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A Case Study of Plant Layout: To Compare Production Efficiency Of Manual Plant Layout And Computerized Plant Layout Using ARENA Software

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Abstract— Industries are working hard to set a benchmark in the present era, and they are working for increasing their potential in production and effectiveness to compete in markets. There are many ways to solve the problem relating to the production like Plant Layout, Line Balancing, Quality Control (QC), Total Quality Management (TQM), and Standard Time. Plant Layout helps in better utilization of man, material and machinery for effective utilization of all resources. And also by the help of simulation we can make a virtual model of Plant Layout of real world environment and also by inputting the data from real world environment. This study of plant layout is done in B. Shankara Sales Organization, Agra which is a piston and piston ring manufacturing company of two and three wheeler vehicle. Here the study of plant layout of company has been done by creating several virtual options of layout without disturbing the original one. And these studies gave a fantastic change in production rate, productivity & plant efficiency with efficient utilization.

Keywords— production, plant layout, line balancing, simulation software, production rate, productivity, plant efficiency.

INTRODUCTION

Plant layout defined as the physical arrangement of everything needed for the product or service (including machines, personnel, raw materials, and finished goods). Plant layout design is the fundamental basis of today's industrial plants which can influence parts of work efficiency.

In industry sectors, it is important to manufacture the products which have good quality products and meet customers' demand. This action could be conducted under existing resources such as employees, machines and other facilities. Plant layout improvement is one of the tools to increasing industrial productivities. Plant layout design has now become a fundamental basis of today's industrial plants which can influence parts of work efficiency. It is needed to appropriately plan and position employees, materials, machines equipments, and other manufacturing supports and facilities to create the most effective plant layout. [1]

Placement of the facilities in the plant area, often referred to as ''facility layout problem'', is known to have a significant impact upon manufacturing costs, work in process, lead times and productivity. A good placement of facilities contributes to the overall efficiency of operations and can reduce until 50% the total operating expenses. The design components of a plant layout consist of facility system, the layout, and the material handling system. Facility system consists of structural system the atmospheric system, life safety system and the sanitation system. The layout consists of all equipment and machinery system. Handling system consists of mechanism required to satisfy facility interactions [2]

CASE STUDY

This project study has been performed at "B. Shankra Sales Organization, Agra". B. Shankra Sales Organization is Piston and Piston Ring Manufacturer Company of two and three wheeler vehicles engine. It is established in 1985 by Mr. Rama Shankar Sharma and it exports pistons of two and three wheeler vehicles engine. Here in this company, pistons are manufactured by casing in casting cell then it goes to piston smoothening cell and after that they do fitting rings in pistons.

The Process Of Piston Making In A Piston Smoothening Cell:- The layout of piston making process with operations & cycle time assembly line is shown in fig 1 and which is related to table of sub production line machines with cycle time is shown in comparison table 1. Firstly we find the process of existing piston making data by arena approach in figure 2. In the present case of company we are using arena simulation, which results production of 307 piston/shift, in which 244 pistons are selected and 63 pistons are rejected. In this we get the efficiency of 69% of selected piston. This is the present layout of the company in which cycle time is 2 min/cycle.

In second case (Figure 3) we do modification in first case and increase 1 machine in the basic model M1 i.e. grinding machine. In this we get production rate of 307 shaft /shift in which selected pistons are 279 and rejected pistons are 28. In this we get efficiency of 69.75% of selected pistons.(7-days& 14-days).

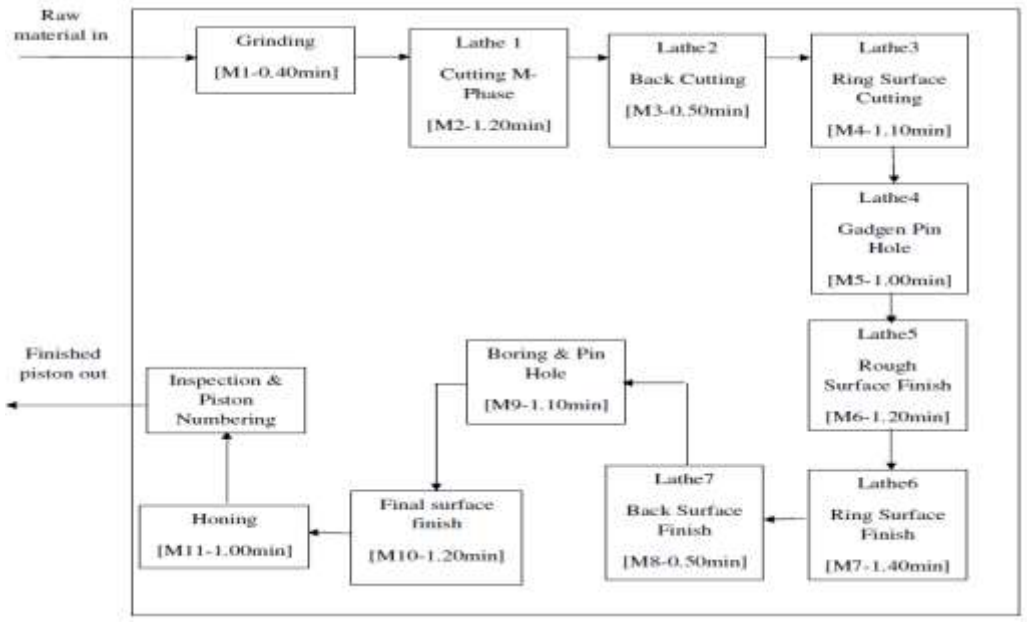

Figure 1: Flow chart of basic layout

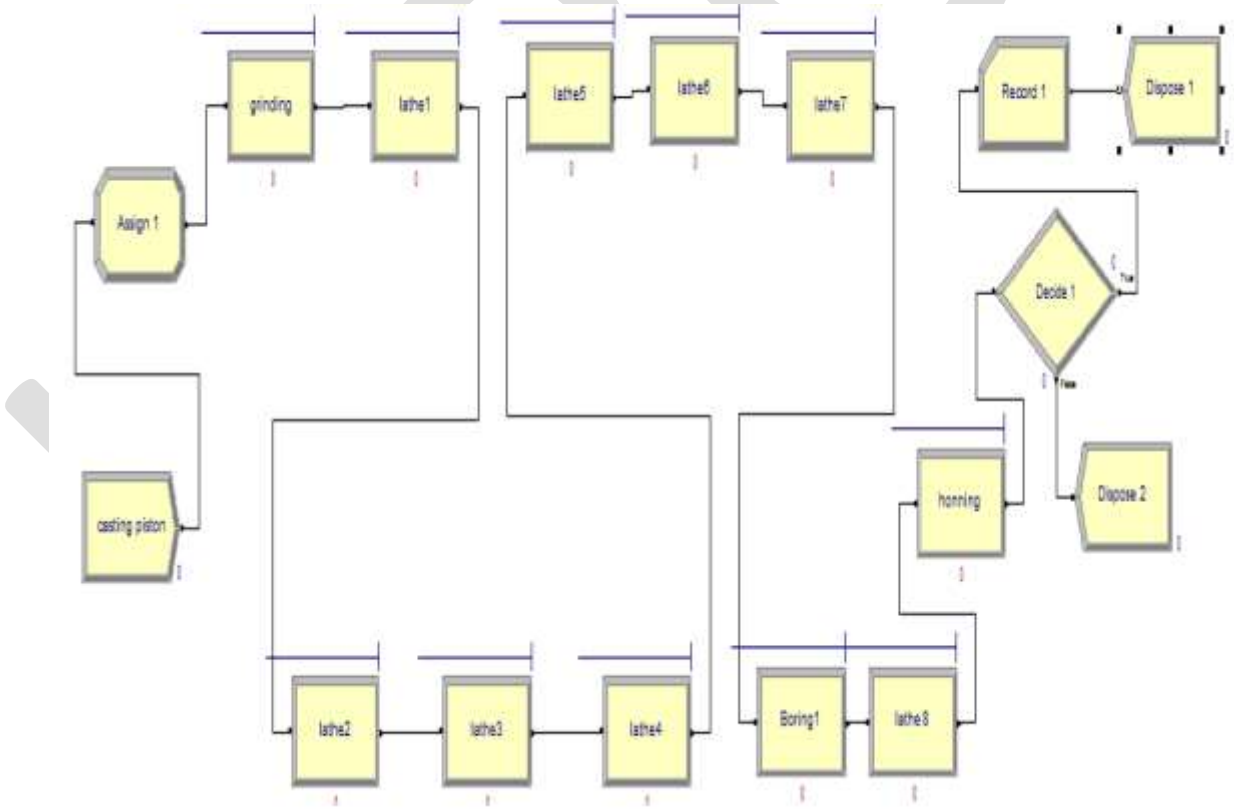

Figure 2: Flow chart of basic layout in ARENA

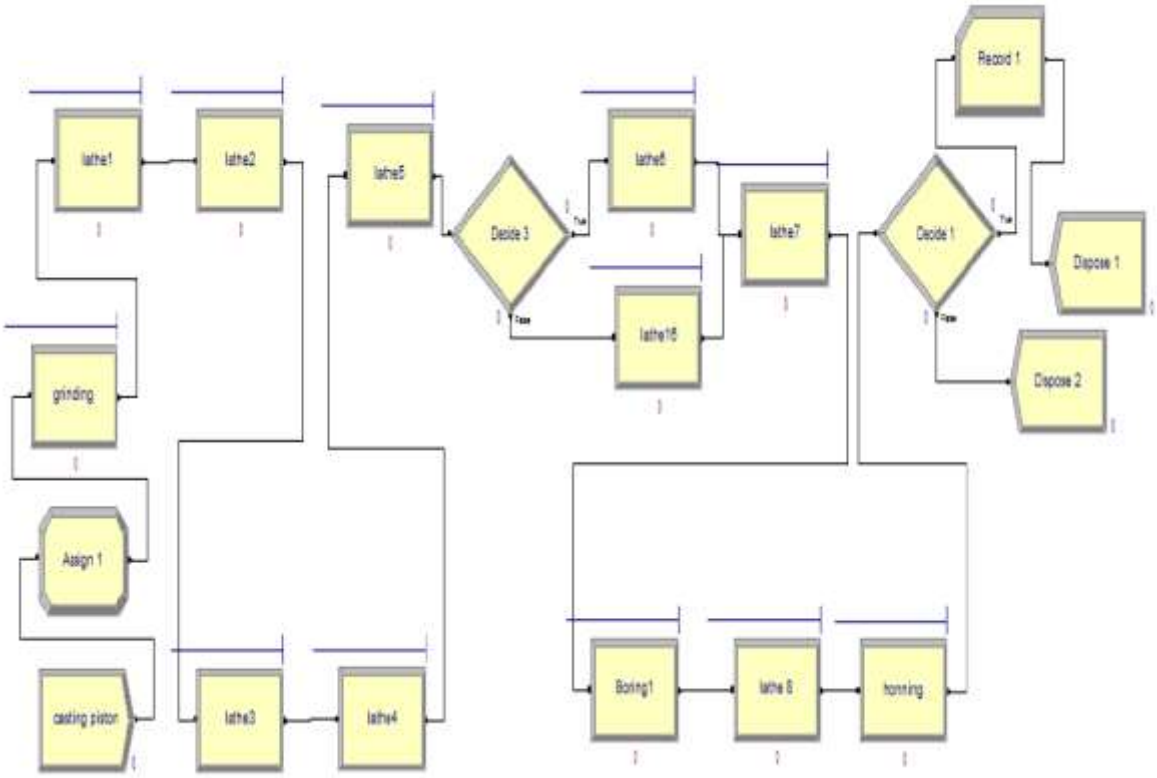

Figure 3: Flow chart of Proposed layout in ARENA

Figure 4 & figure 5 we just plot the graph for showing the utilization of all machines in 1 cycle. Figure 4 is for basic present layout of company & figure 5 is for simulated layout. We can compare the utilization here.

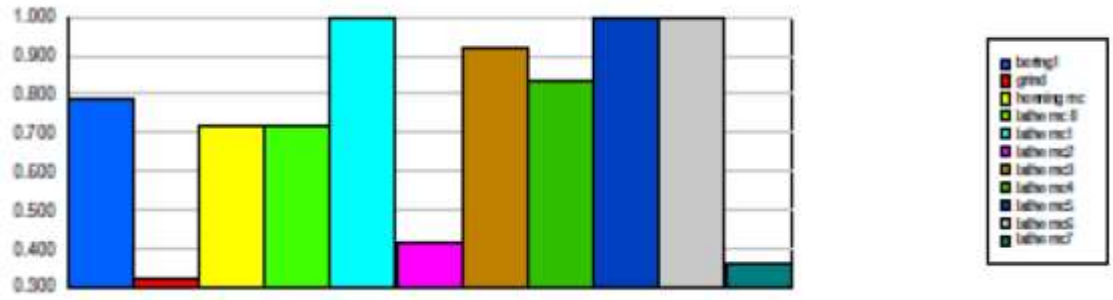

Figure 4: Scheduled Utilization of Machines in basic layout

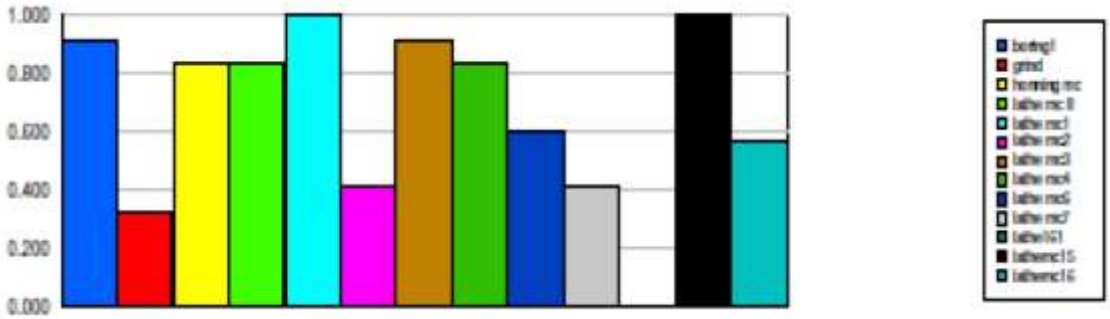

Figure 5: Scheduled Utilization of Machines simulated layout

RESULT

In the study we just got that the efficiency of 1 cycle is increased by 76.61 to 80.95%.and the rejection rate is decreased. In the current layout the total number of piston production in 1 shift is 307 piston/shift, in which 244 pistons are selected and 63 pistons are rejected while in simulated layout we get production rate of 307 shaft /shift in which selected pistons are 279 and rejected pistons are 28.here we are having the comparison table for both the layout in which we compare process time as well as efficiency of current layout & simulated layout. There are 2 areas where we found the results:

- Improvement in Productivity
- Line Balancing Efficiency
- Reduction in rejection Rate
- Increased production efficiency

TABLE – 1Table of % Scheduled Utilization of Machines in basic Layout & Simulated Layout

Sr. No.	M/C	Operations	Basic Layout results		Simulated Results	
			Prod Time (In min)	η	Prod Time (In min)	η
1	Grinding	Grinding	0.4	31.91	0.4	32.82
2	Lathe-1	Cutting M phase	1.2	100	1.2	100
3	Lathe-2	Back Cutting	0.5	41.65	0.5	41.65
4	Lathe-3	Ring Surface Cutting	1.1	91.65	1.1	91.65
5	Lathe-4	Gudgeon Pin Hole	1	83.35	1	83.35
6	Lathe-5	Rough Surface Finish	1.2	100	1.2	59.91
7	Lathe-6	Ring Surface Finish	1.4	100	1.4	41.72
8	Lathe-6a	Ring Surface Finish	-	-	-	-
9	Lathe-7	Back Surface Finish	0.5	35.70	0.5	100
10	Boring MC	Boring & Pin Hole	1.1	78.58	1.1	91.6
11	Lathe-8	Final Surface Finish	1.2	71.40	1.2	83.62
12	Honing	Rotor Surface Finish	1.0	31.91	1.0	83.23
Total Time and Efficiency			10.6 Min	76.61 %	10.6 Min	80.95%

CONCLUSIONS

The study has identified that production line is at under utilization. This is because of inefficiency on the line cause in work overload or idle time. One of the most powerful tools can use for improving productivity is that of "Line Balancing" which aims at examining the way an activity is being carried out and simplifying the method of operation to reduce unnecessary or excess work. And by proper line balancing and plant layout we reduce the power consumption of machine.

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