate to measure the performance of the machine. In ABC bearings Ltd., 70 percentage of the production involved human work. Time study is the better tool for measurement of work where higher involvement of human work. In the meantime it also can be use as a tool for productivity improvement and increase efficiency. Since time study is so important for the company, it had to be done precisely with the element of allowance, rating factor and head count to produce a standard time which can be used as reference to conclude the whole performance of production.

### 1.3 Objectives of study

- To identify the suitable rating factors and allowances using the stopwatch time study that suitable for manual production at ABC bearing ltd.
- To establishes cycle time from the current project on machine hours by using time study method.
- To calculate Overall equipment effectiveness and its improvement.
- To find out time consuming activities and minimize it.

## 2. Literature Review

### 2.1 Motion Study

According to Ralpa M. Barnes (2001) Frank and Lillian M. Gilbreth are known as the parents of motion study. Gilbreth begin investigation to find the "best way" of performing a given task trough analyzing the motions used by his workmen and he easily saw how to make improvements. He also possessed for analyzing work motion situations to enhance their ability for shorter or less

fatiguing motions to improve the work environment. The research included the elimination of all useless motions and the reduction of those remaining motions. The elimination of this unwanted waste known as work simplification. According Fred (1992), Elton Mayo started their research known as the human relations movement and he discovered that people work better when their attitude is better. He undertook a research project to study what factors affected productivity in the Hawthorne plant. Their studied took place between 1924 and 1933.

## 2.2 Time Study

According to Fred E. Mayers (1992), time study was developed by Frederick W. Taylor in about 1880 which he is the first person to use a stopwatch to study and measure work content with his purpose to define "a fair day's work." He called as Father of Time Study. Among his study is 'Taylor Shoveling Experiment' which he studied between 400 and 600 men that using his own shovel from home to moving material from mountains of coal, coke and iron ore in around two mile-long yards. Taylor identify that there have different size of shovels and he wondered which shovel was the most efficient. Thus, he used a stopwatch and measured everything that workers did. He recorded the data for every work in various ways with varied of shovels size, durations to done their work, number of breaks and work hours. The results were fantastic which it reduced time, saving numbers of workers and budgeting for every year.

## 2.3 Techniques of Motion and Time Study

Motion study has the greatest potential for savings. We can by eliminating the task or combining the task with some task. We can rearrange the elements of work to reduce the work content and we can simplify the operation by moving part. Thus, among the techniques for motion study are :

- Process charts
- Flow diagrams
- Operation charts
- Flow process charts
- Multiple activity charts

Gilbreths used flow diagrams to show movement of product around an entire plant because they gave an accurate geographical picture of the entire process. They also develop methods study techniques such as cyclograph, chronocyclographs, movie cameras, etc. The techniques of time study start with the last motion technique and it shows the close relationship between motion study and time study. The techniques of time study are :

- Stopwatch time study
- Expert opinion standards
- Predetermined time standards
- Work sampling time standards

Frederick W. Taylor used a stopwatch and a clipboard to record the time and findings of his study (Foster, 2003). Motion and Time study technique can be used widely for variety of research. For example, Ann Hendrich, Marilyn Chow, Boguslaw A. Skierczynski, Zhenqiang Lu (2008) used this techniques to study spend time of nurse at hospital. L. Aharonson Daniel (1996) used time studies in A&E department. While, Jeffrey S. Smith (2003) survey that many production and manufacturing used simulation as alternative way to develop new effective system.

## 2.4 Relationship and Utilization of Motion and Time Study

Motion and time study helps management determine how much is produced by workers in a specific period of time, therefore making it easier to predict work schedules and output. Motion and Time Study is a scientific method designed by two different people for the same purpose, to increase productivity and reduce time. The two methods evaluate work and try to find ways to improve processes. Frank B. Gilbreth invented motion study designed to determine the best way to complete a job. Frederick W. Taylor designed Time Study; it measures how long it takes a worker to complete a task. Time and Motion Study has become a necessary tool for businesses to be successful today. Time and Motion Study is very important in production control. Now, Offices, Banks, Department Stores, and Hospitals use Motion and Time Study. Offices use it to measure and simplify work in order to reduce costs. Banks use it to help team members reach their sales goals (Foster, 2003).

## 3. Research methodology

### 3.1 Methodology Framework

There are several methods that will be use to achieve research objectives. After the literature review, observation and collecting data is needed. The complete field data collection will be tested before it will be used for data analysis. The problems and non productive in

the work process can be identified based on the data collection and their analysis. Then, the result from the data testing will be determined whether the result can be used or not and if there are any incomplete data, the data collection will be executed again until it fulfills the objective requirement. After all the data and analysis are complete, proposal and opinion will be issued to SME.

### 3.2 Variables

The variables in this study can be classified into two types, which are independent (time and motion technique and dependent variable (an impact in the work process for producing sauce). This research used time and motion technique to study on improving the work process. Meaning, the increasing of work process efficiency is depending on the time and motion technique.

### 3.3 Basic Procedure for Research

There are four steps to complete this study. There are given below according to their sequence :

1. Select: select the process or job to be studied.
2. Record: observe and record all the relevant facts related to the work process.
3. Examine: examine each recorded fact critically
4. Develop: develop the most efficient work process.

### 3.4 Data collection

- Job no 1988 on beain 3 line is selected for time study. Cycle time data was collected for production, heat treatment and assembly department to calculate standard time which is used as single reference for the company. During collection of data of cycle time defect or time consuming activities are observe and solution was given to minimize it. Overall equipment effectiveness is also calculate to measure the performance of the machine. Some chart like pareto chart is also use to monitor and control the process.

### 3.5 Time consuming activities

- Finishing and spark out operation take more time
- Defect in rings
- Cone filling
- Error of packing by worker
- Machine setting
- Changing grinding wheel
- Rework
- Power cut off
- Coolant problem

## 4. Result and discussion

### 4.1 Finishing and spark out operation take more time

In production job number 1988 is cut upto 350 micron. In this 350 micron 60 percentage of material is cut during roughing operation, 30 percentage of material is cut during finishing operation and 10 percentage of material is cut during spark out operation. So that finishing and spark out operation takes more time because more material is cut during these operation. If we reduce these cutting percentage in finishing and spark out then cycle time of the job 1988 is reduce because more material is cut during roughing operation and speed of wheel is greater than finishing and spark out operation. According to calculation of OEE (76.4 percentage) 6.30 hours are working hours in one shift. If we reduce stock removal from finishing and spark out operation then cycle time is reduce up to 4 sec for one ring. By reduction of cycle time of 3 to 4 sec production of rings is increase around 50 rings.

Operation	Stock removal	
	Before	After
Rough	260	300
Finish	80	40
Spark out	10	10

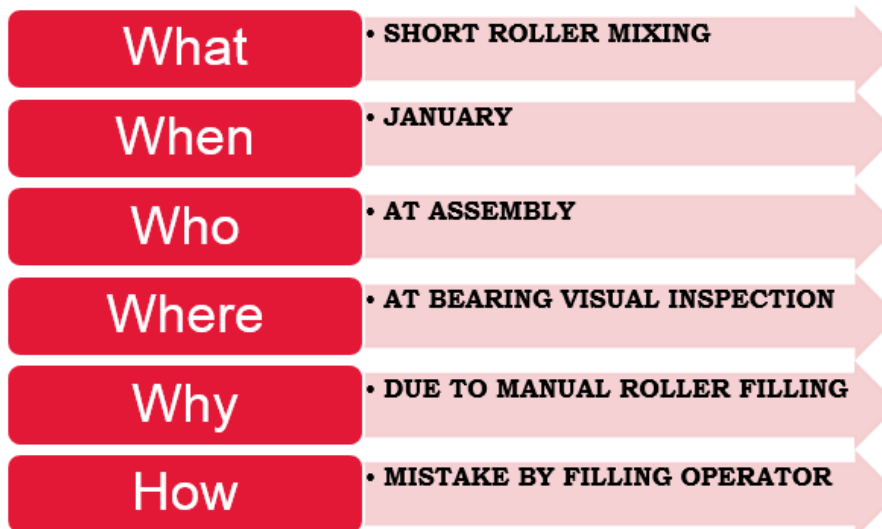
#### 4.2 OEE calculation after solution of problem

OEE FACTOR	CALCULATION	CALCULATED DATA	OEE%
Availability	Operating time/ planned productive time	435/480	.906(90.6%)
performance	(total pieces / operating time)/ideal run rate	(650/435)/1.5	.996(99.6%)
Quality	Good pieces/ total pieces	600/650	.923(92.3%)
Overall OEE	Availability*performance*quality	.906*.996*.923	.833(83.3%)

- By solving the problems in production improvement in the overall equipment effectiveness is 6.9 percentage.

#### 4.3 Human error prevention

In assembly department different kind of jobs were pack manually. So there was problem of mismatch between filling different rollers. Due to this problem, there was so many complaints received from customers. This problem is solved by adapting automatic machine to detect the same rollers in bearing.



#### 4.3.1 Solution of problem

- Solution implemented Introduce auto cone checker to detect roller missing/short roller Poka yoke.



AFTER

#### 4.4 Application of automatic cone filling machine

- In assembly department there are so many operation as mention above. All the operations are carefully observe. And trying to find time consuming activity. In assembly of bearing, there is one operation named cone filling. There are four workers require to fill the cone manually. So that more time is consume in this operation. To reduce the workers working on cone filling there is one machine named automatic cone filling machine select to solve this problem. By application of automatic cone filling machine, there will be saving of three workers in assembly department. If we install the automatic cone filling machine then



three workers are utilize in other work. Salary for one worker per day is 170 rs.By utilizing three worker in other work,there is saving of 510 rs per day. Cost of automatic cone filling machine is around 45000 rs.By utilizing three worker in other work,cost of the machine is recover in 88 days.So that profit is start after 88 days.Cycle time of cone filling is also reduce by using automatic cone filling machine.

## 5.Conclusions

The following conclusions drawn from above study.

- Standard time for all the operation in production,assembly and heat treatment department is calculated.
- Time consuming activities found in all three department.
- Stock removal from roughing operation was increase upto 40 micron so that there was cycle time reduction upto 4 to 5 second behind one ring.
- In cone filling operation,application of automatic cone filling machine three workers are utilize in other work.So there is saving of man and time.
- By solving the problems in production improvement in the overall equipment effectiveness is 6.9 percentage.

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