CHAPTER 4

GEOMETRY AND RE-SPOT DISTRIBUTION

4.1 INTRODUCTION

Geometry spots are very crucial in maintaining quality. The conventional way process planning of spot distribution follows benchmarking and thumb rules for assigning geometry spots. In figure 4.1, the total spots between the mother part “a” and child part “b” is 12, represented in pink color. The given 12 spots have been assigned by the product designer based on the structural stiffness and load carrying requirement of the assembly. The given spots are differentiated as geometry spots for establishing geometry and re-spots to ensure design intended assembly and rigidity.

Figure 4.1 Total spots welded between part “a” and part “b”
The geometry spots of the given assembly identified through conventional process planning way is shown in figure 4.2. There are 4 spot welds assigned between part “a & b”, represented in red color as geometry spots. The rest of the 8 spot welds has been assigned as re-spots, to be welded in re-spot station, represented in yellow color in figure 4.3.

Figure 4.2 Geometry spots welded between parts “a” and “b”

Figure 4.3 Re- spots welded between parts “a” and “b”
4.2 CONVENTIONAL WAY OF SPOT ALLOCATION

In the conventional spot allocation process, spot assignment for each part is a product design activity. Distribution of spots among the fixtures is a process planning activity. The total design intended spots are distributed in all the levels of the assemblies into geometry and re-spot fixtures (or) stations, by the process planner. The spot assignment between the parts of same assembly can be different in conventional process planning, since the benchmarking and thumb rules varies in different organizations.

The chances of spot distribution of a same assembly with three different organizations or process planners are represented in figure 4.4. In chance “A”, there are 4 spots considered and assigned as geometry spots out of 12 total spots. There are 3 spots and 2 spots considered and assigned in chances “B” and “C” respectively. It gives the indication of possible variations in geometry spot assignment in conventional process planning.

Figure 4.4 Geometry spot allocation possibilities in conventional method
4.3 ISSUES IN CONVENTIONAL PROCESS PLANNING

An investigation is carried out with various models of different semi-automated body shops to identify the impact of variations in geometry spot weld assignment. In this study, data of semi-automated lines of similar body structure and production capacity models were considered to generalize the study, figure 4.5.

The investigation offered three major findings.

1. The percentage of geometry spots are higher compared to re-spots.

2. Geometry stations percentage is more than double the re-spot stations percentage in the first 4 models. Model 5 has a closer gap, but with the same trend.

3. There is no uniformity observed in geometry spots distribution. The lowest geometry spots percentage among the 5 models is 59% and the largest percentage is 81%. There is a 22% difference between the models of similar structure and production capacity.
production volume. Production volume plays a role here since the number of stations in body shop varies with respect to production volume.

The models with similar number of parts and spots are considered for further investigations, to understand the impact of variations in conventional process planning, table 4.1. The difference in percentage of geometry spots between model 1 and model 5 is 17%. The percentage of geometry spots is 17% lower in model 5 whereas the percentage of number of parts in model 5 is 15% higher than model 1. There are 2545 spots assigned to set geometry for 320 parts in model 1. A lower count of 2474 spots were assigned to set geometry for 376 parts in model 5. Percentage of geometry stations is 6% higher in model 1 for the same quantity of geometry spots. The statistics of the real-world models clearly indicate that productivity is not often considered in the geometry spot assignment process.

**Table 4.1. Conventional process planning matrix of model 1 & 5**

<table>
<thead>
<tr>
<th>Description</th>
<th>Model “1”</th>
<th>Model “5”</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Geometry Stations</td>
<td>Re-spot Stations</td>
</tr>
<tr>
<td>Fixture quantity</td>
<td>61</td>
<td>13</td>
</tr>
<tr>
<td>Percentage of fixture</td>
<td>82%</td>
<td>18%</td>
</tr>
<tr>
<td>Number of Parts</td>
<td>320</td>
<td>13</td>
</tr>
<tr>
<td>Number of Spots</td>
<td>2,545</td>
<td>821</td>
</tr>
<tr>
<td>Percentage of Spots</td>
<td>76%</td>
<td>24%</td>
</tr>
</tbody>
</table>

4.4 **SUMMARY**

The conventional way of spot distribution follows benchmarking and thumb rules for assigning geometry spots. There is no scientific methodology exists for real world applications. The conventional way of spot weld distribution is not producing uniform and productive results. An experiment conducted to study the appropriate spot distribution among the sheet metal parts and discussed in chapter 5.