

CAPSTONE PROJECT ON OPEN PIT MINING: SUPPLY CHAIN CHALLENGES

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Agenda

- ❖ Objective
- ❖ Background
- ❖ Key Findings
- ❖ Recommendations
- ❖ Appendix:
 - Data Methodology
 - Assumptions

Objective

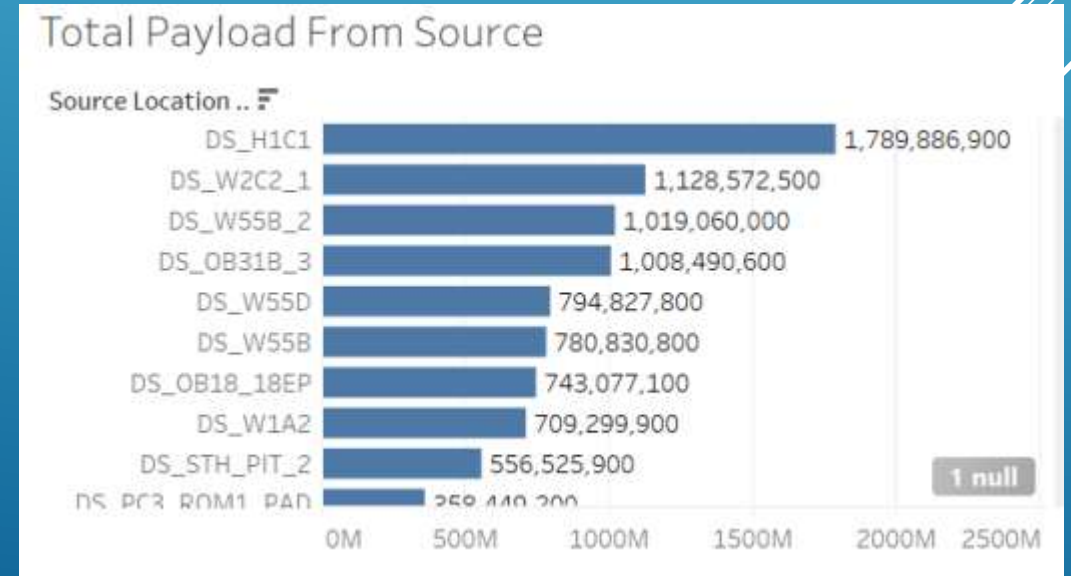
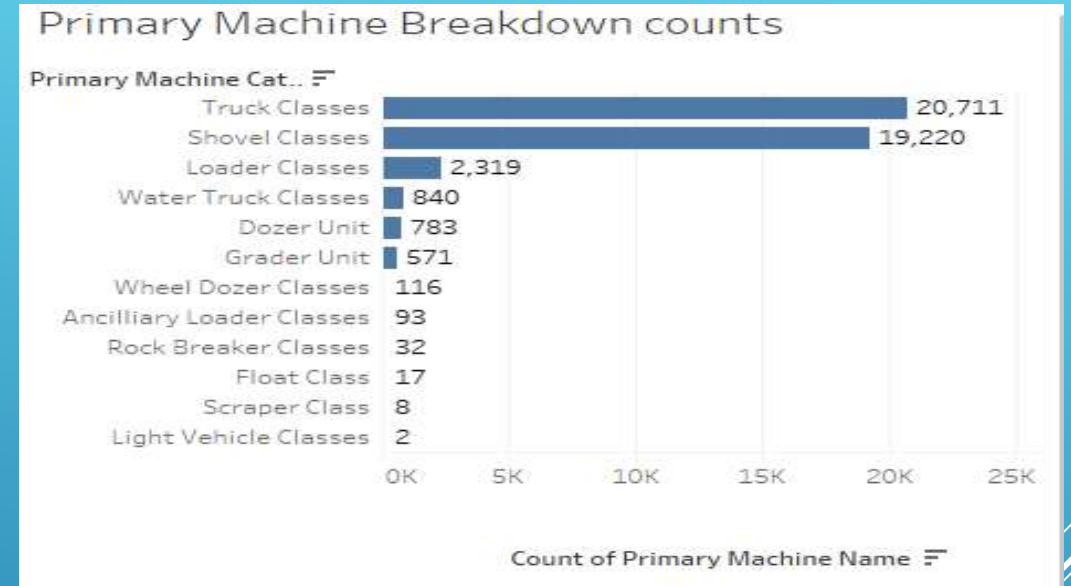
- Gain insights into critical metrics related to production inefficiency and develop an advanced real-time monitoring system.
 - Determine the highest-performing and lowest-performing equipment within the mining operation.
 - Assess the payload carrying capacity of the equipment and enhance understanding in this area.
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Background

- The client is experiencing significant challenges with their production processes, leading to a loss of customer trust.
 - Despite a lack of increased demand, they are struggling to meet their customers' requirements.
 - To address these issues, they need to implement a sophisticated real-time monitoring system to effectively track and manage their production activities.
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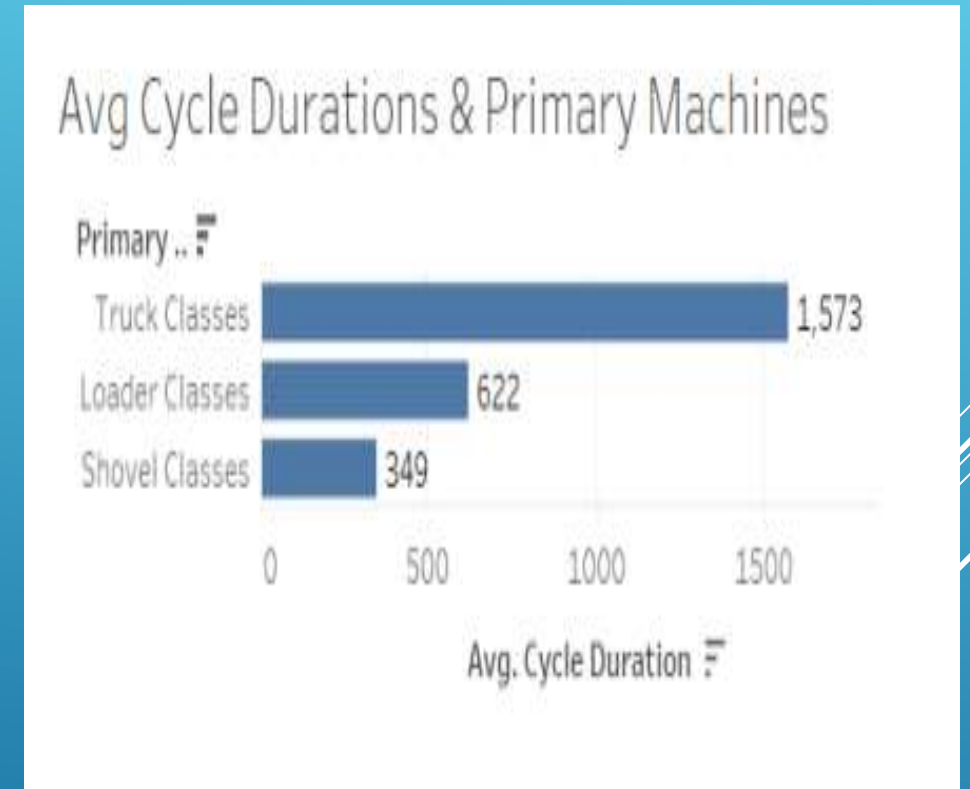
Key findings overview

- At present, there are a total of 126 machines in active operation within the mining sites.
- These machines are categorized into 12 distinct groups, including units such as dozer, grader, and various classes of shovels.
- The payload extracted from 30 different source locations is transported to a network of over 69 destinations.



Key finding overviews

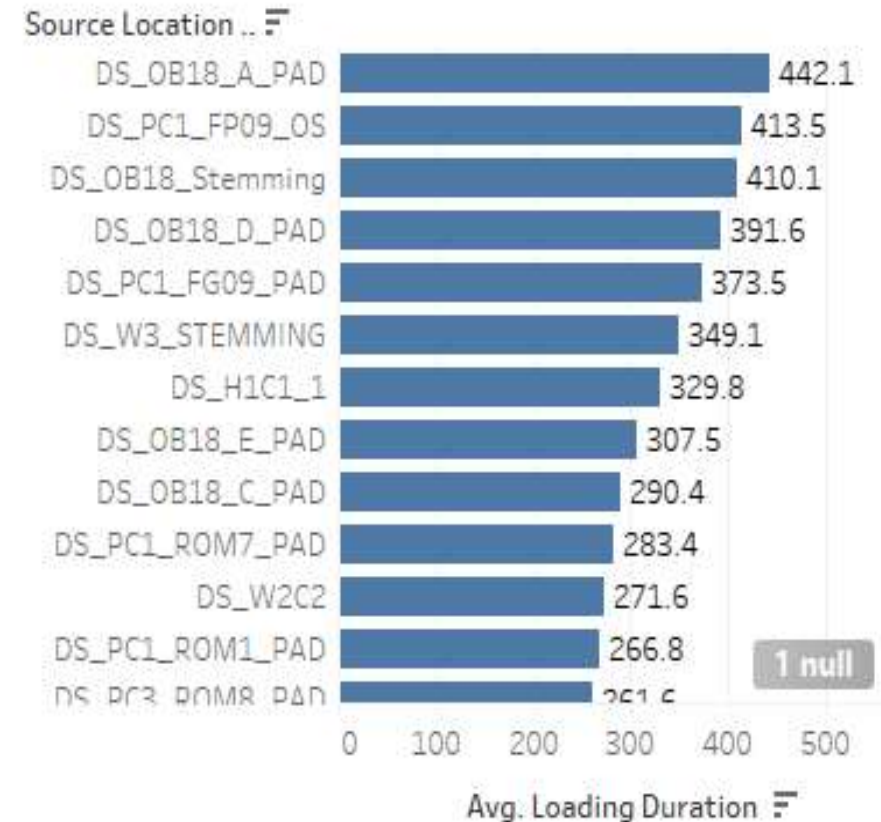
- Payload transportation is primarily handled by Loader, Shovel, and Truck Classes.
- Although Rock Breaker and Scraper classes have longer cycle times, our focus remains on optimizing the cycle time of trucks, shovels, and loaders, as they are responsible for extracting and transporting the payload.
- On average, the cycle time for Truck Classes is approximately 1573 seconds, equivalent to 26 minutes.



Key finding overview

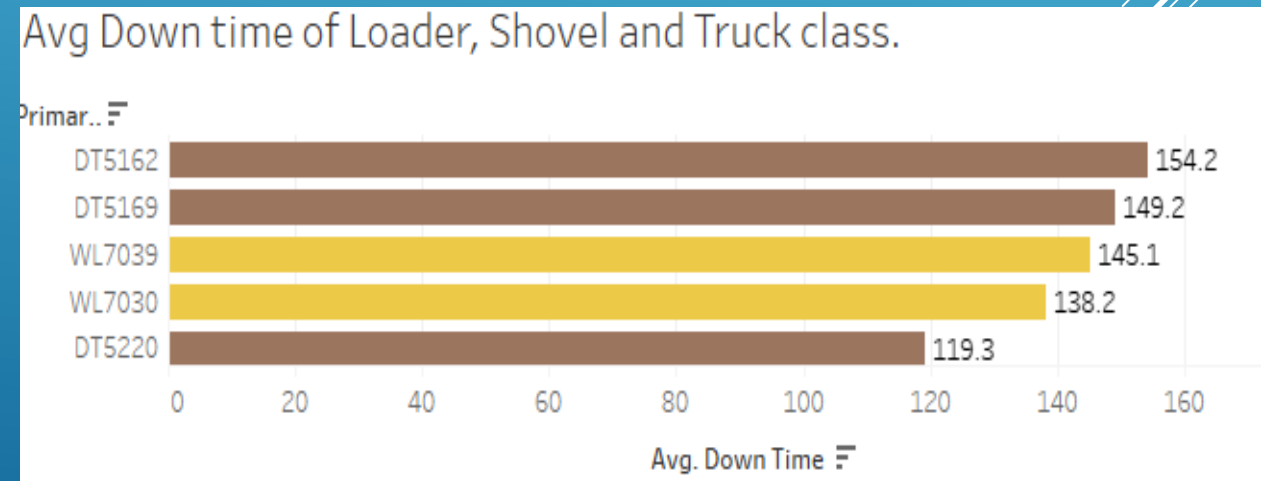
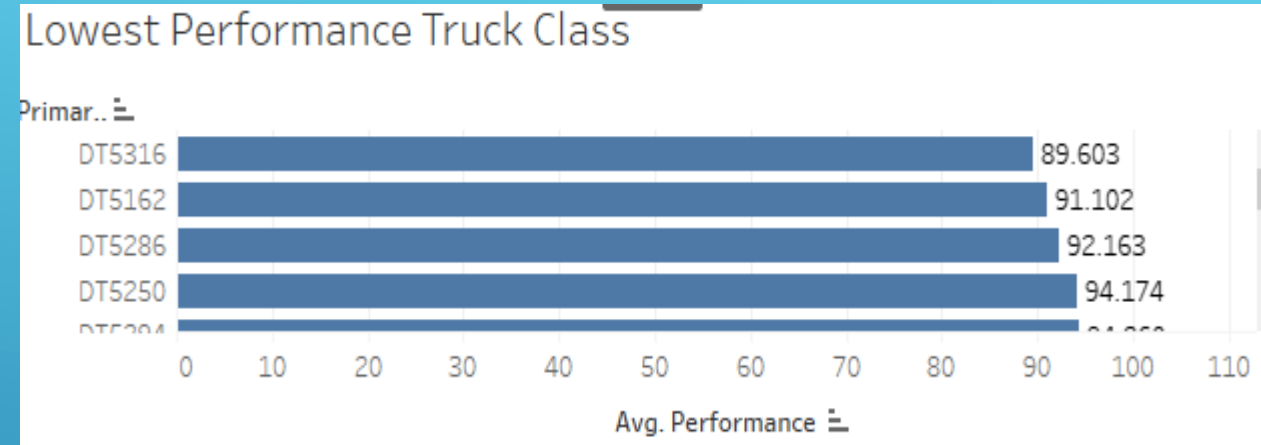
- The cycle duration encompasses various activities such as excavating the ore, loading it onto trucks, and transporting it to the crusher. The trucks then return to the source location empty.
- On average, the loading duration for Loader, Truck, and Shovel classes is approximately 183 seconds. However, only truck classes have an additional dumping duration, averaging around 44.7 seconds, as they travel from the digger to the crusher.
- Certain locations experience longer loading durations, surpassing 400 seconds, indicating the need for further analysis and potential optimization measures.

Source Avg Loading Duration



Key finding for worst performance equipment

- ▶ Among the trucks depicted in the chart to the right, it is evident that they carry the lowest payload compared to others.
- ▶ Out of all the machines, the Avg highest downtime, indicating a need for focused attention and improvements.



Key finding for top performance equipment

- The trucks highlighted in the analysis consistently demonstrate their capability to carry the largest payload quantities.
- Additionally, these trucks exhibit impressive efficiency by achieving the highest payload rates per second or per hour.
- The DT5235 with an idle time that exceeds the least average by 152 seconds, highlighting an opportunity to reduce idle periods and enhance overall productivity.

Truck idle Time

Primar..



Avg. Idle Duration

Avg Payload (truck class)

Primar..



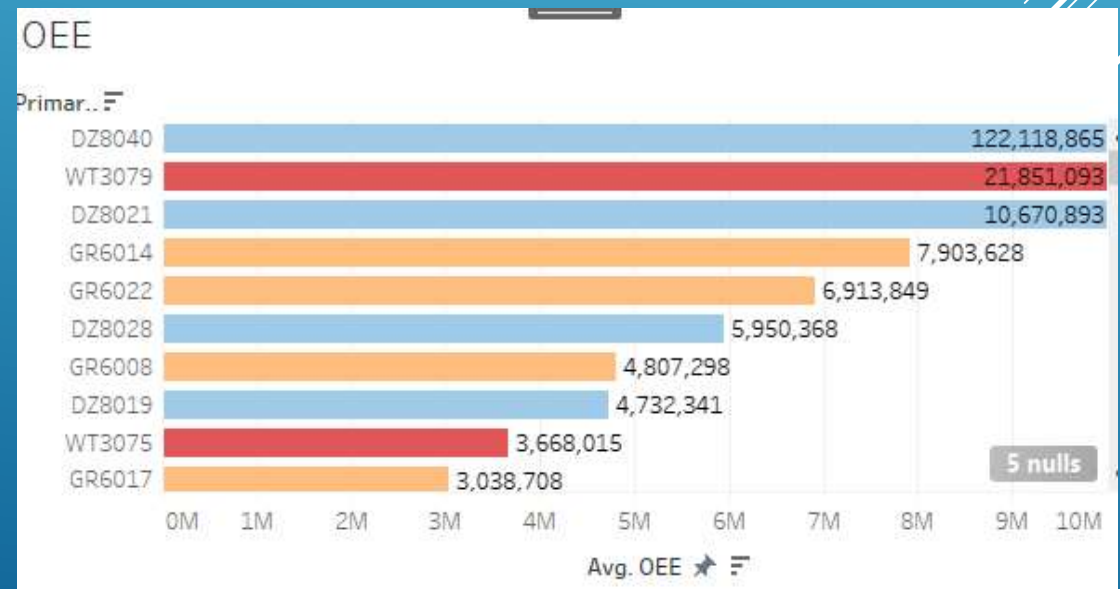
Avg. Payload (kg)

Key findings - OEE


The Overall Equipment Efficiency (OEE) is determined by three key factors:

- ▶ **Availability:** The measure of the equipment's uptime and the extent to which it is available for operation during scheduled production time.
- ▶ **Performance:** The equipment's efficiency and ability to perform at its maximum designed speed or rate.
- ▶ **Quality:** The equipment's ability to produce output that meets the desired quality standards without defects or rework.

To calculate the OEE, these three factors are multiplied together, providing a comprehensive assessment of the equipment's overall effectiveness and productivity.



Recommendations

- Replace machines with an average downtime exceeding 149 seconds, namely DT5286, DT5162, and DT5169.
 - Exclude machines with an Overall Equipment Effectiveness (OEE) below 0, particularly DZ8083 and GR6016.
 - Consider the potential transfer of production resources and equipment from source locations where idle time exceeds 350 seconds to alternative source locations.
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Appendix

Data Methodology:

- ▶ The data cleaning process was performed in Jupyter Notebook, followed by analysis conducted using MySQL Workbench 8.0. Visualizations were created using Tableau Public.
- ▶ Some outliers were identified and removed from the dataset to ensure data accuracy and integrity.
- ▶ The cleaned dataset consists of a total of 44,712 rows, representing the relevant information for analysis.
- ▶ In order to facilitate data processing and analysis, stored procedures were created within MySQL for various purposes, including cycle data, location/movement data, delay data, and Overall Equipment Effectiveness (OEE) calculations.

Assumptions:

- ▶ Net available time (AT available time (imine) - idle duration)
- ▶ Net operating time (operatingtime (cat) - idle duration)
- ▶ Equipment with downtime are assumed to have gone through maintenance

Link

Video link:

https://drive.google.com/drive/folders/10iLw5Vw9uxvgTc-d8_HZ-X9WEQBaQ5tE?usp=sharing

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Thank You

