Coal terminal

Data MINING, ANALYSIS and VISUALIZATION

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Objective:

To analyze and visualize fake data from the Bowen Basin Australia Coal terminal. This data is used exclusively for analytics training purposes.

Hypothetical scenario:

Suppose, I hired by a Coal Terminal to assess which of their Coal Reclaimer machine requires maintenance in the upcoming month.

These machines run literally round the clock 24/7 for the 365 days a year. Every minute of the downtime equates to millions of dollars lost in revenue, that is why it is crucial to identify exactly when these machines require maintenance (neither less or more is acceptable).

Currently, the Coal Terminal follows the following criteria: a Reclaimer-type machine requires maintenance when within the previous month there was at least one 8-hour period when the average idle capacity was over 10%.

Idle capacity is a utilization metric which, for the purpose of this project, is defined as:

$$\text{Idle Capacity} = \frac{(\text{Actual Tonnage} - \text{Nominal Capacity})}{\text{Nominal Capacity}}$$

Image: Reclaimer Machine

Note: Idle Capacity is a bad matrix. Lower the Idle capacity means less time the machine would be in the Idle condition which is good. Contrary, the higher the Idle capacity higher the loss.

Task:

The task is to find out which of the 5 machines are expecting to exceed 10% of its idle capacity in the month of September 2015 so that it would help in order to identify which one or many should require maintenance in the upcoming months. Also, create a report (this one) for the executive stakeholders with your recommendations/results.

The five machines are as follows,
RL1 (Reclaimer)
RL2 (Reclaimer)
SR1 (Stacker-Reclaimer)
SR4A (Stacker-Reclaimer)
SR6 (Stacker-Reclaimer)

Below, the image of stockyard where these 5 machines are located.

Image: Stockyard

Results:

Summary
Below image shows the summary of 8 hours of moving average idle capacity of all machines which exceeds 10% of its idle capacity in the month of September 2015.
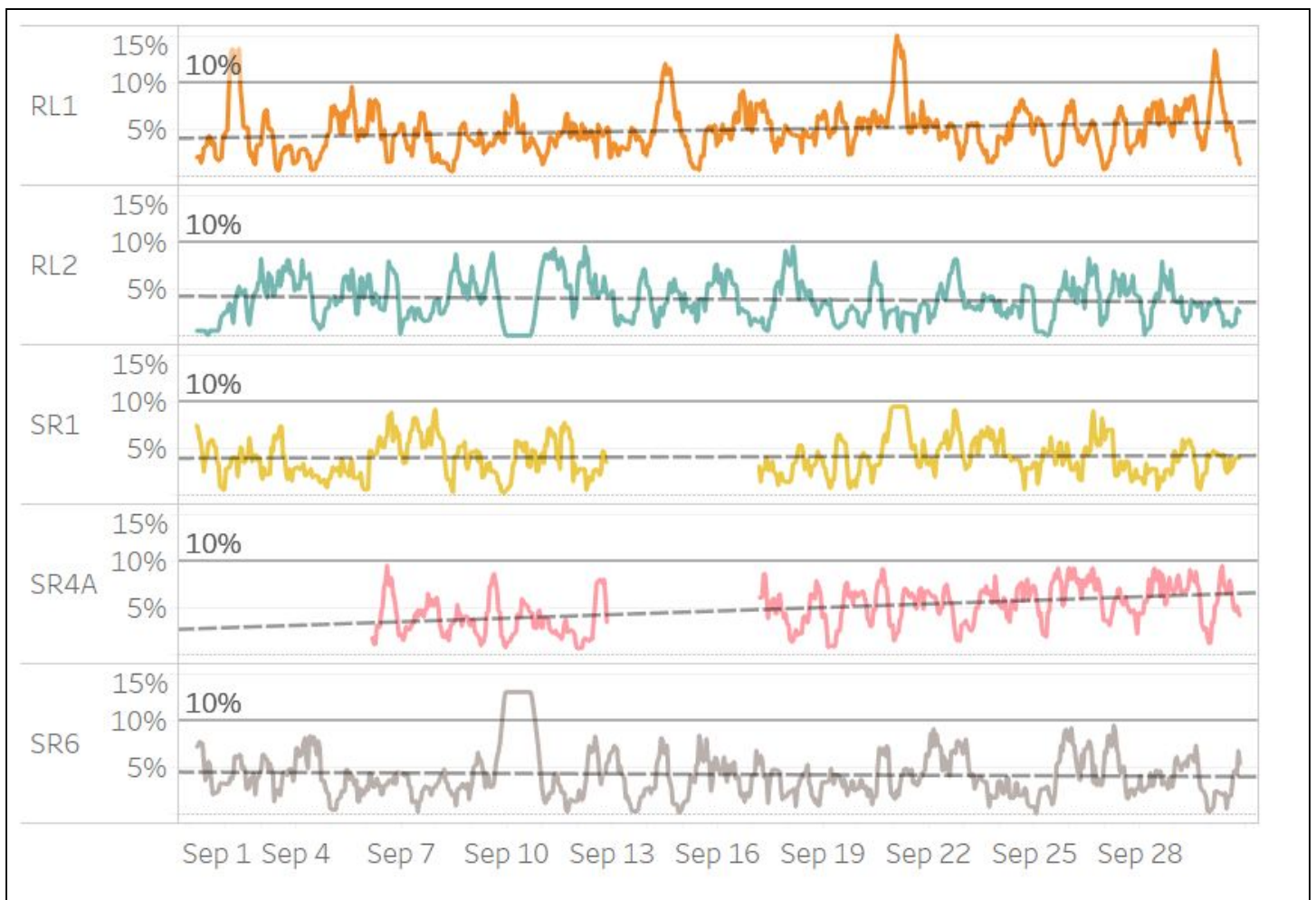
Image: Summary

Reclaimer RL1

This image below illustrates the 8 hours of moving average idle capacity of Reclaimer RL1 expressed as a percentage of normal capacity.

Throughout the month RL1 exceeds the threshold of nominal capacity multiple times as follows,

2/9 - rolling average peaked at 14%

14/9 - rolling average peaked at 12%

21/9 - rolling average peaked at 15%

21/9 - rolling average peaked at 13%

In addition, the data shows an upward trending line. If this trend line continues every hour of operation will be increasing idle capacity by approximately 0.05% in the long run.

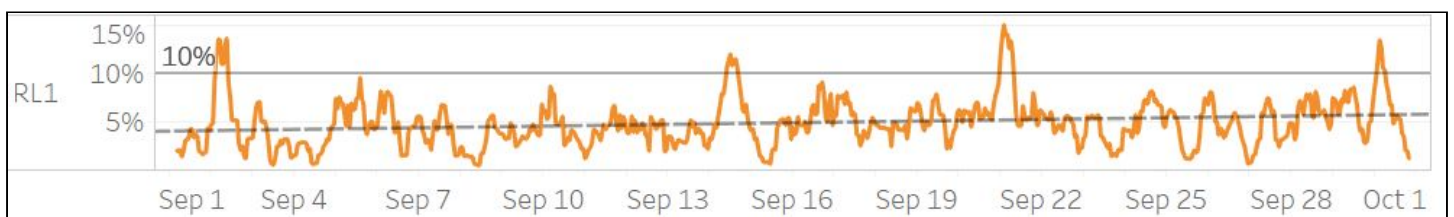This is evidence that this machine requires maintenance in the upcoming month

Image: RL1

Reclaimer RL2

This image below illustrates the 8 hours of moving average idle capacity of Reclaimer RL2 expressed as a percentage of normal capacity.

Throughout the month RL2 doesn't exceed the threshold of nominal capacity.

In addition, the data shows a normal trending line. If this trend line continues every hour of operation, it doesn't require the maintenance in the long run.
This is evidence that this machine doesn't require maintenance in the upcoming month.
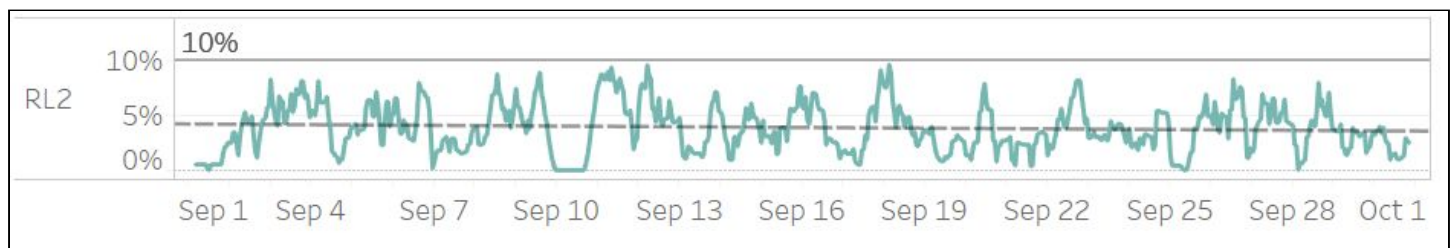

Image: RL2

Stacker-Reclaimer SR1

This image above illustrates the 8 hours of moving average idle capacity of Reclaimer SR1 expressed as a percentage of normal capacity.

Throughout the month SR1 doesn't exceeds the threshold of nominal capacity.

In addition, the data shows a normal trending line. If this trend line continues every hour of operation, it doesn't require the maintenance in the long run.
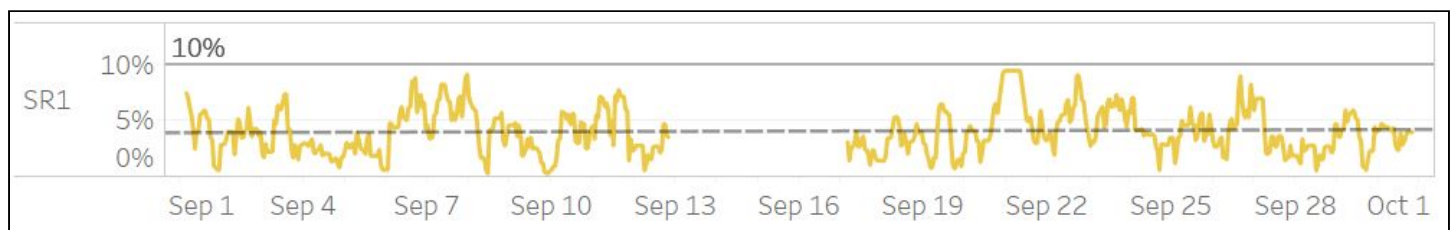This is evidence that this machine doesn't require maintenance in the upcoming month.

Image: SR1

Stacker-Reclaimer SR4A

Although it doesn't exceed the threshold of 10% of idle capacity, the upward trending line shows this machine would require maintanace in the upcoming month. In order to validate this assumption, further investigation required especially at the beginning of October month.
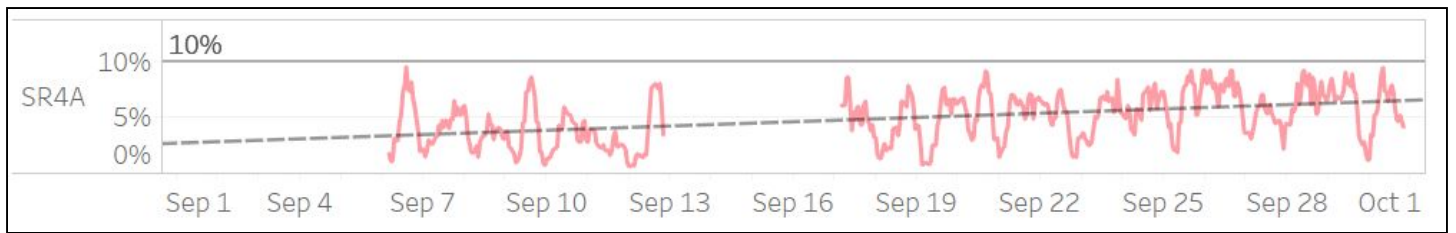
Image: SR4A

Stacker-Reclaimer SR6

In the image below, this machine exceeds the threshold of 10% idle capacity once in the month of September 2015 but it seems that it is a voluntary action due to its linearity. Besides, the normal trend line shows that this machine does not need maintenance at least in few upcoming months.
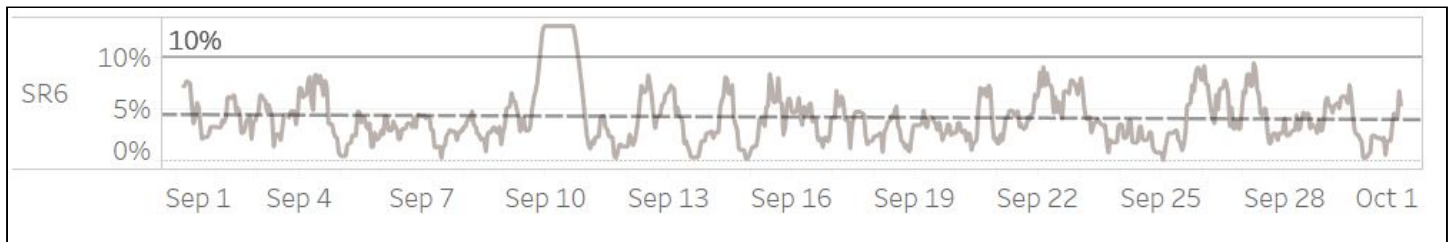

Image: SR6