

# Time and Motion Study for Reducing Cycle Time of Planetary Carrier

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**Abstract**— The main objective of this paper is to increase the production rate. In industries to make the shipment in exact time it is very necessary to set a target for production department. The total work of the production department is completed by different operator so without standard target it is impossible to reach the goal. To increase the productivity of planetary carrier studied on time and motion study by using systematic observation, interview with discussion and stopwatch time study. Time and motion study terms are used as a interchangeably for study of conservation of human resources for doing task by most efficient method. Work study is scientific research involving work techniques with the objective of identifying the best way of doing a work to improve its operational and production efficiency.

**Key words:** Time and motion study, Productivity, Man power factor, Time standard

## I. INTRODUCTION

Time and motion study is the important thing in any company to determine the production rate. Human judgment has always been a strong factor to be overcome in attempting to remove the difficulties that surrounding this subject. In critical condition the rating phase of time study which is not too satisfactory in many instances. The Motion and time study affects the way a man works and how much he takes effort to complete his work.

Previous work say that due to wrong sequence of operations, improper utilization of manpower, there was less productivity. So that time and motion study is important. To improve the productivity by introducing new sequence of operations.

In this paper efforts have made to present how to increase productivity of planetary carrier. In this paper the effect of various parameters like cycle time of each machine, material handling, sequence of operations, how many machines operate by single operator studied.

### A. Problem Statement

Time and motion study is the important aspect in business determine the production rate. Whether the motion time or the production rate, this element is taken care in any transaction in a company. In this study, the production company is settling down the cycle time of machine and material handling processes. It involved both the machine and manpower. In the process of manpower has no time standard stated because as we know, manpower process will be influence by many factors. Not as the machine that had been set and produced as what we wish to. When there is no time standard, any task could be finished out of planned. In this study, the process that involved manpower in packaging process is determined and studied. While, a time standard is determined to know the time needed the process could be

finished. In business, both of these elements are important to execute the maximum profitable production rate.

### B. Research Objective

The objectives in this study was to identify work, time standard to work which involves manpower in production and material handling processes and see changes which occurred on cost and company production after Time and Motion Study takes place.

## II. MOTION STUDY

Motion and time study is not scientific throughout. The techniques do attempt to follow a scientific procedure, but there is room for considerable environment. To achieve reasonable results it is essential to use combine motion and time study to determine a production standard. It is particularly important that reasonable effort be applied in motion study to insure equitable results when time study is used. In fact, much of the difficulty with time study, aside from lack of scientific procedure, is a result of applying it without a thorough study of the motion pattern of the job.

Basically, motion study is the foundation for time study. The time study determine the time to do the job with respect to a certain method and is valid only upto the method is continued. Once a new way to do the job is developed, the time study must be changed to agree with the new method. Otherwise the time allowed for the job would be too great, and a loose standard would result. This, in turn, would mean inconsistent standards or unequal opportunity for all persons on incentive work to earn essentially equal bonuses.

Motion study can be used successfully without time study but time study cannot be used without motion study. Since motion study is the foundation for time study and should be done before a time study is made, this Bulletin will consider motion study techniques first.

The purpose of motion study should be to determine the greatest economy of effort with due regard for safety and the human aspect. The total cost for human expenditure of effort can be reduced at the same time that the unit cost for human effort is increased. The same amount of work can be accomplished in less time with more efficient application of human effort which will justify higher hourly wage rates.

Stated simply, motion study means,

- 1) Find out how a job is being done now.
- 2) Thoroughly question the reason for each step as it is being done now on the job.
- 3) Remove the steps on the job which cannot be fully justified.
- 4) Install and standardize the new procedure for doing the job.

A. Process Chart

To study the over-all situation, one usually makes a process chart and a flow diagram. On the process chart, all the various steps involved in furthering the product from raw material to final finish the form are listed in the order in which they now exist. It is essential that each and every phase of the series of steps in the over-all picture be shown. No assumptions should be made. Above all, it is highly desirable to observe the series of events on the actual scene instead of trying to picture what is taking place from a distant office.

The symbols used may look somewhat queer, but, with usage, one will soon discover that they assist in spotting features about a series of steps which will lead to simplifying the process. The symbols used in this chart are

- An operation, a step which progresses the product through change in shape, etc. along to completion.
- ➡ A move operation, a transportation from one location to another, but not involving a change in shape of the product nor progressing the product along to completion.
- ▼ A temporary storage, a waiting of the article or product for the next event to happen.
- An inspection of a quantity nature.

Machine No.	Machine Type	Process Description	Symbol
1	Conventional Lathe	Turning	●
		Inprocess Inspection	■
		Movement	➡
2	CNC Machine	Rough Boring/Facing Finish Bore/Facing	●
		Inprocess Inspection	■
		Movement	➡
3	CNC Machine	Turning	●
		Inprocess Inspection	■
		Movement	➡
4	Broaching Machine	Finish Broaching	●
		Inprocess Inspection	■
		Movement	➡
5	SPM 1	Drilling and Boring	●
		Inprocess Inspection	■
		Movement	➡
6	SPM 2	Pad Milling	●
		Inprocess Inspection	■
		Movement	➡

7	VMC Machine	Drilling	●
		Inprocess Inspection	■
		Movement	➡
8	Balancing Machine and Drilling Machine	Balancing and excess material removing with drilling machine	●
		Inprocess Inspection	■
		Movement	➡
9	Manual	Deburring	■
		Movement	➡
10	Manual/Visual	Final Inspection	■
		Movement	➡
11	Washing Machine	Cleaning and Washing	●
12	Millipore	Millipore	■
13	Oiling /Packing	Unlearned Parts, Rusty Parts	●
14	Storage	No Defined Area	▲
15	Dispatch		

Table 1:

III. TIME STUDY

The method of doing the work has been determined by motion study, sometimes it is desirable to find out how much time is used to do the work. Many industries have adopted different type of a time study system to record the time on a job. The name time study implies that some sort of a time-measuring device must be used. In most cases it is a stopwatch. This particular area is more familiar to the employee, because employee is able to taking at least the physical aspects of a time study with his stopwatch and board. Before taking a time study, it is necessary to understand just what a time study attempts to do.

A time study attempts to find out the amount of work that a qualified operator, properly trained, can do in a given time. This is essential for the operator to do the work with respect to a specific method, under certain conditions, and at a same pace which will produce a physical reaction. Certain allowances for personal and other delays are provided.

In this explanation, "certain" is used several times. Each individual plant faces difficulties to determine the exact specifications for the "certain" method, "certain" conditions, "certain" pace, "certain" physical reaction, and "certain" allowances. Just how the specifications are determined unilaterally by management or bilaterally by management and the employees or union is decided in each case by the person or persons involved. But it must be remembered that the employees' acceptance of the final answer the production-standard-time to be allowed is one of the criteria for the success of time study.

All phases in job method, working conditions and allowances must be carefully considered when the time

study is to be taken. It is undeserved to expect a production worker to accept a production standard that is not based on these phases. It is an idea in mind that the following suggested steps in time study are considered. This is essential because only a scientific procedure is attempted, some parts of taking a time study.

#### A. Determining the Job Content

The determine job content which is involves recording the method of doing the job exactly as it is done whenever the time study is taken. This should be done in such detail that the work can be reproduced at any time in the future. Details include recording -

- 1) The general information about the job.
- 2) The workplace description.
- 3) The conditions and environment surrounding the workplace.
- 4) The method used by the operator.

The record obtained is of the utmost importance for the administration of a sound time study system because it provides information for-

- Determining the magnitude of job changes as they occur.
- Training other operators in the standard method to enable them to meet the standard time.
- Developing standard time data.

The importance of making the proper record of the time study is further emphasized when the consequences of an incomplete description are considered. An incomplete time study record can cause the standard times to become useless because the unskilled operators. Without proper records inaccuracies develop in the standard time because of changes in method, equipment, workplace, and surroundings which cannot be checked. Perhaps the most chaotic result is the gradual development of undesirable attitudes on the part of the people on the job. They begin to associate standard times with production quotas rather than as measurements of the physical work required. This feeling leads to a resistance to change, even though the suggested method requires no increase in physical effort.

Before considering the methods description complete, two important questions should be asked:

- 1) Can the job be reproduced from the methods description?
- 2) Does the description include everything the worker has to do?

#### B. Determining the Elements of the Job

Time values of a job can be secured in a number of different ways. Perhaps the two extremes would be to secure the over-all time to do the whole job and divide this time by the number of pieces or pounds produced to get a unit measure and to determine the time for each motion and a total of all the motion times for one unit produced to give a unit measure.

There are no fixed regulations as to how a job should be broken down into elements, but there are a few guides which can be used. The rest has to be built up through experience. The guides are -

Contents of each element should be as homogeneous as possible. This means that a unit of work

such as "insert a screw" should be in one element, but other units of work in the same job should be in other elements. Hand and machine times standard should be placed in various parts. Hand time is under the operator's control and is subject to rating or leveling. Machine time depends upon the automatic feed and definite value depends upon physical characteristics of the part. This cannot be determined without actual time study.

#### C. Recording the Actual Time Values

In recording the actual time values, two (questions need to be answered)

- 1) What method of reading a stopwatch is going to be used?
- 2) When have an adequate number of stopwatch readings have secured?

#### 1) Sketch Of Planetary Carrier

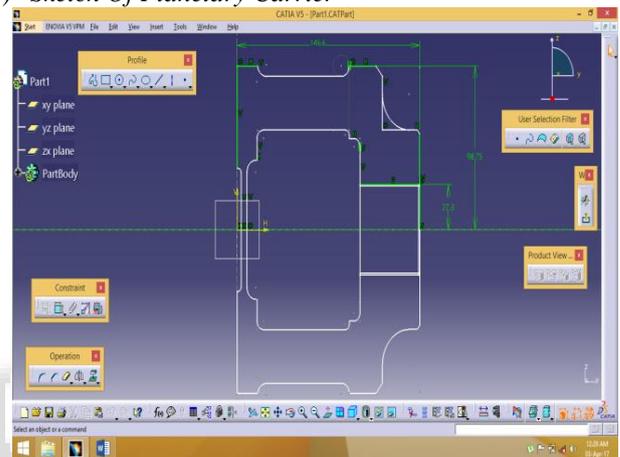


Fig. 1:

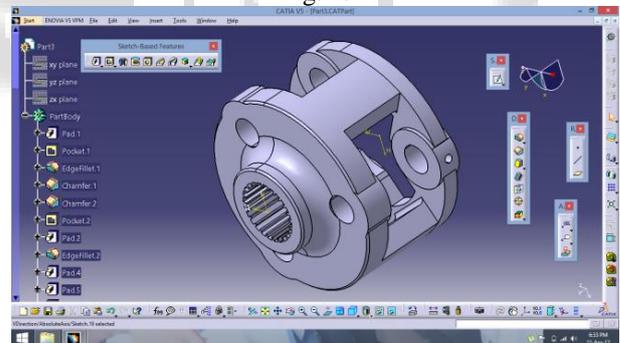


Fig. 2:

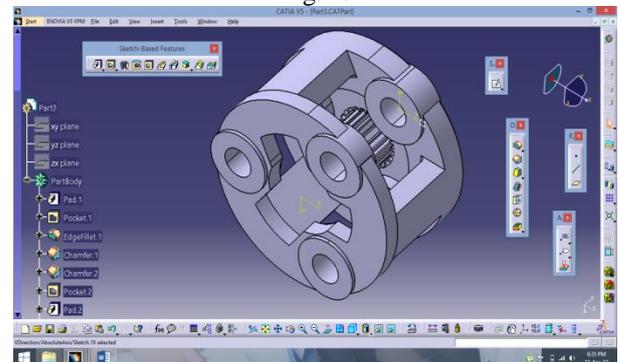


Fig. 3:

2) Sequence of Machine used

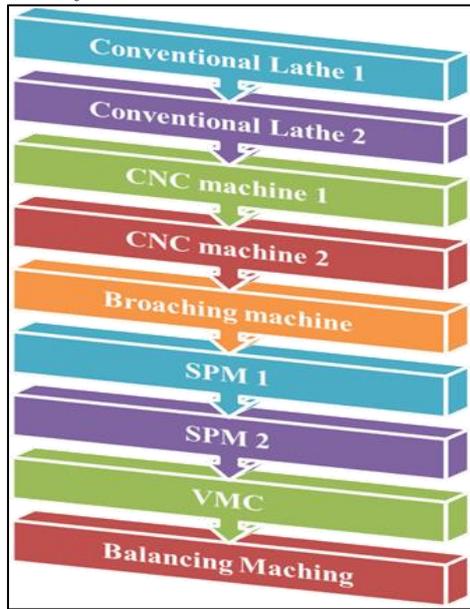


Fig. 4: Sequence of Machine used

3) Table of Actual Cycle Time of Operations before Implementation

Sr. No	Machine Name	Operation Name	Operation Time
1	Conventional Lathe	Turning	40 sec
2	CNC 1	Finish bore and Facing	3 min
3	CNC 2	Facing, Turning and Back Boring	4 min
4	Broaching	Finish broaching	20 sec
5	SPM 1	Drilling and Boring	2 min 52 sec
6	SPM 2	Pad Milling	1 min
7	VMC Machine	Drilling	1 min 50 sec
8	Balancing & Drilling Machine	Balancing and excess material removing	1 min
9	Washing Machine	Cleaning & Washing	2 min/4 Qty.

Table 2: Table of Actual Cycle Time of Operations before Implementation

D. Working Area

First we observed all machines in the plant and also observed the material handling system from raw material to the finished product. After that we measured cycle time of all machines and find out the working area. Then we select the CNC machine-2 because of it consume more time for operation.

Our implementation is that, we introduced new conventional lathe machine after first conventional lathe for to reduce the working load on CNC machine-2. By using new conventional lathe machine we decreased length of job by rough facing operation.

Sr. No	Machine Name	Operation Name	Old Operation time	New operation time
1	Conventional	Turning	40 sec	40 sec

	Lathe			
2	CNC 1	Finish bore and Facing	3 min	3 min
3	CNC 2	Facing, Turning and Back Boring	4 min	3 min 12 sec
4	Broaching	Finish broaching	20 sec	20 sec
5	SPM 1	Drilling and Boring	2 min 52 sec	2 min 52 sec
6	SPM 2	Pad Milling	1 min	1 min
7	VMC Machine	Drilling	1 min 50 sec	1 min 50 sec
8	Balancing & Drilling Machine	Balancing and excess material removing	1 min	1 min
9	Washing Machine	Cleaning & Washing	2 min/4 Qty.	2 min / 4 Qty.

Table 3: of Actual Cycle Time of Operations after Implementation

IV. DISCUSSION

From earlier paper it is clear that there was improper utilization of manpower, wrong sequence of operation due to that productivity of overall plant decreased. To improve the productivity by introducing new sequence of operations. By utilizing proper man, machine and material to improve the production rate. By implementing of new Lathe machine between two CNC machines, reduce the load on next CNC and ultimately decrease the cycle time of this machine and finally production rate increases by implementing this new machine.

V. CONCLUSION

From the above discussion it is clear that productivity increased in production company by proper utilization of man power, material handling and sequence of operations. Also from this study the objective successfully achieved by the application of time study and motion study. In addition, positive changes also observed. The optimum number of human resources assigned to any organizational activities leads to economy, reduction in time and thus quality work is obtained. Material handling activities are performed with some degree of efficiency, although there is much scope of improvement. To set a standard target for different product time and motion study is mandatory. Target of production achieved by introducing new machine for reducing work load on another machine and changed sequence of operation with the help of time and motion study.

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