Rework Reduction of Gaps and Alignments in an Automobile Assembly Plant

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Abstract
India is one of the fastest growing hubs for auto manufacturing industry. Most of the global auto manufacturing leaders are moving towards Indian market. In this study, the productivity of an automobile assembly plant XYZ is improved by implementing lean techniques and IE tools. The focus of this study is tackling a frequent problem of nonconforming gaps and alignments in a particular car model assembled in the plant. This paper explains the methodology implemented to reduce cycle time as well as rework caused by nonconforming gaps in a detailed manner.

Index terms — root cause analysis, gaps, alignments, cause effect, graphical analysis.

1 Introduction
The XYZ assembly plant consisted of four major production units namely Body shop, Paint shop, Assembly line and Finish line. Body shop, Assembly line and Finish line each has a quality-check workstation at the end of their respective lines. Nonconformity of gaps and alignments, of a certain car model assembled in the plant was observed frequently. This nonconformity to standards resulted in excess rework after the quality-check of Assembly line. The workstation where these gaps and alignments were set acted as a bottleneck for the entire assembly line (because operators of this workstation were required for heavy rework frequently) which in turn affected the productivity of the entire plant. Process standardization was required along with verification of Body shop and Assembly line standards for gaps and alignments. The cause of excess variation in dimensions wastobe identified.

2 II.
3 Preliminary Analysis a) Root Cause Analysis
Defined problem was rejection of cars due to measure of gaps and alignments present not conforming with the allowed specifications. Checkpoints between ‘door and fender’ of the car were identified to be in the crash zone and 100% cars were affected by this problem. Location of the problem was identified to be the workstation of Assembly line where gaps and alignments were set. For future reference, the workstation will be named -Station 18.

4 b) Cause Effect Diagram
The cause effect diagram revealed that the operator checking process for gaps and alignment was improper and could be a potential cause of excess variation. Another plausible cause identified was irregular recalibration of filler gauges rendering them to show incorrect values of gaps.

5 Methodology
Four major tasks were implemented to tackle this issue. These tasks included identification of missing checkpoints in Body shop, collecting data for four important checkpoints at four different stages and plotting graphs. IV.
On performing root cause analysis and analyzing the trends of different measurements of gaps and alignment, recommendations of gap setting at Body shop are provided. Apart from that, standardization of the process, placing skilled operators for setting gaps and revising the standards was recommended.

6 a) Identifying missing checkpoints for gaps and alignments

7 Results and Conclusion

Similar methodology can be implemented for other crucial gaps and alignments. Bonnet and front bumper gaps can be considered as cycle time is increased drastically if the process is not efficient and standardized. Further an electric measurement system could be used to minimize time required to take readings.

Figure 1: Fishbone Diagram Tool

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Figure 2: Figure 2:

- Assembly Line
  - 4 points—Sidewall 1, Sidewall 2, Sidewall 3, Sidewall 4

- Body Shop
  - 2 points—Sidewall 2, Sidewall 4

Figure 3: Figure 3:

- Assembly Line
  - 3 points—Sidewall 6, Sidewall 7, Sidewall 9

- Body Shop
  - 2 points—Sidewall 6, Sidewall 9

These 2 points missing in body shop standards
7 RESULTS AND CONCLUSION

- Assembly line
- Body Shop

Figure 4: Figure 4:

3 points—Sidewall 10, Sidewall 11, Sidewall 12
2 points—Sidewall 11, Sidewall 12

- Assembly Line
- Body Shop

Figure 5: Figure 5:

1 point—Front 19 Gap and alignment
1 point—Front 19 only Gap (no alignment)

Figure 6: Figure 6:

<table>
<thead>
<tr>
<th>Body No.</th>
<th>Body Shop</th>
<th>Panorama</th>
<th>ST.18 (BS)</th>
<th>ST.18(A)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Front 15</td>
<td>Front 19</td>
<td>Front 15</td>
<td>Front 19</td>
</tr>
<tr>
<td>20105557</td>
<td>2.7</td>
<td>1.2</td>
<td>35</td>
<td>43</td>
</tr>
<tr>
<td>20105562</td>
<td>2.7</td>
<td>1.7</td>
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<tr>
<td>20105569</td>
<td>1.2</td>
<td>1.5</td>
<td>35</td>
<td>39</td>
</tr>
</tbody>
</table>
Figure 7: Figure 7:

Body Shop Limits — Body Shop Readings —
Assembly Limits — Panorama Readings —
Before setting — After Setting —

Figure 8: Figure 8:

Figure 9:

Figure 10:

Figure 9: Figure 10:
Figure 10: Figure 11:

Figure 11: Figure 12:
<table>
<thead>
<tr>
<th>Checkpoint</th>
<th>Body Shop Standards</th>
<th>Recommendation</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>A pillar to Fender</td>
<td>3.2+0.5 3.2-0.5</td>
<td>2.7-3.2mm</td>
<td>Within Body Shop Standards</td>
</tr>
<tr>
<td>Bonnet to Fender</td>
<td>3.2+0.5 3.2-0.5</td>
<td>2.7-3.2mm</td>
<td>Within Body Shop Standards</td>
</tr>
<tr>
<td>Door to Fender</td>
<td>3.5+0.5 3.5-0.5</td>
<td>3.1-3.6mm</td>
<td>Within Body Shop Standards</td>
</tr>
<tr>
<td>Rear Door to Side-wall</td>
<td>-</td>
<td>4.0-4.5mm</td>
<td>Checkpoint to be added</td>
</tr>
</tbody>
</table>

Figure 12: Table 1:
Acknowledgment

I would like to thank the management of XYZ plant for providing me this special opportunity to undergo training in this esteemed organization.

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