

# Productivity Improvement in Assembly Line of Automobile Industry by Reducing Cycle time of Operations

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**Abstract:** The present study has been done at one of the famous automobile industry, a leader manufacturer of tractors. The aim of study is to identify various problems on the assembly line which are causing assembly line to stop. There are two assembly lines rear assembly line and front assembly line and the work has been done on the front assembly line. The bottle neck problem is found in front assembly line and is solved by reducing the cycle time of the operations by utilizing the work study techniques and material handling techniques and it was found that cycle time of the bottle neck operation was reduced by 14.66 % per trolley.

**Key words:** Automobile industry, Assembly line, Work study techniques, Material handling techniques.

## 1 INTRODUCTION

For an organization to survive and remain profitable in this high competitive environment, organizations have to work to increase its productivity by optimum use of resources available within them.

### 1.1 Productivity

Productivity can be defined as a ratio between the output volume and the volume of inputs. In other words, it measures how well production inputs, such as labour, time, material, facility capital, are being used in an economy to produce a given level of output.

The expression for the productivity is as under:-

$$\text{Productivity} = (\text{output} / \text{input})$$

“Productivity isn’t everything, but in the long run it is almost everything. A country’s ability to improve its standard of living over time depends almost entirely on its ability to raise its output per worker.” said Paul Krugman, The Age of Diminishing Expectations (1994).

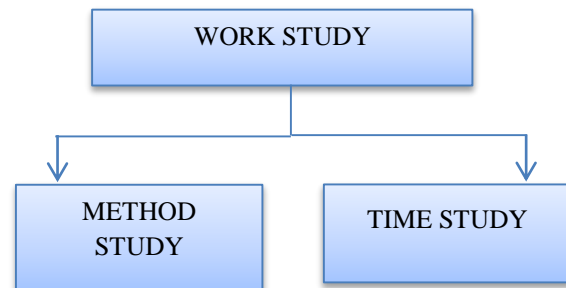
Productivity is considered as a key source of economic development and competitiveness.

### 1.2 Work Study

Work study investigates the work done in a firm/company/organization and it aim to find the best and most efficient way of using all the resources which are available i.e. material, man, machine, money etc.

Work study techniques involve Method study and Time study techniques.

As shown in figure 1



[Figure 1]

#### 1.2.1 Method Study

Method study targets at finding the best way of doing the work. Method study involves systematic investigation (Which involves recording and critical investigation) of the current method of doing the job so that easy, fast, which causes less fatigue to the worker, safe, economical way of doing the work can be developed and installed at low cost. This is basically achieved by eliminating the unnecessary motions which are involved in a procedure of doing the work and the same can also be achieved by changing the sequence of operations or process itself.

### 1.2.2 Time study

Time study is a technique of work measurement used to establish time for a qualified worker to carry out specified task under specified conditions and at defined level of performance.

### 1.3 Case Study

The study has been carried at one of the famous automobile assembly plant which is a leading manufacturer of tractors in India and also famous for exporting tractors abroad. In this company there are two assembly lines rear assembly line and front assembly line and the study has been carried out on the front assembly line in which there are various operation stages which are creating bottle neck on the front assembly line. It is desirable that 110 tractors to be assembled on the assembly line but it was observed that around 90% of tractors are assembled in a day. Thus the concern of this paper is to present the ideas which can be used by the organization to reduce its cycle time of the operations in its front assembly line to enhance the efficiency of the system.

### 1.4 Objectives

- To identify the operations which are creating bottle neck in the front assembly line.
- Identify the problem stations in assembly line where bottle neck situation arises by using method study technique.
- Develop a method to solve the problem which are causing assembly line to stop or to slow down its production level than expected level.
- Conduct time study after implementation of the new method for trial period of 10 days.
- Suggest new method to the concern department in the organization.

### 1.5 Productivity improvement technique

The technique which has been used in this study is the work study technique in the first bottle neck operations to identify the causes reducing the production rate by stopping the assembly line and then further on to these stations the root cause of the problems are identified by method study technique and then after the new improved method was developed and implemented for trial period of 10 days and trial period time study of these stations were conducted and the results of the time study were compared before and after implementation of the new method.

### 1.6 Roles and Responsibility in the Study:-

- To study existing methods of doing the work and identifying the problems in the existing method which are causing assembly line to stop.
- To develop a practical, economical and most importantly safe method to be used in front assembly line.
- To implement and conduct the test run of the newly developed method for 10 days.

- To conduct time study after implementation of the new method.
- To compare the result of new method with result of the older method in terms of timing.
- To suggest new method to be implemented in the front assembly line.

## 2 STUDIES AT COMPANY

### 2.1 Method study implication

- First step is to determine the sequence of the operations in the front assembly line and create a process chart of front assembly line.
- Now from the past time study data provided by the company we studied the bottle neck operations and their respected stations which are reducing the production rate and it was found that sub assembly of the right fender of the tractor model 439XL took around 17:37 minutes and the time should be around 12 minutes for 4 pieces loaded in trolley.
- The problem associated with present method is that sub assembly station for nut bolts is at different place and the sub assembly of the right side fender is at different place. The worker has to move from sub assembly station to assembly location of the nut bolts and then return to the original station where actual sub assembly of the fender is taking place. It was observed that this extra movement involves around 32 seconds on an average of 30 samples taken and the labour gets fatigue when he do this again and again this reduces the performance of the labour due to unnecessary motion. Approximately 15 times worker have to move unnecessary in a day just to create assembly of nut bolt and move to the sub assembly station where actual sub assembly of the right hand side fender take place which means around 480 seconds are wasted in a day at this station and this effect is increased by the fatigue of the worker caused by un-necessary motion of the workers.

And in this station it was found that pneumatic torque gun pipes get inter tangled with another stations pipes as the point of pneumatic input to guns of different station is common and 10 times approximately the pipe gets inter tangled with the other pneumatic gun pipe and workers cannot work when the pneumatic gun pipes are inter tangled, and around 15 seconds are spent just to untangle the pipes and the time get wasted due to inter tangle of the pneumatic pipes is around 150 seconds daily and total time wasted at this station increases to  $(480 + 150)\text{seconds} = 630$  seconds minimum or around 10:50 minutes per day and exhausted to labour also.

- Now a new material handling technique was proposed in which the nut bolt sub assembly is available by welding cup holders to the trolley system in which nut bolt assembly is already available on the right hand side of fender trolley, and instead of using pneumatic torque guns battery operated torque guns idea was proposed which eliminate the problem of inter tangling of the pneumatic pipes.

- The developed new material handling system and battery operated torque guns idea was implemented for period of 10 days.
- Time study was done for 10 days and it was found that time required for assembly of right side fender trolley of product 439XL was reduced to 15:02 minutes from 17:37 minutes and by using battery operated torque gun the problem of inter tangling of pneumatic pipes were eliminated and 15 seconds are saved on each right hand fender trolley for 439XL product.



Figure-2(a) Before 1



Figure-2(b) Before 2



Figure-2(c) Before 3

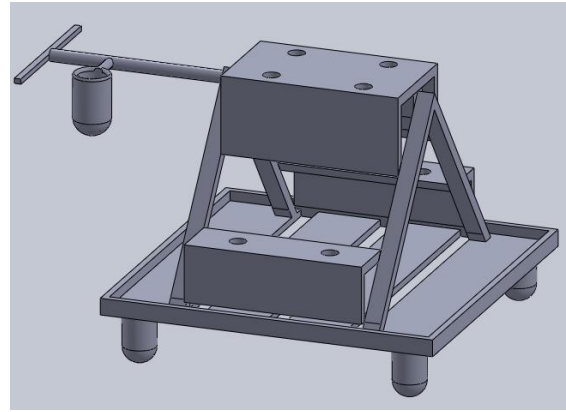


Figure-3(a) Drawing of improved Trolley system



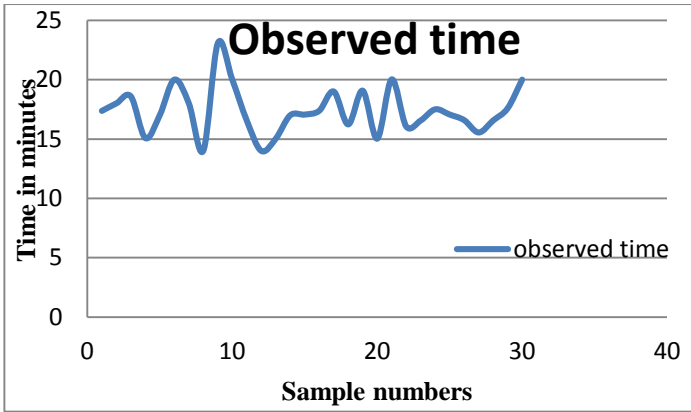
Figure-3(b) Battery operated torque gun

Sr no.	Operations	Time consumed by old method 30 samples average (min).	Time consumed by new method 30 samples average (min).
1	Sub assembly of RH Fender.	17:37	15:02

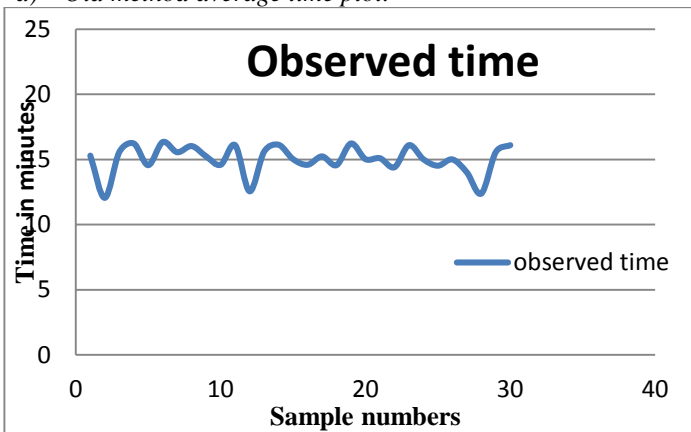
Table-1 Time description sheet

Sr. no	Work Stations	Steps before	Single step distance	Distance before applying new method	After steps	Single step distance	Distance after material handling technique
1	Sub assembly of RH Fender	75-77	.254 meter	19.55 meter approximate	49-55	.254 meter	13.97 meter approximate

Table-2 Motion description sheet



a) Old method average time plot.



b) New method average time plot.

### 3. RESULT AND CONCLUSION

#### 3.1 Result

The result can be concluded from this study that time required to complete the sub assembly of the right hand side fender was reduced from average of 17:37 minutes to 15:02 minutes approx. and per trolley 02:35 minutes it could be saved approx.

Percentage decrease in time by above study is

$$= (1057-902)/1057 \times 100 = 14.66\%$$

Percentage decrease in motion of worker

$$= (19.55-13.97)/19.55 \times 100 = 28.54\%$$

#### 3.2 Conclusion

The main objective of this paper is to present ideas to improve the productivity of automobile industry by reducing the cycle time of the operations which are taking extra time than desired time by using the concept of work study and material handling techniques.

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