International Journal of Engineering Research And Advanced Technology (IJERAT)
ISSN: 2454-6135 [Special Volume. 02 Issue.01, May-2016]

Performance Analysis and Improvement of Production Control Logistics Operations of Automotive Manufacturing Company using Lean Principles

G.V.Prabhushankar[1] and Ravi Kumar K[2]

[1]Head of the Department, Department of Industrial Engineering and Management , Siddaganga Institute of Technology, Tumkur – 572103, Karnataka, India.

[2]M.Tech student, Department Industrial Engineering and Management, Siddaganga Institute of Technology, Tumkur – 572103,Karnataka, India.

ABSTRACT

The objective was to study the plant layout of production control logistics of Automotive component manufacturing company, based on lean, plant layout and material handling principles for safe layout planning, effective utilization of the space, time and labour. In this study a detailed analysis of plant layout, flow of raw material, sorting process of raw materials, number of material handlings and stock details of raw material has been investigated. By considering the principles of plant layout and constraints of system, the new plant has been designed and compared with the present layout. The designed layout leads to easy flow of raw materials (uni-directional material flow), reduced number of material handlings, potential utilization of production control logistics area and time saving and labour saving in the company.

Key Words: *Production logistics, Throughput time, Plant layout, Lean manufacturing.*

---

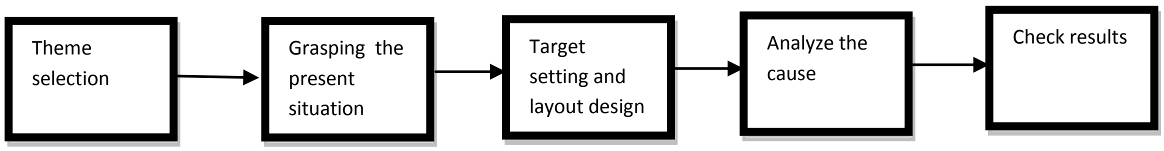
1. INTRODUCTION

With rapid increase in consumption rate, of manufacturing companies need to increase their effectiveness in quality, cost and delivery to compete against competitors. This calls for innovative approaches to problem solving and improving efficiency. Some of the innovative approaches used are lean manufacturing system, Total Quality Management (TQM) and six sigma. Apart from these innovative approaches conventional industrial engineering approaches such as time and motion study, ergonomics and plant layout and material handling systems are also being extensively used.

Plant layout design has become a fundamental basis of today's industrial plants which can influence the work efficiency. It is needed to appropriately plan and position employees, materials, machines, and other manufacturing supports and facilities to create the most effective plant layout. A new layout becomes necessary when the existing layout becomes ineffective and poor.

For the past three decades lean manufacturing has been practiced by organizations to improve their production systems. This concept originated in Japan after the second world war when Japanese manufacturers faced the problems such as insufficient materials, financial resources and unskilled human resources[1]. The Japanese could not afford the huge investment to implement mass production systems as practiced by US manufacturers. These conditions resulted in the birth of lean in Japan in the mid-1940s.Toyoda Kiichiro, president of Toyota motor company, Shigeo Shingo and Taiichi Ohno developed a new process improvement philosophy which is known as the Toyota Production System (TPS) or Lean Manufacturing [2]. Womack and Jones summarize five basic lean principles: value, value stream mapping, flow, pull and perfection [3]. Lean thinking establishes a way to do more with less human effort, less equipment, less time and less space while creating the product exactly as desired by the customers, i.e., pull. Finally, through continuous improvements activities perfection is achieved. The main idea is to minimize wastes or muda (the Japanese's word for waste) in order to increase the efficiency of production system. This means eliminating seven wastes such as: over production and inventory, unnecessary movement of material, waiting and delays, over processing, unneeded worker motion, and the defects. Lean layout, based around the principle of One Piece Flow, will enhance production performance, not only improving velocity of parts through the system but also reducing the amount of defects produced and eliminating waste by default [4].

2. METHODOLOGY



In this study an organised, purposeful structure of methodology consisting of interrelated and interdependent steps (components, factors, members, parts etc.) has been used. These steps continually influence one another to maintain their activity and existence of the system, in order to achieve the goal of the system.

2.1 Theme selection

In this step a detailed analysis of plant layout, flow of raw material, sorting process of raw material, number of material handlings and stock details of raw material has been investigated. During the investigation of present layout, it was found that there was wasted time, improper utilization of available space, that is to say, there was long movement of the material and frequent interruption as well as unutilized area of the plant. Then the theme was set as to develop the lean and safe layout after performing feasibility test among various alternatives.

2.2 Grasping the present situation

The detailed study of present layout was done in this section. The raw materials flow was not uni-directional. Distance movement of tow motor was found out to be 5.6 km/shift. Number of raw material handling was 6 times per part. Number of forklift operation was 4 times per part. Minimum stock in production control of Local Supply Parts(raw materials), complete knockdown parts and finished goods were 1.7 days,13 days and 0.8 days respectively. The aisle space was 51% of the total space allocated. 10% of the supplied parts to line side used to come back without being used. Safety objectives of plant layout were studied to get a fair idea of the plant. The interference between man and the forklift was 2, forklift to forklift was 1, tow motor to tow motor interference was 5. The existing layout of production control logistics is shown in the Fig 2.1.

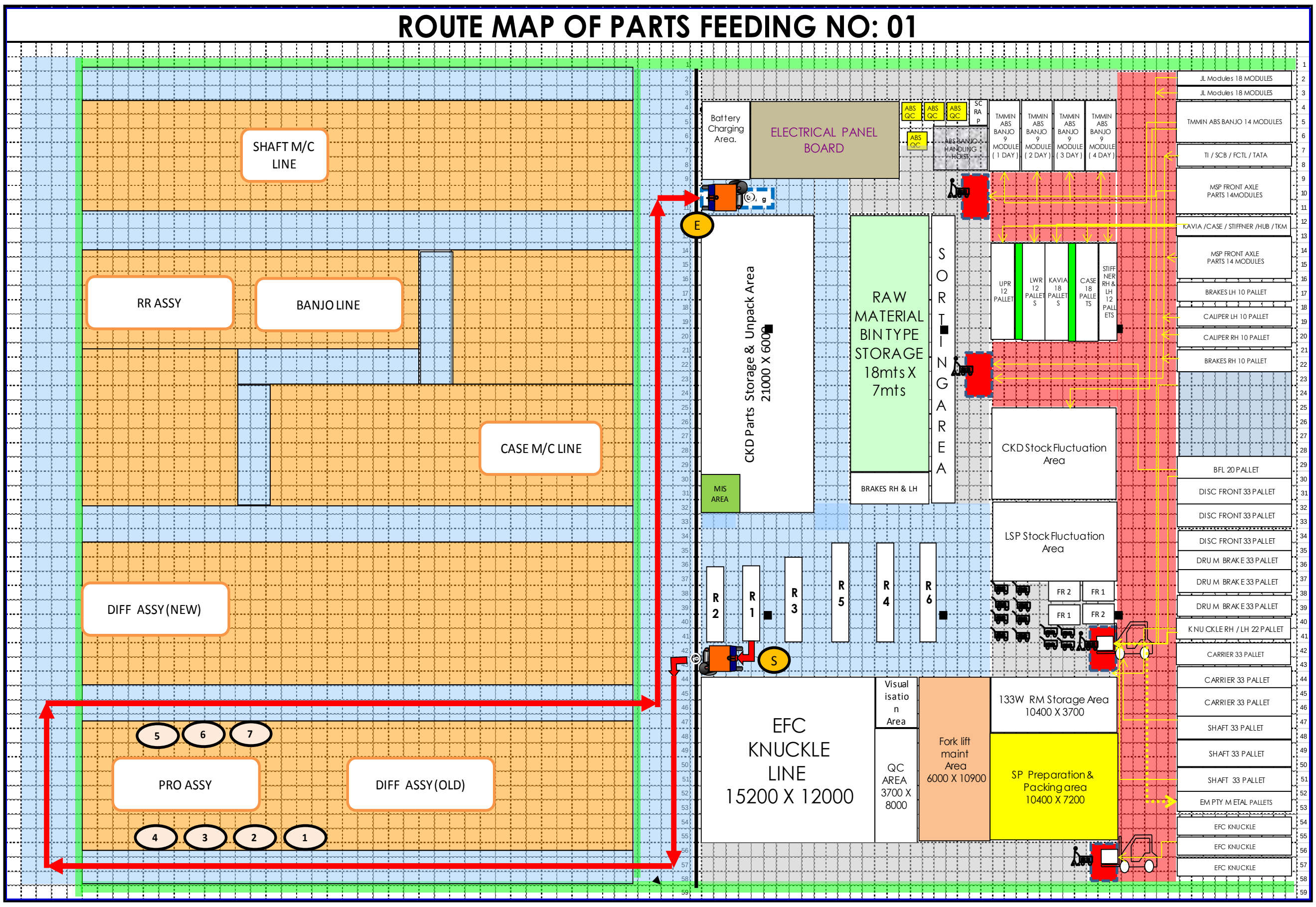


Fig 2.1 Present Layout of Production Control Logistics

2.3 Target setting

Target was set to develop the lean and safe layout of production control logistics. The targets are set under three categories such as safety, operational and quality. Under safety objectives, it was decided to eliminate man forklift and tow motor separation which was 5, and eliminate all 3 touch zones and also eliminate two way movement of the tow motor. Under operational objectives, elimination of sorting the local supply parts and to convert the zig zag material flow into unidirectional material flow, reduced inventory based on stuffing standardization for local supply parts. Also target was set to eliminate rack storage of local supply parts. FIFO (First In First Out) of raw materials was adopted to reduce damage to raw materials while waiting in the production control logistic area. This helps in eliminating issues related to quality. These are shown in Table 2.1

Table 2.1 Target Objectives

Safety	Operational	Quality
• Interference of Forklifts, man and Tow motor. • Reduce the number of touch zones. • No two way movement of tow motor.	• Sorting elimination of local supply parts • Unidirectional material flow. • Supplier based stuffing standardization for Local supply parts. • No rack location for LSP.	• FIFO

Based on the target objectives current performance indicators were identified and targets were set as ideal conditions. Effort was made to identify the gap and fulfil them. The problem clarification is shown in Table 2.2

Table 2.2 Clarifying Problem

Areas	Current condition	Ideal condition	Gap
Raw material inventory	1.7 days	0.7 days	1day
FG stock	0.8 days	0.7 days	0.1 day
CKD stock	13 days	5 days	8 day
Multiple handling	5 handling	2 handling	3 handling
Number of touch zones	5	2	3
F/L to F/L interference	3	0	3
Man entry into fork lift zone	3	0	3
Aisle space	51%	33%	18%

2.4 Analyze the cause

Brain storming session was carried out to analyze the cause. Some possible suggestion are given to reduce the inventory level of raw material, reduce multiple part handling, supply standardization, and safer logistics layout are tabulated in the Table 2.3

Table 2.3 Approach

Sl No	What	How
1	Reduce Inventory level - R/M & FG	• **Increasing arrival frequency by mixed stuffing in trucks**. • Selective Parts to be stored in Container & disposal of Non Moving parts. • Increase Stack height of Un touched Modules in safety stock area. • Storage methodology to be changed. • **Finished goods stock reduction considering domestic required**.
2	Increase in arrival Frequency	• **Reduce inventory by Increase in Arrival frequency of local supplier**.
3	Reduce Multiple Parts handling	• **Remodification of Lay out to point of usage storage**. • P-Lane Concept study & develop.
4	Supply Standardization	• **Unidirectional Flow.** • **Minimize Conveyance dist. by Parts storage near usage point.** • **Standardization of Aisle with respect to F/L operation (Movement & Switch Back).** • **Tow Motor Movement aisle standardization.**
5	Safer Logistics Lay out	• **Man Entry into F/L zone elimination by kaizens.** • **F/l to F/L interference elimination by lay out changeover.** • **Clear Visibility for Operation Control**

Further feasibility study was conducted on the above tabulated “Hows” and those which are appropriate to the situation (which are indicated in bold) were used in designing new layout. Using these, a new layout was designed. The proposed layout is shown in Fig 2.2

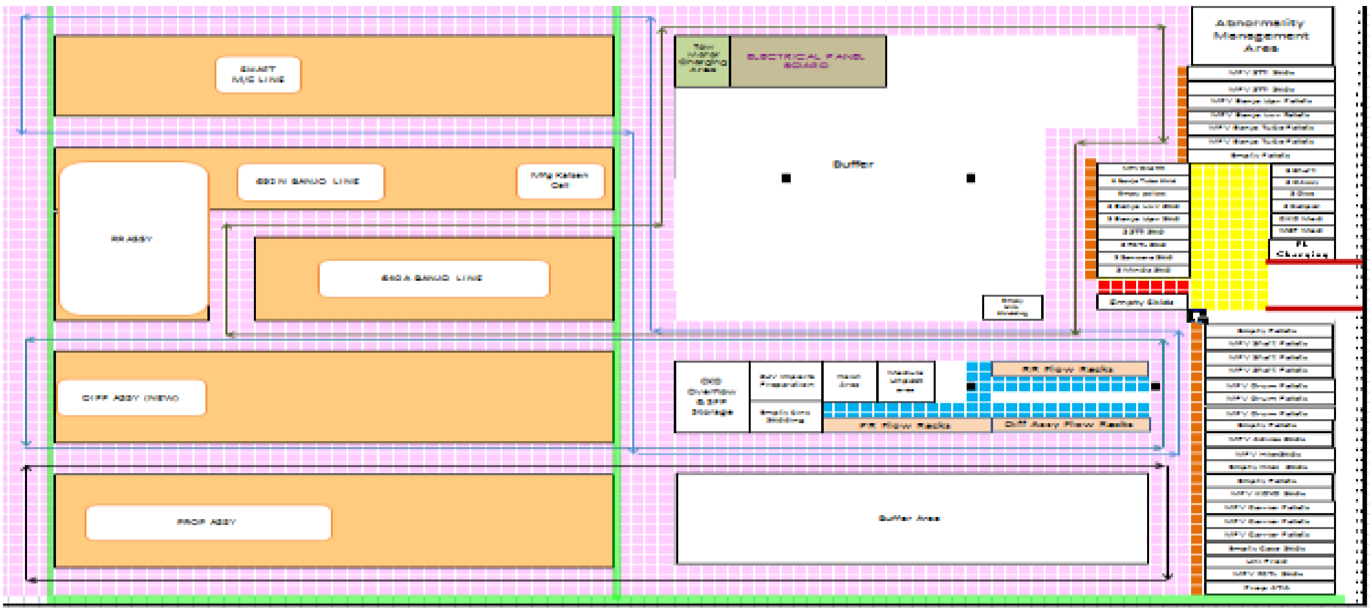


FIG.2.2 PROPOSED LAYOUT

2.5 RESULTS

It was found that number of handlings were reduced from 5 to 2, distance travelled by tow motor was reduced from 5 to 2 kilometres per shift, forklift interference was eliminated, and man entry into F/L zone are reduced from 4 to 2. Finally, rearranged layout, reduced inventory level of raw material from 1.7 days requirement to 0.7 days requirement, increased utilization of the available space, resulting in reduction in waste and increased production.

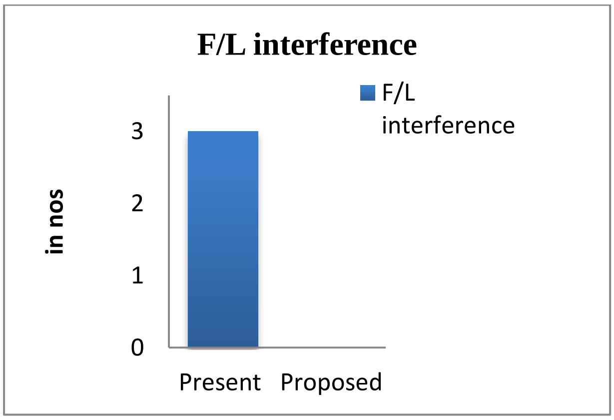


Fig2.3 F/L Interference Compared To Present

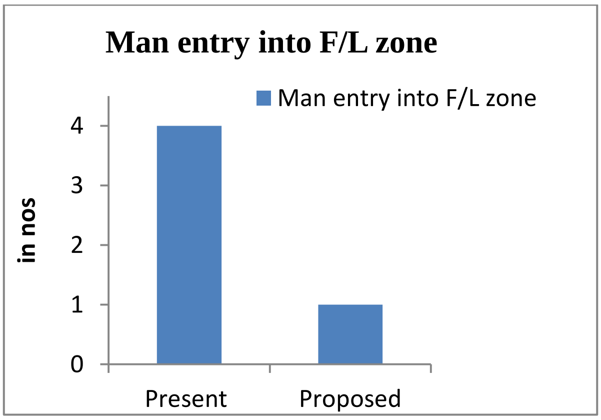


Fig 2.4Man Entry into F/L Zone Compared To Present

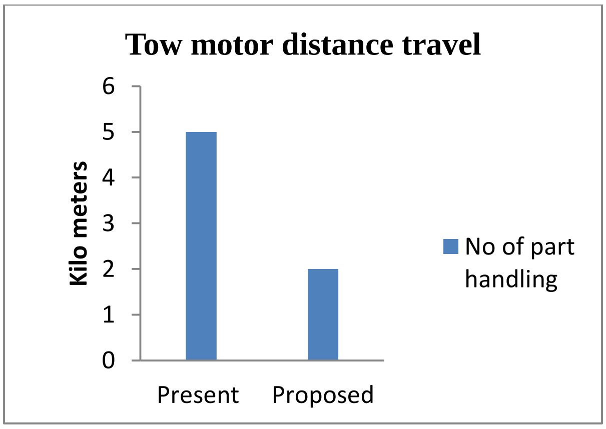


Fig 2.5 Tow motor Distance Travel Compared to Present

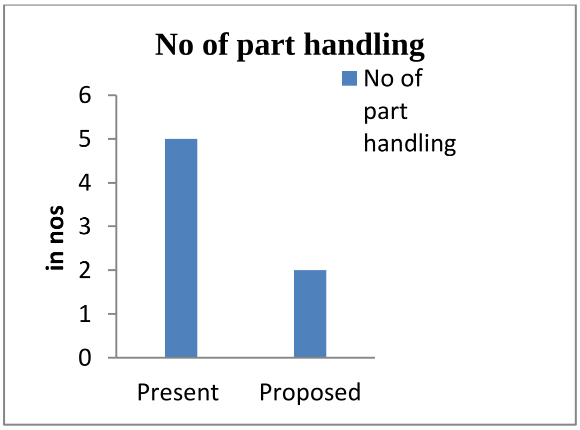


Fig 2.6 No of Part Handling Compared to Present

3. CONCLUSIONS

In this study, principles of plant layout, material flow and lean manufacturing principles were effectively implemented to solve the problem of forklifts, man and tow motor separation, the number of touch zones, two way movement of tow motor, sorting of local supply parts, zigzag material flow, supplier based stuffing standardization for local supply parts, rack location for local supply parts**,** and material flow (first in first out). A new layout has been designed which resulted in the number of handlings were reduced from 5 to 2, distance travelled by tow motor was reduced from 5 to 2 kilometres per shift, forklift interference was eliminated, and man entry into F/L zone are reduced from 4 to 2. Finally, rearranged layout, reduced inventory level of raw material from 1.7 days requirement to 0.7 days requirement, increased utilization of the available space, resulting in reduction in waste and increased production. Further, proposed layout also leads to unidirectional material flow.

REFERENCES

[1]. Ohno, T. (1988). Toyota production system: beyond large-scale production. Cambridge,MA, Productivity Press.

[2]. Womack, J.P., Jones, D.T., & Roos, D. (1990). The machine that change the world. New York, Free Press.

[3]. Womack, J.P., & Jones, D.T. (1996). Lean thinking: banish waste and create wealth in your corporation. New York, Simon & Schuster.

[4]. R Muther, "Systematic Layout planning", Mc Graw, 1955

[5]. M. Khansuwan and C. Poowarat, "A Study on Plant Layout Improvement": A Case Study at Kritchai Mechanical Company Ltd., a project for Bachelor's degree in Industrial Engineering, Faculty of Engineering, Thammasat University, 1999.

[6]. Pascal Dennis, 2002, '*Lean Production Simplified',* Second Edition, fourth Indian reprint 2012, Productivity Press, New York, USA.