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Productivity Improvement Of SEEOM Using Industrial Engineering Techniques

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ABSTRACT

Method study technique is used along side of time study. Method study is used for study the method in which way the process is done. Time study is used find the cycle time of each process in the assembly process. Method study and time study concepts are used to increase the productivity of process by reducing different wastes like unnecessary moment, rework etc from process. It reduces work in progress. We can use both technique for optimizing the productivity of assembly shop. Method study and time study are done to improve the productivity of SEEOM (Stored Energy Electrical Operating Mechanism) in the company. Primary data is collected by observation method i.e. by video recording. With method study and time study, 5s technique is also used for proper utilization of space in workplace area. By using 5s technique workplace area can be properly managed and thereby helps in improving the productivity.

Keywords: Method study, Time study, Cycle time, 5s, Productivity

I. INTRODUCTION

SEEOM stands for Stored Energy Electrical Operating Mechanism. It is a electrically operating device. It is used as mounting on the circuit breaker which are available in 3-Pole and 4-Pole variety of different rating ranging for 40A to 630A. SEEOM is used to operate Circuit Breaker from remote area. Mainly two type of SEEOM are assembled DN2 SEEOM and DN3 SEEOM. It is mainly used in large projects including marine application like navy.

II. PROBLEM

After the analysis of assembly shop of SEEOM, it was found that most of work is done manually by workers. They does not have any standard time for each operation. There were many non-value added activities due to which the productivity of the shop was low. Main aim of this project to Increase the productivity of SEEOM shop by eliminating non-value added activity.

III. METHODOLOGY

Here method study approach is used along with time study and 5s to improve the productivity of shop. Work has been done in method study approach as below.

A. Select

Project was given from the company. It was given as SEEOM shop was new and no standard data was available about shop. Project was to improve productivity of SEEOM.

B. Recording

For time study whole assembly process was divided into small element and then time of each element was recorded.

Table 1. Time Study Of DN2 SEEOM Assembly

Sr. No	Activity	Average Cycle Time(sec)
1	Cam riveting 1	45.44
2	Cam riveting 2	24.75
3	Rack pin riveting	11.15
4	Pawl riveting	62.42
5	Ratchet riveting	72.70
6	LHS plate riveting	21.93
7	RHS plate riveting 1 (Plate clamp 1)	25.04
8	RHS plate riveting 2 (Plate clamp 2)	11.60
9	RHS plate riveting 3 (three rivets)	61.35
10	RHS plate riveting 4 (trip lever)	34.48
11	Handle Sub Ass.	68.74
12	Pinion Sub Ass.	41.55
13	RHS Sub Ass.	400.11
14	D-shaft Sub Ass.	46.56
15	LHS Sub Ass.	170.73
16	Flag Sub Ass.	50.70
17	Rack Sub Ass. 1	41.54
18	Rack Sub Ass. 2	156.97
19	Micro-switch Sub Ass.	49.78
20	Main Assembly	1275.80
21	Wiring of Base	890.59
22	Wiring of Assembly	2009.18
23	Lubrication	84.36
24	Joining	365.00
25	Cover2(Labelling)	243.13
26	Quality1 (By in-house)	444.14
27	Quality2 (by quality)	388.00
28	Pre-packaging	85.60
29	Packaging1(sealing)	142.65
30	Packaging2(Cartoning)	368.83
	Total Cycle time in Seconds	**7694.82**
	Total Cycle time in Minutes	**128.25**

Table 2. Summary Of SEEOM Shop

Sr. No.		Data Per Shift
1	Production Time	450 mins
2	No. of Units per Shift by one Operator	3.51 nos.
3	Cycle Time	128.27 mins
4	No of Operators	3
5	No. of Units per Shift by 3 operators	10 nos.
6	Actual Production in a shift	8 nos.
7	Productivity	80%

C. Analysis

In analysis phase the data collected in recording phase is analyse. To analyse the data different tools pareto's diagram, cause and effect diagram, brainstorming were used.

1. Pareto's Diagram

Pareto's diagram of cycle time is drawn. From this we can get the activities which is taking maximum time.

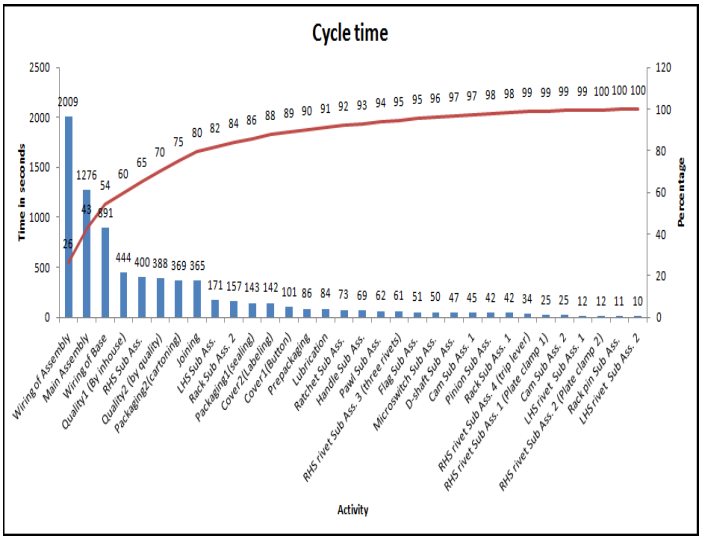

Figure 1. Pareto chart of Assembly

From the chart, it can easily be seen that first eight activities consume 80% of total time of assembly. So we should mainly focus on first eight activities and try to reduce the cycle time of each activity. So it will give better results.

Reasons due to which cycle time is more are listed done.

Rework: due to forgetting to fit some parts of assembly

Motion: Searching for tools and material

Waiting-time waste: Waiting for material

Inventory waste: Excessive Work in Progress and material

Defects: Defectives components

2. Brainstorming

After selecting first 8 activates from pareto's diagram to find the causes of more cycle time Brainstorming is done. By doing Brainstorming various reasons for low productivity were find out.

They given as follow.

1. New labours
2. Less trained labours
3. Less tools
4. No power tools
5. Old SOP
6. Poor 5s
7. Poor layout
8. More cycle time
9. Material shortage
10. Poor Material Quality

3. Cause and Effect Diagram

After due brainstorming then a Cause and Effect diagram was developed. From cause and effect diagram major causes of low productivity can be find out.

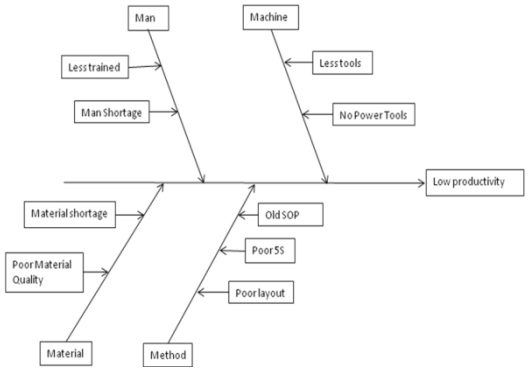

Figure 2. Cause and effect Diagram

Major causes of low productivity were less trained operator. Tools available were less and no power tools were available. The Layout of the shop was poor due which there unnecessary movement of the operator. 5s of the shop was also poor. No PEEP implementation, excessive inventory.

Layout is a major problem. Below shows present layout of shop.

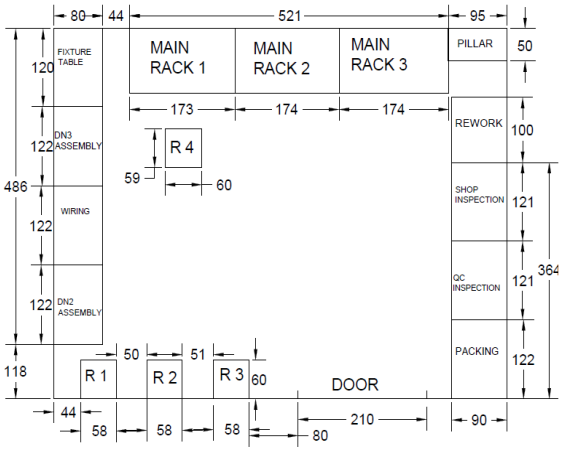

Figure 3. Layout of SEEOM shop

D. Development and Improvement

In this phase different improvements steps were taken to eliminate the problems present in shop.

1. Man

New labours were sent to Gurukul training program for train them. In Gurukul training program three days training is given to them about how to do assembly, information regarding safety and also they are given training of 5s.

2. Machine

They were given new set of tools as they have to share their tools to each other before. Power tool is also given to them to increase the speed of assembly and reduce the cycle time of assembly process. It help to fulfil their daily requirement of product.

3. 5s Implementation

1st S - Sort

It first started with the counting of all the components in workplace and tag was applied to components which contain information like Name of the component, Catalogue number, and Quantity. Then necessary and unnecessary component were identified. Unnecessary components were placed in red tag area. The excess inventory from the workplace area was sent to store. The damaged material was sent to store to scrap.

Figure 4. Unnecessary inventory

2nd S - Set in order

PEEP was implemented. Every component was given it particular place. Binning of the material which was placed in carton was done.

Figure 5. Before-After PEEP

3rd S - Shine

Cleaning of the workplace area was done. the machine and tools are cleaned. Floor area and rack were also cleaned.

Figure 6. Before-After 5s

4th S - Standardize

Then the place for every items and tool were standardized. The checklist is prepared to check the daily activities are followed properly or not.

5th S - Sustain

Then new practices are sustained. Internal audits conducted to maintain discipline. Previous four S's must be continued over time. This can be achieved by developing a sense of self-discipline in employees who will participate in 5S.

Benefits of 5s implementation

- The workplace becomes cleaner and better organized.
- Shop floor and office operation becomes safer.
- Visible results enhance the generation of more and better ideas
- Lead-time reduced
- In-process inventory is reduced.
- Space usage is improved.

4. New layout

After doing few changes in the layout following improvements are obtain.

- Table was provided near DN2 assembly table for placing fixtures
- Three racks are now placed near to table so operator's walking distance is reduced.
- One table has provided near rack-4 to place assembly.
- Two tables are given for cooling station.
- Separate table for engineering department is provided

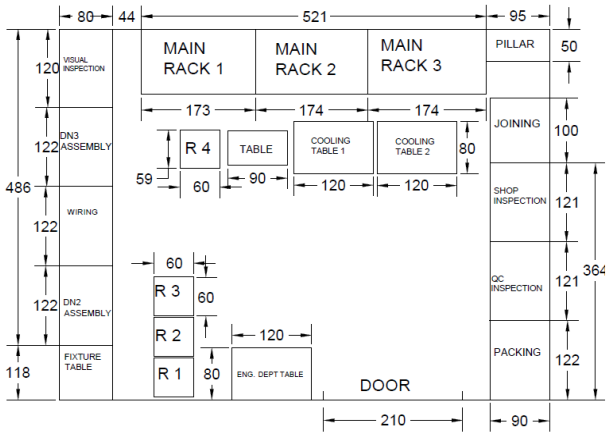

Figure 5.12 New layout of SEEOM shop

IV. RESULTS

Table 3. Time Study Of DN2 SEEOM Assembly

Sr. No	Activity	Old Cycle Time	New Cycle Time
1	Cam riveting 1	45.44	45.44
2	Cam riveting 2	24.75	24.75
3	Rack pin riveting	11.15	11.15
4	Pawl riveting	62.42	55.64
5	Ratchet riveting	72.70	72.70
7	LHS plate riveting	21.93	21.93
8	RHS plate riveting 1 (Plate clamp 1)	25.04	25.04
9	RHS plate riveting 2 (Plate clamp 2)	11.60	11.60
10	RHS plate riveting 3 (three rivets)	61.35	61.35
11	RHS plate riveting 4 (trip lever)	34.48	34.48
12	Handle Sub Ass.	68.74	68.74
13	Pinion Sub Ass.	41.55	41.55
14	RHS Sub Ass.	400.11	318.44
15	D-shaft Sub Ass.	46.56	46.56
16	LHS Sub Ass.	170.73	142.06
17	Flag Sub Ass.	50.70	50.70
18	Rack Sub Ass.	198.51	109.37
19	Micro switch Sub Ass.	49.78	49.78
20	Main Assembly	1275.80	1040.81
21	Wiring of Base	890.59	890.59
22	Wiring of Assembly	2009.18	1523.17
23	Lubrication	84.36	84.36
24	Joining	365.00	365.00
25	Cover preparing	243.13	243.03
26	Quality1 (By in-house)	444.14	444.14
27	Quality2 (by quality)	388.00	388.00
28	Pre-packaging	85.60	85.60
29	Packaging1(Sealing)	142.65	142.65
30	Packaging2 (Cartoning)	368.83	368.83
	Total Time in Seconds	**7694.82**	**6767.46**
	Total Time in Minutes	**128.25**	**112.79**

After implementing various improvement steps and doing various kaizens like giving shadow board for tools, hardware bins on each table, making riveting bin for rivet shop, etc the overall cycle time of the assembly reduced. Total cycle time reduce from 128.25 minutes to 112.79 minutes i.e. 15.56 minutes. So total 12.13% cycle time is reduced.

Table 4. Summary Table Of SEEOM Shop

		Before	After
Sr. No		Data Per Shift	Data Per Shift
1	Production Time	450 mins	450 mins
2	Cycle Time	128.27 mins	112.79 mins
3	No. of Units per Shift	3.51 nos.	4 nos.

	by one Operator		
4	No of Operators	3	4
5	No. of Units per Shift by 3 operators	10 nos.	16 nos.
6	Actual Production in a shift	8 nos.	15 nos.
7	Productivity	80%	93.75%

After reducing cycle time and designing new layout the productivity of the shop is increased. Production increase from 8 units per day to 15 units per day. And Productivity increase from 80% to 93.75% i.e. 13.75% of productivity increased

V. CONCLUSION

In this study the method study and time study is mainly used. By doing analysis of collected data it can be concluded that there many non-value added in the process due to which time required to make a product is high and productivity is low. Skill level of operators were low, tools available were less and there were no power tools. Layout of shop was poor. So to improve productivity first 5s was done. Then new tools and power tools were provided. Training to operators was provided. New layout was implemented. Many kaizen were done to improve the workplace area. After implementing improvement in shop the better results were obtained. Due which the cycle time was reduce from 128.27 minutes to 112.79 minutes i.e. 12.13% cycle time is reduced. Productivity increased from 80% to 93.75% i.e. 13.75%. Manpower was increase from 3 to 4 as demand of product is increasing and as a result, production is increase from 8 units per shift to 15 units per shift.

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