

MANUFACTURING LINES_NON-OPERATIONAL REASONS

RELEVANT JMP PLATFORMS AND STATISTICAL TECHNIQUES

Quality and Process : Pareto Plot

Graph Builder : Bar Chart

Formula Editor : Creating new variables

PROBLEM STATEMENT

The quality team at a company that manufactures insulation material used in industrial applications is concerned about the amount of time their three main production lines are non-operational due to needed repairs and maintenance.



The team has decided that a helpful first step is to summarize these non-operational events with a simple set of graphs and statistics so that management and other relevant teams in the company can have an accurate view into this issue. Data from the past 10 month has been gathered and summarized into a data table that includes the frequency each of the lines was non-operational, the reason, and the number of hours until the line was back up-and-running.

DATA SET

Manufacturing_Lines_Non_Operational_Reasons.jmp

Line	Production Line (A, B, C).
Reasons	The reason the line was non-operational (19 types).
Frequency	The number of times during the past 10 months the line was non-operational for each reason.
Downtime	Total number of hours the line was non-operational for each reason (in Hours).

EXERCISES

1. Create a Pareto Plot for all lines in aggregate displaying the number of times the lines were non-operational for each of the 19 reasons. What are the top 5 reasons that the lines were non-operational? What percentage of all the times the lines were non-operational was because of these top 5 reasons?

Instructions: Analyze > Quality and Process > Pareto Plot. Choose 'Reasons' for the Y role, 'Frequency' for the Freq role. Click OK. Under the Red Triangle next to the Plot title, select Cumulative Percent > Show Cum Percent Points and Label Cum Percent Points.
Note: For this and other graphs you'll create in the Exercises, you'll need to select-and-drag the right-hand side of the graph frame to make wider to view the numbers.

2. Create a Pareto Plot for each line displaying the number of times the line was non-operational for each of the 19 reasons. What are the top 5 reasons that each line was non-operational? What percentage of all times each line was non-operational was because of these top 5 reasons? Which reasons are in the top 5 for individual lines but not in the top 5 overall?

Instructions: Analyze > Quality and Process > Pareto Plot. Choose 'Reasons' for the Y role, 'Frequency' for the Freq role, and 'Line' as the By role. Click OK. Under the Red Triangle next to the Plot title for each 'Line', select Cumulative Percent > Show Cum Percent Points and Label Cum Percent Points.


3. Create a Pareto Plot for all lines in aggregate displaying the amount of time the lines were non-operational for each of the 19 reasons. What are the top 5 reasons that resulted in the lines being non-operational for the most amount of time? What percentage of the total downtime was because of these top 5 reasons? How do these results compare to your analysis on the frequency the lines were non-operational in Exercise 1?

Instructions: Analyze > Quality and Process > Pareto Plot. Choose 'Reasons' for the Y role, 'Downtime' for the Freq role. Click OK. Under the Red Triangle next to the Plot title, select Cumulative Percent > Show Cum Percent Points and Label Cum Percent Points.


4. Create a Pareto Plot for each Line displaying the amount of time the lines were non-operational for each of the 19 reasons. What are the top 5 reasons that resulted in each of the lines being non-operational for the most amount of time? What percentage of the total downtime was because of these top 5 reasons? Which reasons are in the top 5 for individual lines but not in the top 5 overall? How do these results compare to your analysis on the frequency of times the lines were down? How do these results compare to your analysis on the frequency of times each of the lines were down in Exercise 2?

Instructions: Analyze > Quality and Process > Pareto Plot. Choose 'Reasons' for the Y role, 'Downtime' for the Freq role, and 'Line' as the By role. Click OK. Under the Red Triangle next to the Plot title for each line, select Cumulative Percent > Show Cum Percent Points and Label Cum Percent Points.

5. Create a comparative side-by-side Bar Chart displaying the frequency each of the lines were non-operational for the 19 reasons. Identify a few reasons where there's a large difference in the frequency of non-operational status between the lines. Identify a few reasons where the frequency is similar across the lines.

Instructions: Graph > Graph Builder. Place 'Frequency' in the Y role, 'Reasons' in the X role, 'Line' in the Overlay role. Choose the Bar Chart icon in the graph palette.  Right-click on the X axis and choose Order by > Frequency, descending. The Reasons are now ordered from highest 'Frequency' cumulative across the lines to lowest.


6. Create a comparative side-by-side Bar Chart displaying the amount of time each of the lines were non-operational for the 19 reasons. Identify a few reasons where there's a large difference in the amount of downtime between the lines. Identify a few reasons where the amount of downtime is similar across the lines.

Instructions: Graph > Graph Builder. Place 'Downtime' in the Y role, 'Reasons' in the X role, 'Line' in the Overlay role. Choose the Bar Chart icon in the graph palette.  Right-click on the X axis and choose Order by > Frequency, descending. The Reasons are now ordered from highest amount of 'Downtime' cumulative across the lines to lowest.


7. Create a new variable that is the average amount of time the line is non-operational for each reason.

Instructions: Highlight both the 'Frequency' and 'Downtime' columns. Right-click on the highlighted columns and choose New Formula Column > Combine > Ratio (reverse order). Rename the column 'Avg Downtime per Incident'.

8. Create Bar Chart displaying the 'Average Downtime per Incident' across all lines in aggregate. What are the top 5 reasons having the largest average downtime? What are the 5 reasons with the smallest average downtime?

Instructions: Graph > Graph Builder. Place 'Avg Downtime per Incident' in the Y role, 'Reasons' in the X role, Choose the Bar Chart icon in the graph palette.  Right-click on the X axis and choose Order by > Frequency, descending.

9. Create comparative side-by-side Bar Chart displaying the 'Average Downtime per Incident' for each line. Summarize a few insights this graph reveals.

Instructions: Graph > Graph Builder. Place 'Avg Downtime per Incident' in the Y role, 'Reasons' in the X role, and 'Line' in the Overlay role. Choose the Bar Chart icon in the graph palette.  Right-click on the X axis and choose Order by > Frequency, descending.

10. What are some next steps the quality team can take to improve these production lines? What other data would be helpful to have? Can you think of any reasons why the lines do not perform similarly with regard to the frequency and amount of time they're non-operational.