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Optimization of Quality and Productivity with Systematic Layout Planning

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Abstract: *To achieve the objective of high profitability, manufacturers are keen to reduce their operational cost. Improving quality and reducing the chances of defects helps in reducing operational cost, thereby, helps to increase efficiency and profitability. Identifying the key areas where quality can be improved and attaining the quality objectives is part of continual improvement in manufacturing companies. The research paper emphasizes on improving the quality at manufacturing cell with the help of management techniques that do not require significant investments but much desirable results are achieved.*

Keywords: *layout, rejection, dent & damage, handling.*

I. INTRODUCTION

An automobile constitutes of hundreds of small parts that are arranged together in proper manner. Automobile companies today do not tend to manufacture all the components they require to manufacture an automobile. Instead, they prefer outsourcing of the components. For this purpose, they develop vendor companies. The vendor companies manufacture components from scratch and supply them to automobile manufacturers, the key characteristics being quality products, economical price and timely delivery. For these industries, price of the components is decided by end customer only and to achieve high productivity, it is of at most important to manufacture high quality components by incurring minimum costs.

In today's competitive business environment it is of at most importance to keep business operations highly efficient and flexible to cope up with ever changing customer requirements and sustain and grow in neck to neck competition.

To optimize, sustain and improve business operations, industries adopt standardized procedures that are acknowledged worldwide. Implementation of these standardized procedures add business value to organization. Hence, in recent times it can be seen that organizations investing heavily in standardization of their day to day business operations.

II. BUSINESS OBJECTIVES

- A. To optimize cylinder block cell that has maximum rejection records in the plant.
- B. To reduce cost of poor quality by improving quality at cylinder block cell.

III. RESEARCH OBJECTIVES

- A. To find measures that will lead to optimization of cylinder block cell.
- B. To identify defect characteristics and neutralize them to improve the quality.

IV. RESEARCH METHODOLOGY

Applied research is a form of systematic inquiry involving the practical application of science. It accesses and uses some part of the research communities accumulated theories, knowledge, methods, and techniques, for a specific, often state, business, or client driven purpose. Applied research is contrasted with pure research in discussion about research ideals, methodologies, programs, and projects.

Applied research deals with solving practical problems and generally employs empirical methodologies. Because applied research resides in the messy real world, strict research protocols may need to be relaxed. For example, it may be impossible to use a random sample. Thus, transparency in the methodology is crucial. Implications for interpretation of results brought about by relaxing anotherwise strict canon of methodology should also be considered. Since Applied Research has a provisional close to the problem and close to the data orientation it may also use a more provisional conceptual framework such as working hypothesis or pillar questions. Following are the sources used for data collection.

A. Primary Data Source:

Observation Method:-

1. By observing and spending time on actual work field of all departments data is collected.
2. Study of 4MT conditions:

4MT study is the standard way to study any manufacturing cell. It gives overall idea of working conditions at the cell, information of product and helps to identify problems and provides scientific way to collect data in order to find solution. Data was collected by Observing manufacturing cells and study 4MT conditions on the cell to identify problem and reach to the root cause of problem. 4MT stands for:

- Man
- Machine
- Method
- Material
- Tool

Interview Method

- By doing interviews of the officials and the workers of all departments data is collected.

B. Secondary data sources:

- Daily inspection reports.
- Management review meeting report.
- Non conformity reports

V. DATA ANALYSIS

The cylinder block cell is dedicated to production of cylinder blocks of 2 wheeler automobiles of Bajaj Auto Ltd.(BAL). Following components are manufactured in this cell:

- 1) Cylinder block JD
- 2) Cylinder block JE
- 3) Cylinder block D106A

4) Cylinder block C101

Total inspection quantity carried out on this cell in last six months for each component is shown in following table:

TABLE I: Total inspection quantity

PART	TOTAL INSPECTION QTY/MONTH(2016)					
	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE
CYL. BLOCK JD	6948	6544	3629	8941	8011	2666
CYL. BLOCK JE	8393	7912	9271	4645	15937	4960
CYL. BLOCK D106A	7652	8871	8689	5915	8061	914
CYL. BLOCK C101	-	-	18294	24733	17954	3283

A. Rejection:

Total rejection is classified into two categories.

- 1) Casting rejection.
- 2) Machining rejection.

Out of these two categories, casting rejection can only be detected and not avoided at manufacturing cell end but machining rejection can be detected, controlled and prevented at manufacturing cell end.

Machining rejection:

Machining rejection of a part manufactured can be due to one of following reasons.

- 1) Dent/ damage
- 2) Dimensional inaccuracy
- 3) Operation miss
- 4) Step mark
- 5) Chattering
- 6) Dimensional shift
- 7) Setting damage.

B. Sources of rejection:

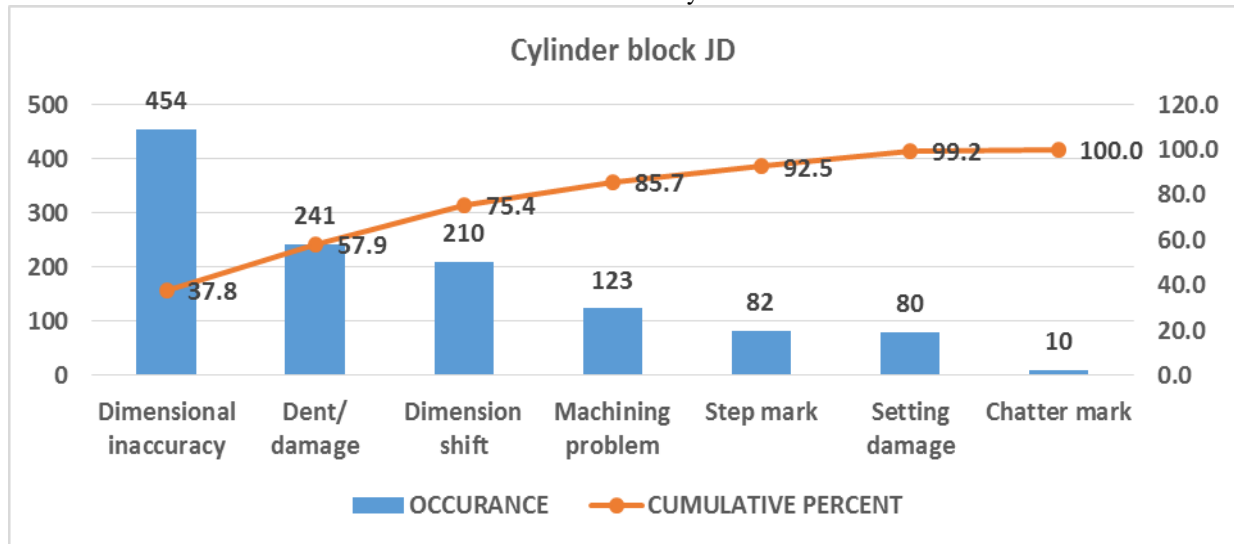
TABLE II: Defect matrix (4MT)

Sr.no.	Phenomenon	Sources				
		Man	Machine	Material	Method	Tool
1	Dent/ damage	•			•	
2	Dimensional inaccuracy		•			•
3	Dimension shift		•			•
4	Step mark		•			•
5	Chattering		•	•		
6	Line mark		•			•
7	Setting damage	•	•			•

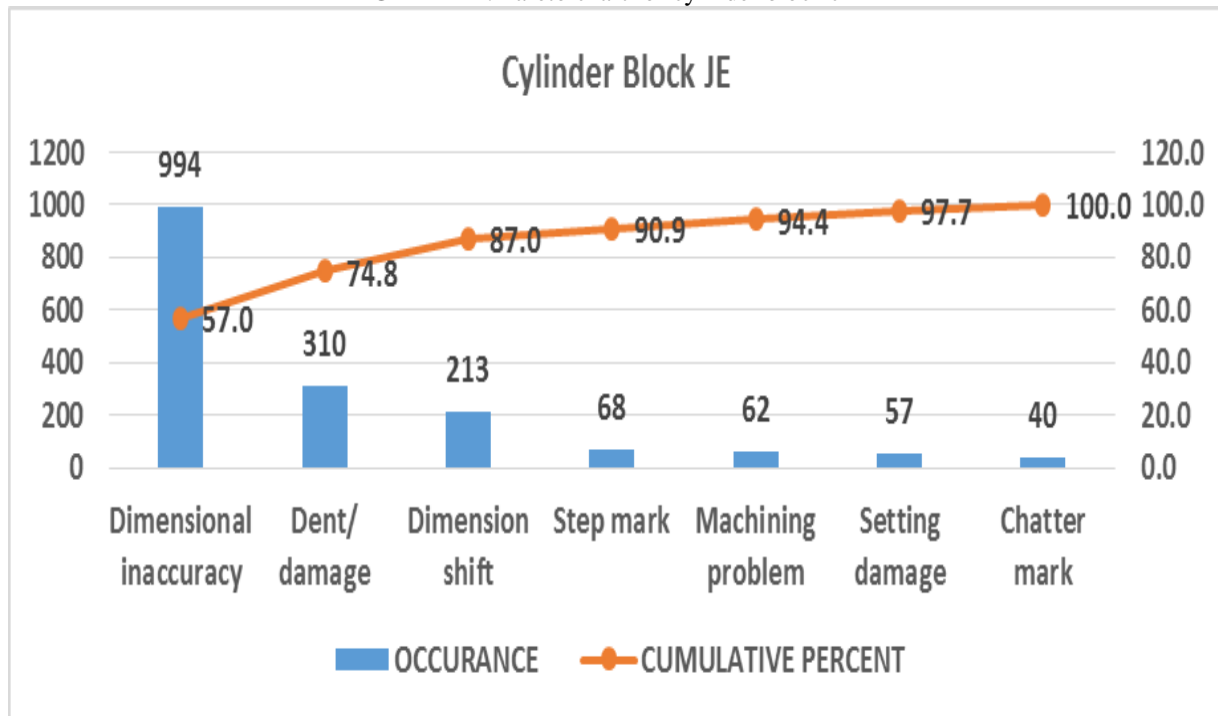
Pareto analysis:

- Pareto Analysis is a statistical technique in decision-making used for the selection of a limited number of tasks that produce significant overall effect. It uses the Pareto Principle (also known as the 80/20 rule) the idea that by doing 20% of the work you can generate 80% of the benefit of doing the entire job.
- Pareto analysis is based on Pareto charts. Pareto charts for each of cylinder block based on rejection data during January 2016- June 2016 are given below:

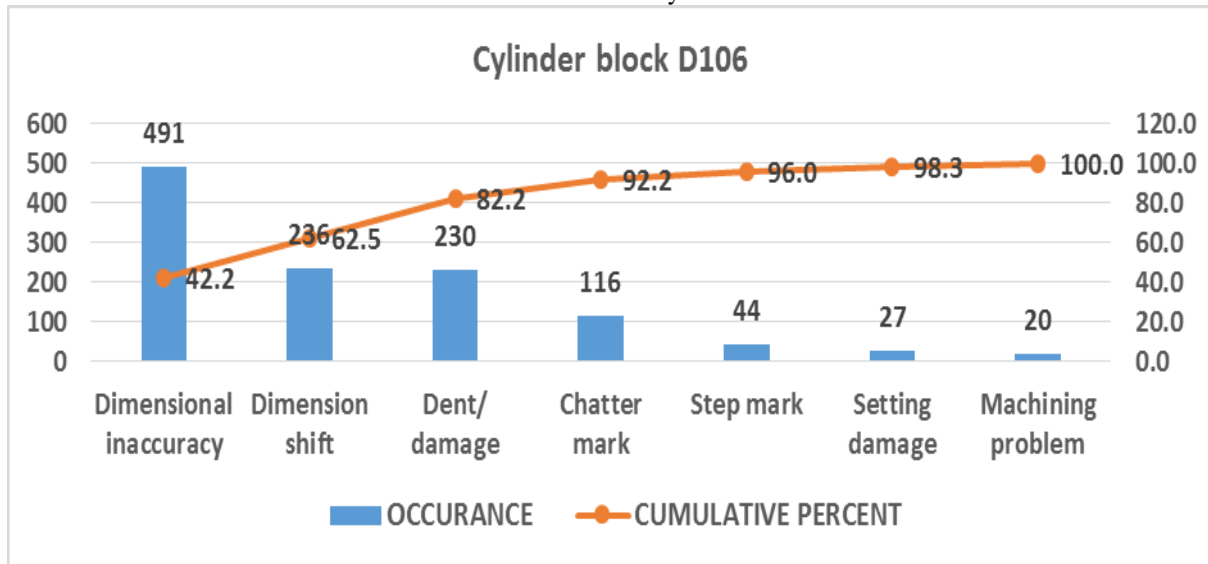
GRAPH I: Pareto chart for cylinder block JD



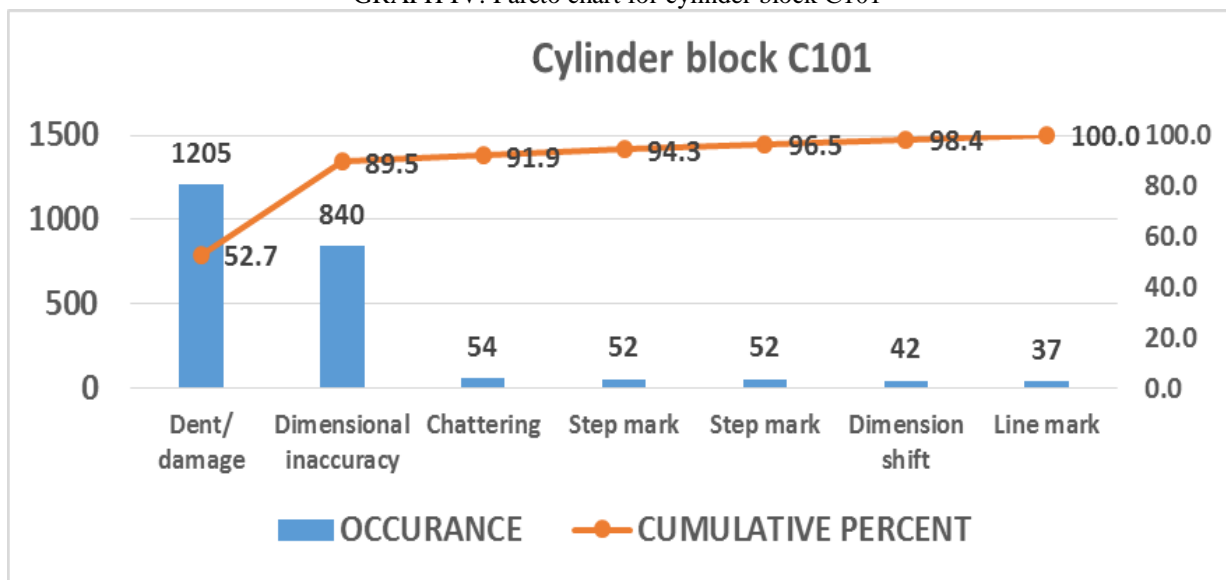
GRAPH II: Pareto chart for cylinder block JE



GRAPF III: Pareto chart for cylinder block D106

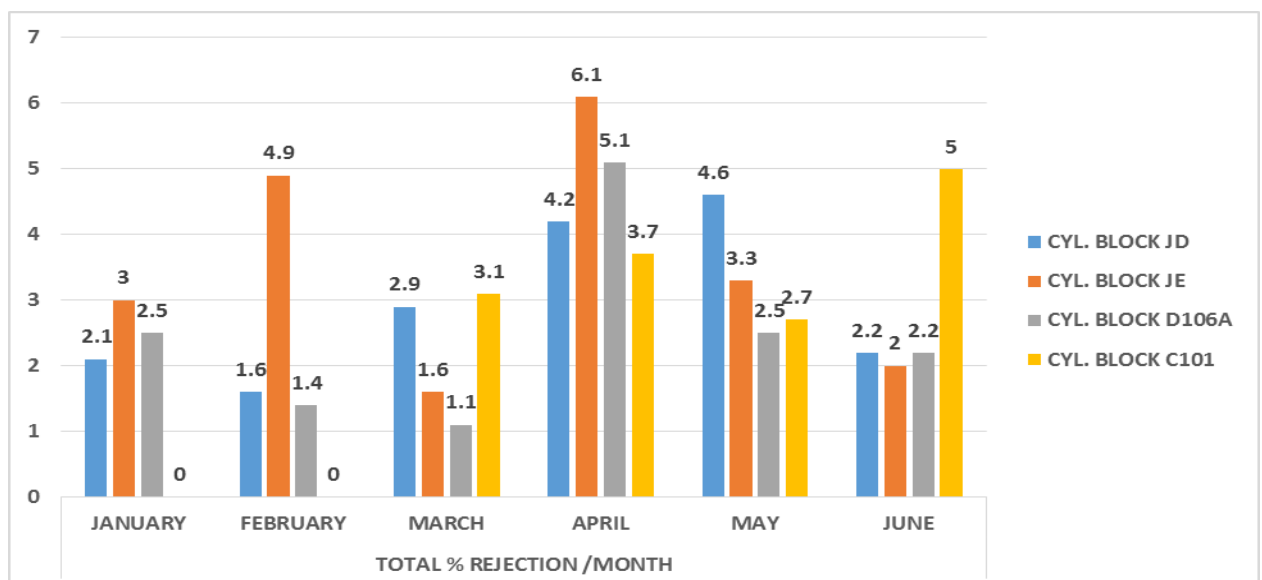


GRAPH IV: Pareto chart for cylinder block C101



C. Total Rejection Percentage:

GRAPH V: Total rejection per month in 2016



By analyzing the graphs, it is clear that, major repetitive rejection phenomenon: Dent & damage.

Following table shows the percentage of rejection due to damage/dent in total rejection in last six months.

D. Sources of Damage/Dent Rejection:

Probable sources of rejection due to damage and dent are:

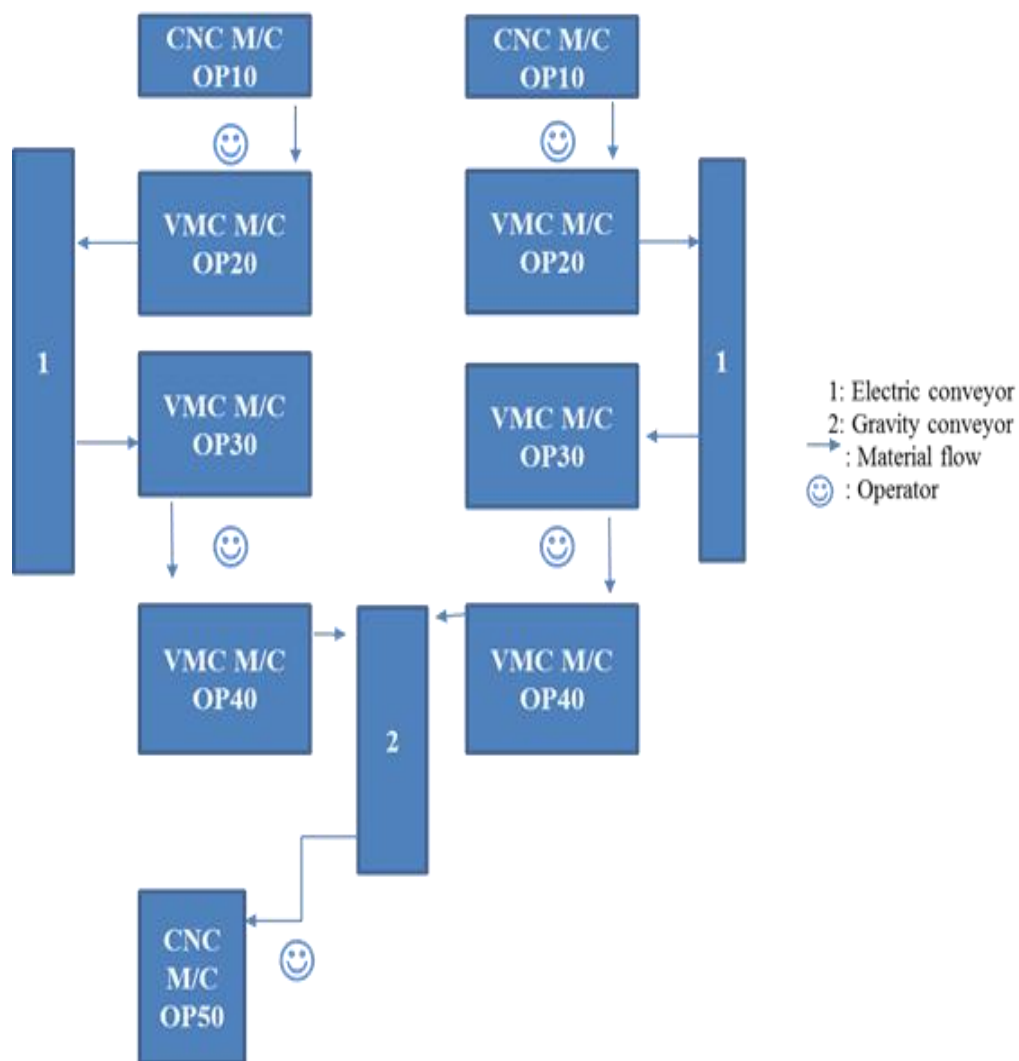
- 1) Damage at workstation.
- 2) Handling damage during operation.
- 3) Damage on conveyor.

VI. STUDY AND ANALYSIS

A. Current cell layout:

Current cell layout of cylinder block cell is as follows:

IMAGE I: Current cell layout



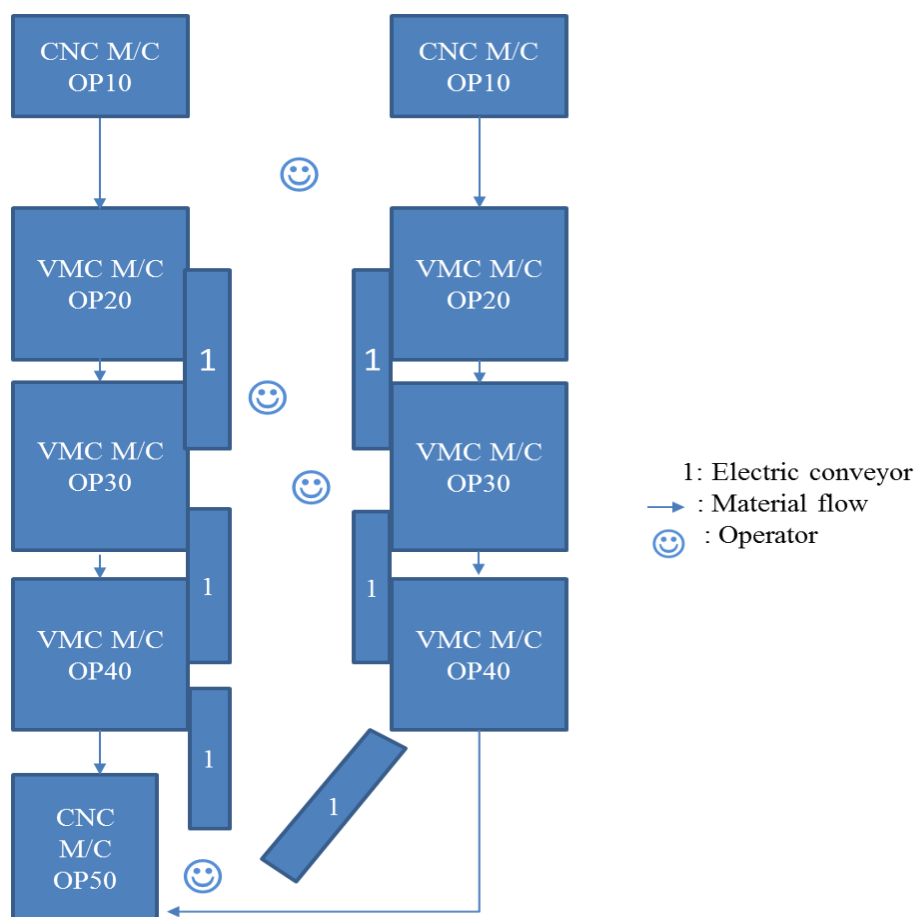
Observations:

- i) Conveyors are oversized
- ii) Need of careful material handling
- iii) Need to ensure cleanliness of bins before use.

B. Scope of improvement:

Proposed cell layout:

IMAGE II: Proposed cell layout

*Improvement Possibilities in New Layout:*

- 1) Reduced material handling
- 2) Single piece material flow
- 3) Elimination of electric conveyors
- 4) Proper material handling
- 5) Reduced human resource requirement from 5 to 4.

VII. CONCLUSION

- 1) Avoiding sources of damage:
 - i) Handling damage during operation
 - ii) Damage on conveyors

Number of sources of rejection cleared: 2

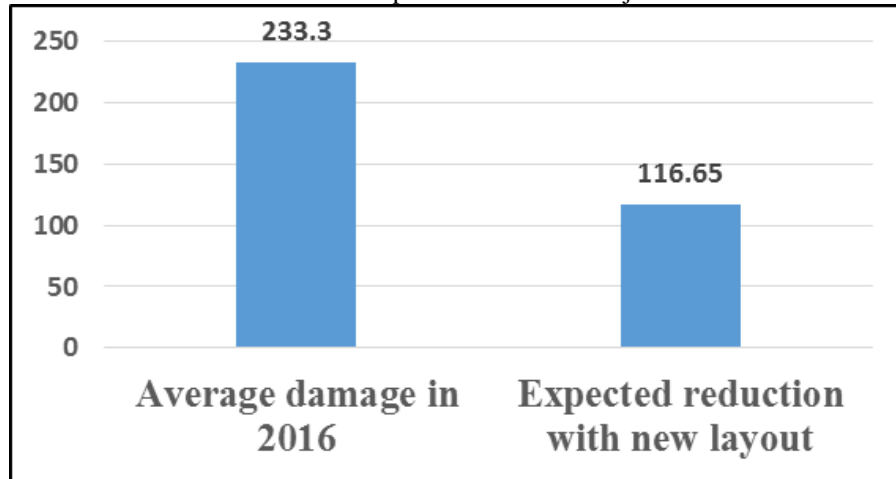
Expected reduction in damage/dent of components: at least 50%

Components rejected on cylinder block cell due to damage/ dent in 2016:

TABLE: average components rejected due to damage in 2016

January	February	March	April	May	June	Average
86	62	298	449	244	261	233.33

GRAPH VI: Expected reduction in rejection



- 2) Reduction in Cost of poor quality by approximately 40%.
- 3) Reduction in manpower requirement.

TABLE III: Man power reduction

	MAN REQUIREMENT/ SHIFT	NO. OF SHIFTS/ DAY	TOTAL MAN REQ./ DAY	APPROX WAGE OF 1 OPERATOR/ MONTH	TOTAL WAGES/ MONTH
BEFORE	5	3	15	8000	120000
AFTER	4	3	12	8000	96000

Savings in wages: 24000/ month.

- 4) Ease in supervising.
- 5) Savings in maintenance of conveyor systems.

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