

## Complimentary the Lean Manufacturing in Foundries by Including the Value Stream Mapping to Improve The Production of Cast Steel.

Praveen Tandon<sup>1</sup>, Dr. Ajay Tiwari<sup>2</sup>, Sunanda Das<sup>3</sup> and Shashikant Tamrakar<sup>4</sup>  
(Mechanical Engineering Department, Dr. C.V. Raman University, INDIA)

**ABSTRACT:-** As casting is a continuous & sequential process, it involves many steps. The time taken in each step is different. So we have to calculate the Takt Time. In a competitive market every organization is striving hard to get enhanced quality of product along with minimizing the production cost. Lean Manufacturing is a systematic approach to eliminate wastes, reducing the unnecessary cost and improves the efficiency of overall process. It is based on identifying and reducing waste coupled with continuous improvement. Value Stream Mapping (VSM) is an analyzing technique and streamlines work processes using the mechanism of Lean Manufacturing. VSM helps to monitor, identify, present and decrease waste in the processes. Any activity which does not add any value in the final product called waste and our ultimate aim is that it must be eliminated. VSM can serve as a guide line for Lean Manufacturing.

**Keywords:-** Lean Manufacturing, Value Stream, Value Stream Mapping, Cast steel, flow chart.

### I. INTRODUCTION

In this competitive market, every business organization is struggling hard to get more work done in less time. The aim of any business activity has been to continuously minimize waste and maximize flow of man, machine, money and time which would ultimately lead to satisfaction of customer by providing right product at the exact time in the desired quantity and the predetermined quality at an affordable price. This can be achieved by adopting and implementing lean manufacturing system which is more than a cost reduction program. It goals at eliminating wastes which could be in the form of overproduction and inventory, movement of materials, waiting and delays, over processing, extra activities, rework, unnecessary motion and defects in quality of final product.

Lean can be defined as a strategy & methodology for achieving significant and continuous improvement in performance thought of the elimination of all types of waste of resources and time in the total production process. Lean has a vital role to play in new product development and in the improvement in the design of existing products, including idea creation, design for manufacture, design for assembly and design for test, design for rapid prototyping, design for product, design for portfolio management, design for market and design for competitor analysis, design for management of risks, design for forecasting of sales, setting of key performance indicators and value analysis to reduce the cost of existing products. Industrial organizations are continuously striving hard to survive so as to increase their productivity and output of their operations and processes. Lean had been originally discovered and defined as the process of removing waste, Value Stream Mapping is a visualization which streamlines work processes using the tools and techniques of Lean Manufacturing.

VSM helps in identifying, demonstrating and decreasing waste in the processes. Waste being any activity that does not add value to the final product. Value Stream Mapping (VSM) is a visualization and representation which streamlines the work processes using the tools and techniques of Lean Manufacturing. VSM help to identify demonstrate and decrease waste in the processes. Waste being any activity in a process that does not add value to the final product. VSM can serve as a blue print for Lean Manufacturing.

On the basis of literature review related to LM and VSM, production in automotive industries had been increased successfully. Cast Steel foundry is a process comprised of various of stages and steps.

## II. CASE STUDY

A case study conducted at automotive industry and some of the observations may be useful to engineers in implementing VSM in small, medium and large industries.

## III. SELECTION OF PRODUCT FAMILY

The first step is selection of critical part family. After study of all part families, one part family was selected over all the product families. The frame is main assemblies in a car seat.

## IV. CURRENT STATE MAP

Before draw a current state map collect a require data to draw current state map. Data collecting method: Method that will be used in collecting data needed is observation to the activities that performed in the shop floor. Data is collected by using a stopwatch.

Time matrix for each process:

| Process Name      | Cycle Time(Value Added) | Operator |
|-------------------|-------------------------|----------|
| Cushion Assembly  | 416                     | 1        |
| Marriage Assembly | 265                     | 1        |
| Final Inspection  | 0                       | 2        |
| FG stock          | 5190                    | 0        |

Mapping the value stream always start with the customer demand. To create a current state map following steps are followed.

### Step-1 Calculate Takt Time

Takt time is defined as net available time divided by customer demand. The net available time is the total operation time during a specific period, meaning the total amount of time, which adds value on value stream. Customer Demand can be determined on customer forecast or based on the currently customer order.

### Step-2 Understand customer demand

Customer demand based on monthly or weekly. Customer demand is 1778 sets/month.

### Step-3 Map the process flow

This step involves various processes to complete the product. In addition, measure relevant data to put in a value stream mapping box. Moreover, see the WIP between two processes.

### Step-4 Map the material flow

The flow of material from raw material to finished goods is given by supplier to customer.

### Step-5 Map the information flow

The information flow provided demand information. Information are given by electronic or manually.

### Step-6 Draw the Time line

Calculate production lead times for inventory triangles by dividing quantity of inventory by the customer daily requirement. Current State Map shown in Fig 1.

### 4.3 Future State Map

Analyzing the current state map, the lead time and amount of inventory are more between processes. Supermarket is used between two processes to reduce inventory wastage during process and convert the process from build to stock (push) to make to order (pull). Future State Map shown in Fig 2.

## V. SOFTWARE USED TO DRAW VSM

E-Draw Max, Version 7 was used to draw all the maps. EDraw Max is vector-based diagramming software with rich examples. E-Draw Max software is easy to create flow charts, network-diagrams, chart and graphics, value stream mapping, SWOT diagram etc. E-Draw Max includes all the libraries and examples of E-draw product line.

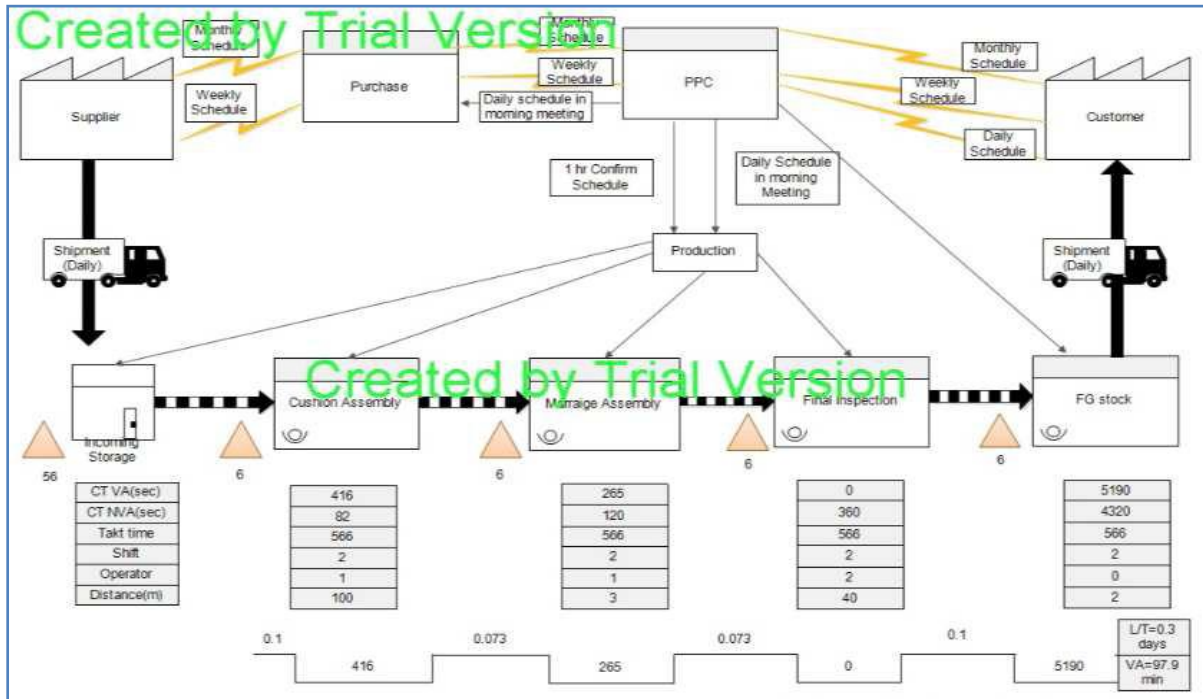


Fig 1:- Current State Map

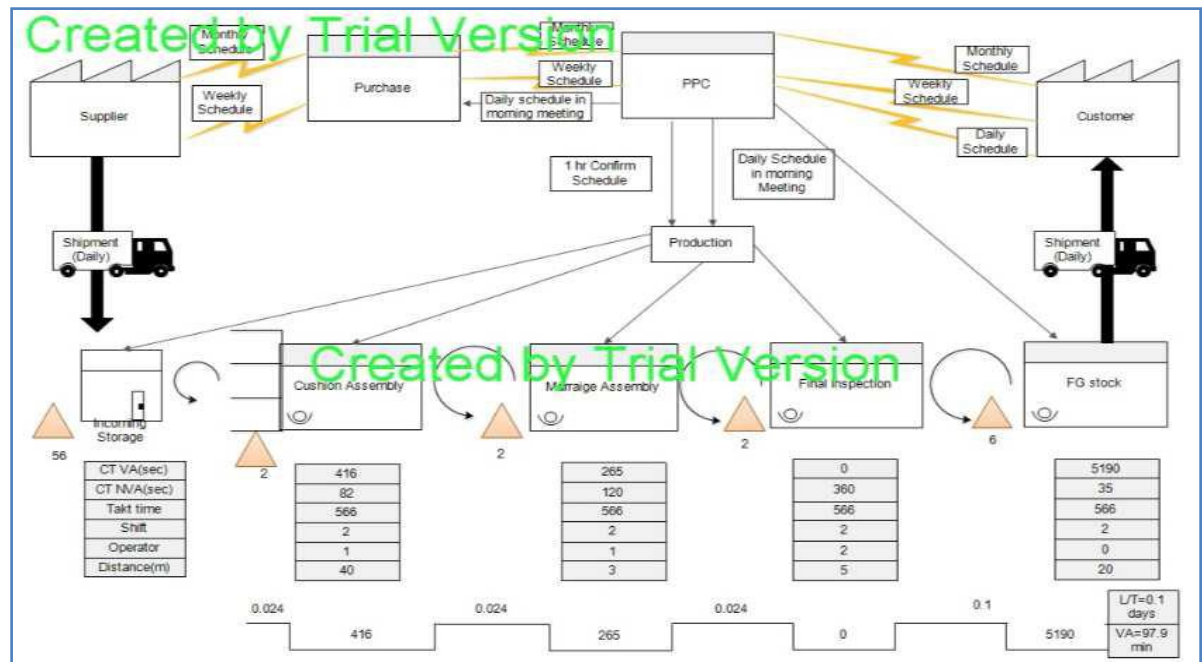


Fig 2:- Future State Map

**VI. COMPARISON OF CURRENT STATE MAP AND FUTURE STATE MAP VARIABLE BEFORE AFTER IMPROVEMENT**

|                     |              |            |              |
|---------------------|--------------|------------|--------------|
| <b>Lead Time</b>    | <b>0.3 0</b> | <b>.1</b>  | <b>66.7%</b> |
| <b>C/T NVA(sec)</b> | <b>802</b>   | <b>597</b> | <b>25.6%</b> |
| <b>Distance(m)</b>  | <b>145</b>   | <b>68</b>  | <b>53.1%</b> |

## **VII. CONCLUSIONS**

By using value stream mapping we observed that non-value added time is reduce by 25.6%.Also,the  
WIP is reduced and thereby lead time is reduced by 66.7%.This proves the utility of value stream mapping  
technique..

## **REFERENCES**

- [1]. Juan C Tinoco [2004] "Implementation of Lean Manufacturing"
- [2]. R.M.Belokar, Vikas Kumar, Sandeep Singh Kharb, "An application of value stream mapping in automotive industry",
- [3]. IIITEE, July-2012, pp 152-157
- [4]. G.Saranya, Mr.S.B.Nithyananth, "Improvement of crankshaft assembly supply chain using lean techniques", IJMER, Apr-2012, pp-403-406
- [5]. Rahul R Joshi, Prof G.R.Naik, "Process improvement by using value stream mapping", IJERT, July-2012
- [6]. J.Dinesh, A.Prabhukarthi, "Reduction of lead time using value stream mapping in pump manufacturing industry", MISSA, April-2013.
- [7]. Soniya Parihar, Sanjay Jain, Lokesh Bajpai, "value stream mapping: Case study of assembly process", IJERT, Oct-2012.
- [8]. Anderes Nielsen, "Getting started with value stream mapping, 2008.
- [9]. Rother M., J.Shook, "Learning to see", Lean Enterprise Institute, 1999
- [10]. Emil suciu, Mihal, Arvinte value stream mapping-A lean production methodology, 2011