

## REDUCING THE SHORTAGE OF GREEN TYRE IN TYRE MANUFACTURING PROCESS

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### ABSTRACT

Tyre manufacturing is an ever growing industry which annually produces more than a billion tyres world over. Standardized tyre manufacturing process includes mainly of compounding and mixing, component manufacturing and assembly, curing and finishing steps. Out of these steps tyre building is the process in which the materials are assembled to obtain the final shape and dimension. This is called the green tyre. The aim of this study is to find out the major causes affecting the shortage of green tyre in tyre building machine and to give suggestions to overcome these causes. In this paper Root cause analysis is done in order to find out the major problems affecting the green tyre shortage and some suggestion were also given to reduce these shortage.

**KEYWORDS:** Cause and Effect Diagram, Pareto Chart, Root Cause Analysis, Green Tyre

### INTRODUCTION

Rubber processing industry is a major branched one because of the production of a lot of products for various applications. Products from polymers and composites with a polymer matrix find a wide range of applications [1].

The rubber industry plays a very important part in polymer processing since the tyre production occupies a dominant position in this branch. Thus the tyre production is very important for in industrial development, especially regarding the raw material consumption. New firms in market have increased competition. Most of the industries focus on product quality, product cost and productivity. Because of these, a company should have to reduce the production losses in order to increase the productivity to satisfy the market demand. To increase the productivity, the right quality and quantity of all the components needed for the assembly should be available at right time. Production loss is mainly due to unavailability of the component at the assembling unit.

Root cause analysis (RCA) is a method of problem solving that tries to identify the root cause of problems which is affecting the production loss. Root cause analysis practise tries to solve problem by attempting to identify and correct the root causes of events, as opposed to simply addressing their symptoms [3]. By focussing correction on root causes, problem recurrence can be prevented.

A case study is conducted on one of the leading tyre manufacturing industry in the world. The company is focussing to reduce the production loss of green tyre in tyre building machine. So as a fore work to reduce the production loss of green tyre, case study, Root cause analysis for reducing the production loss in the company's manufacturing unit is

conducted. The objective of study is to find out the major problems in the company which causes a production loss and to suggest counter measures to minimize the effect.

The company is facing the production loss of green tyre in tyre building machines, so that they are not able to meet its demand in the market. So the firm has to reduce the unwanted losses of production so as to maintain the steady production level and to meet the demands in the market. In order to reduce the green tyre loss all the assembly components should be available at right time in quantity and quality to meet the demand. If any one of the component is facing the shortage at the assembling unit, then it may lead to green tyre loss which will affect the overall productivity. Production may be stopped due to many reasons such as material shortage, absenteeism, breakdown etc.

Case study was conducted on the production loss of green tyre of the company and to find out the root cause of these losses so as to eliminate them and to decrease the production loss caused due to these problems.

## ROOT CAUSE ANALYSIS

The RCA is a four step process involving the following

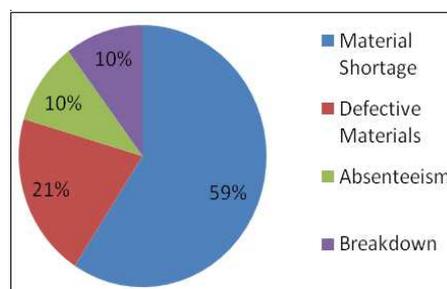
- Data collection
- Cause charting
- Root cause identification
- Result and analysis

### Data Collection

Green Tyre loss data was collected for six months (APR-13 to Sep-13) from the stock preparation book of the company. The tonnage losses of each of the major causes are given in Table 1.

**Table 1: Causes and the Tonnage Losses**

Sl. No.	Causes	Tonnage Loss in MT
1	Material Shortage	2.9
2	Defective Materials	1
3	Absenteeism	0.5
4	Breakdown	0.5



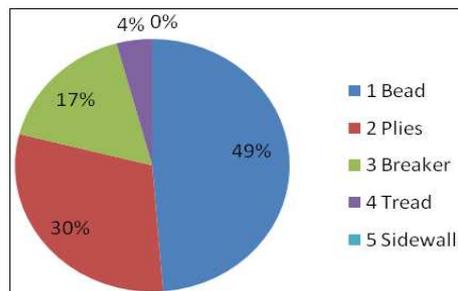
**Figure 1: Pie Chart Showing Causes for Production Loss**

From the Figure 1 it is clear that the material shortage (59%) accounts for the most of production loss of green tyre to the company. There are different types of materials which are used in green tyre for assembling in tyre building

machines are bead, plies, breakers, tread, sidewalls. The tonnage losses of each of the material shortage are given in Table 2. From the Figure 2 it is clear that the bead shortage accounts (49%) of the production loss to the company.

**Table 2: Material Shortage and the Tonnage Losses**

Sl. No.	Material Shortage	Tonnage Loss in MT
1	Bead	5.8
2	Plies	3.6
3	Breaker	2
4	Tread	0.5
5	Sidewalls	0.0



**Figure 2: Pie Chart Showing Material Shortage for Production Loss**

From the chart it is clear that the bead shortage has an tremendous influence on the green tyre loss. Bead preparation unit has 3 stages

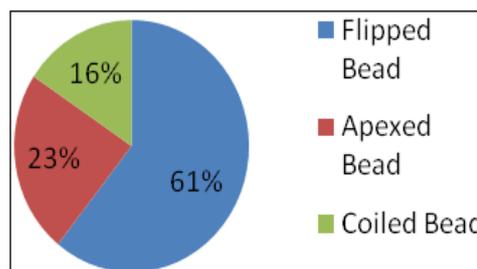
- Bead coiling
- Bead apexing
- Bead flipping

Tonnage losses of each of the material shortage is given in the Table 3

**Table 3: Material Shortage and the Tonnage Losses in Bead Preparation Unit**

Sl. No.	Material Shortage	Tonnage Loss in MT
1	Flipped Bead	3.1
2	Apexed Bead	1.2
3	Coiled Bead	0.8

From the Figure 3 it is very clear that flipped bead causes for the major production loss. It accounts 60% of losses compared to coiling and apexing. So that root cause analysis was conducted to identify root cause of the flipped bead.



**Figure 3: Pie Chart Showing Material Shortage in Bead Preparation Unit**

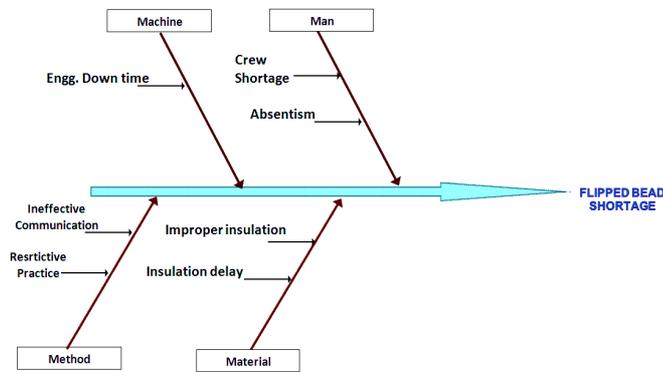
**Cause Charting and Root Cause Identification**

Cause and effect diagrams or Ishikawa diagrams (Fish bone diagram) is one of the seven basic tools of quality, which is used to identify potential factors causing an overall effect.

It was used in the study to identify the root cause of major problems which is identified in the previous section. A Pareto chart, where individual values are represented in descending order by bars, and the cumulative total is represented by the line. The left vertical axis is the percentage tonnage loss and right vertical axis is the cumulative percentage of tonnage loss. The purpose of Pareto chart is to highlight the most important among a set of factors.

**Root Cause Identification of Flipped Bead**

The flipping is the bias cut, slitted fabric for wrapping the bead bundle. The purpose of flipping is to protect the bead from damages in further processing.

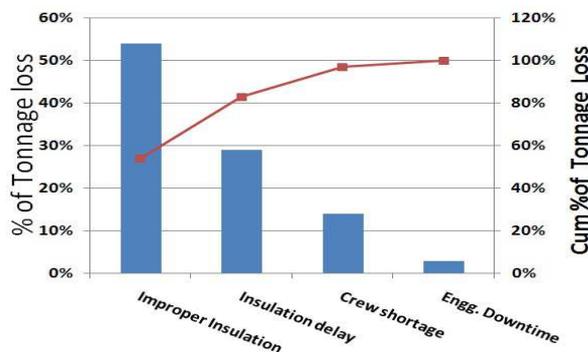


**Figure 4: Initial Cause and Effect Diagram of Flipped Bead Shortage**

Figure 4 shows the initial cause and effect diagram of flipped bead shortage. The cause of flipped bead shortage may be due to improper insulation, insulation delay, crew shortage and engineering downtime.

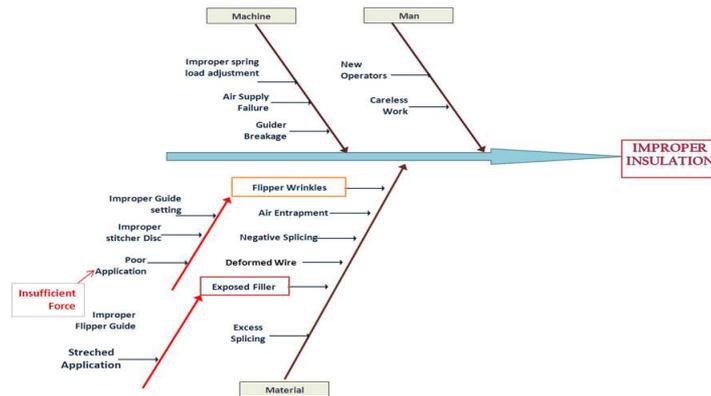
**Results and Analysis**

A Pareto chart Figure 5 was constructed as per the percentage of loss in hours of each causes of flipped bead shortage. From the graph it is clear that the improper insulation is the major causes of flipped bead shortage.



**Figure 5: Pareto Chart of Flipped Bead Shortage**

A detailed study was conducted on causes for flipped bead shortage and the final cause and effect diagram is prepared as given in Figure 6.



**Figure 6: Final Cause and Effect Diagram for the Improper Insulation Flipped Bead**

Reasons for the improper insulation was identified as poor application and the root cause of poor application is due to insufficient force acting on the flipper guide mechanism.

From the cause and effect diagram, the root cause of flipped bead shortage was identified. In the case of improper insulation of flipped bead is identified as the major cause of flipped bead shortage. Insufficient force acting on the flipper guide is the root cause for the improper insulation. By providing the DSBC 32-125 mm cylinder having an air pressure of 6 bars and 450N force is the counter measure for preventing the improper insulation of flipped bead.

## CONCLUSIONS

Root cause analysis was conducted for the major causes affecting production loss to the company. Root causes of production loss of green tyre were identified using cause and effect diagram. Counter measures causing production stoppage was also suggested.

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