

# CAPSTONE PROJECT OPEN PIT MINING SUPPLY CHAIN PROBLEM

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# AGENDA

- Objective
- Background
- Key findings
- Recommendations
- Appendix:
  - Data methodology
  - Assumptions

# OBJECTIVE

- To understand the key metrics regarding inefficient production and to build a smart live monitoring system
- To Identify the top-performing and the worst-performing equipments
- To understand payload carrying capacity of the equipments

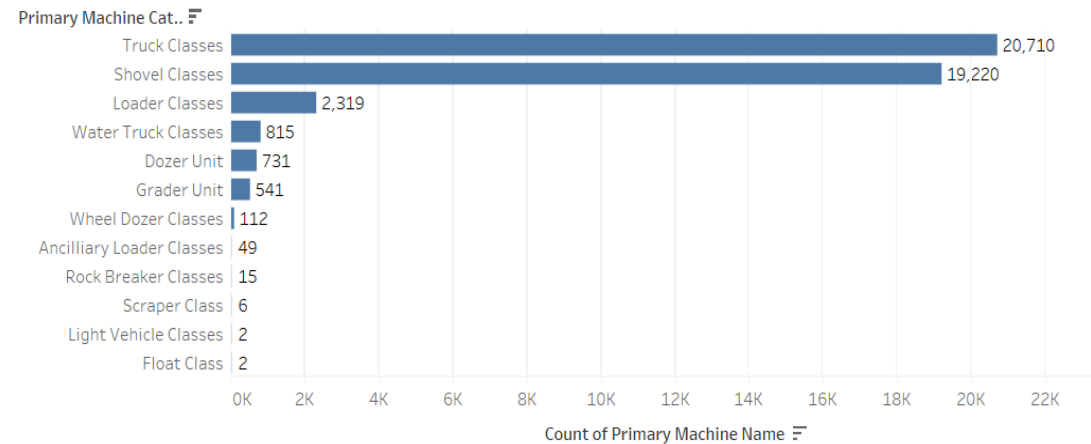
# BACKGROUND

- Client is facing problems of inefficient production and is losing customers' trust
- There is no surge in demand yet they are unable to meet the requirements
- They require a smart live monitoring system to keep track of production

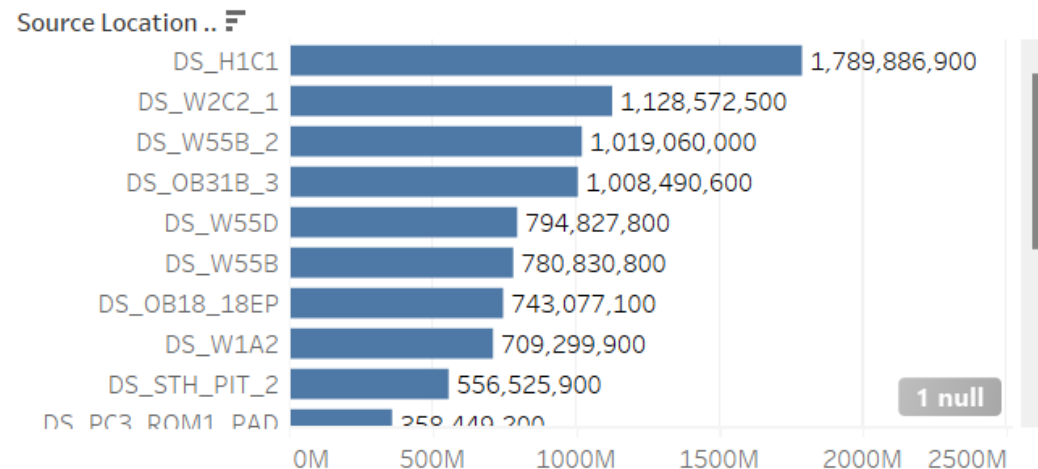
# Key Findings - Overview

- 126 machines currently operating in the mines
- The machines are divided into 12 categories like Dozer Unit, Grader unit, shovel classes etc.
- Payload is extracted from 30 source locations and transported to over 69 destinations

Primary Machine Breakdown



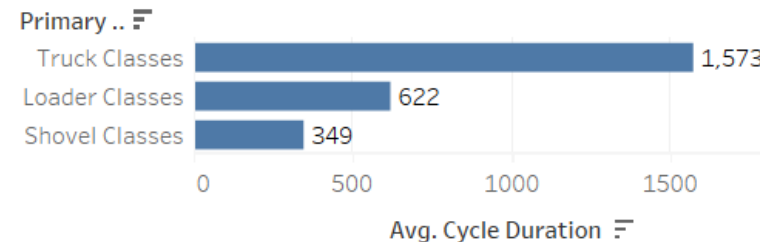
Total Payload From Source



# Key Findings - Overview

- Only Loader, Shovel and Truck Classes carry payload
- Rock breaker, Scraper classes have a much higher cycle time, however, we are focused on the truck cycle as only truck, shovel and loader classes are used to extract and transport payload
- Average cycle time Truck Classes: 1573 seconds (26 minutes)

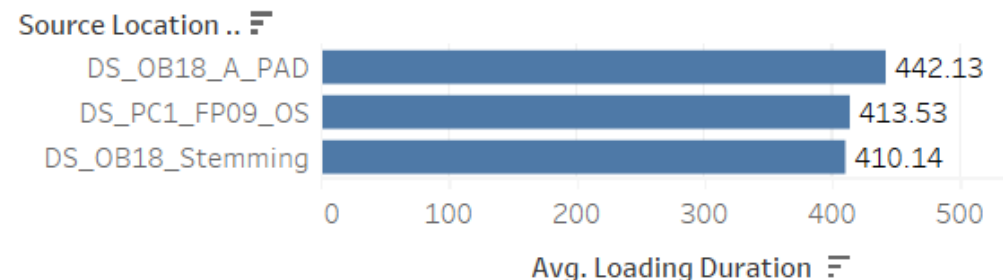
Avg Cycle Durations & Primary Machines



## Key Findings - Overview

- The cycle duration includes digging the ore, loading the ore on to trucks and then transporting them to the crusher and the trucks return empty to the source location.
- Average loading duration is 183 seconds (Loader, Truck and Shovel classes). Only truck classes have a dumping duration, with an average of 44.7 seconds as they travel from digger to crusher
- Locations with the highest loading durations exceeding 400 seconds

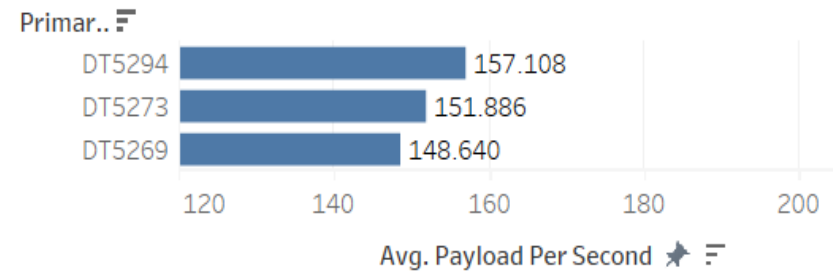
Source Avg Loading Durations



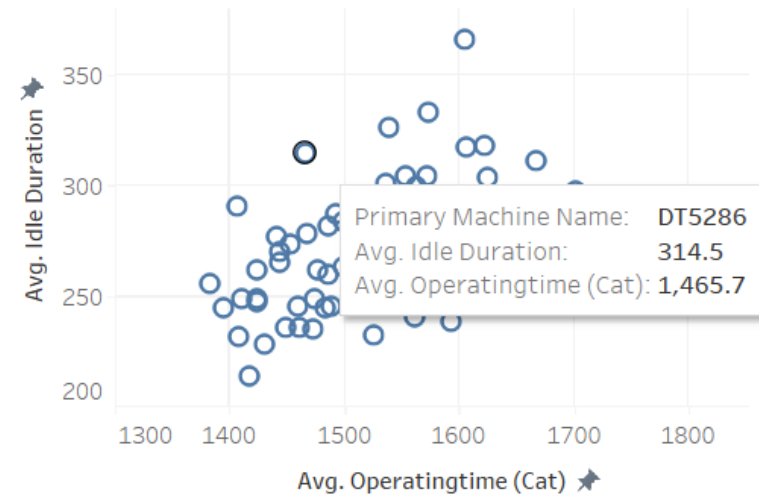
# Key Findings – Worst Performing Equipments

- The trucks on the chart to the right carry the least payload
- The chart in the bottom-right shows the relationship between operating and idle time
- The machines below have highest downtime

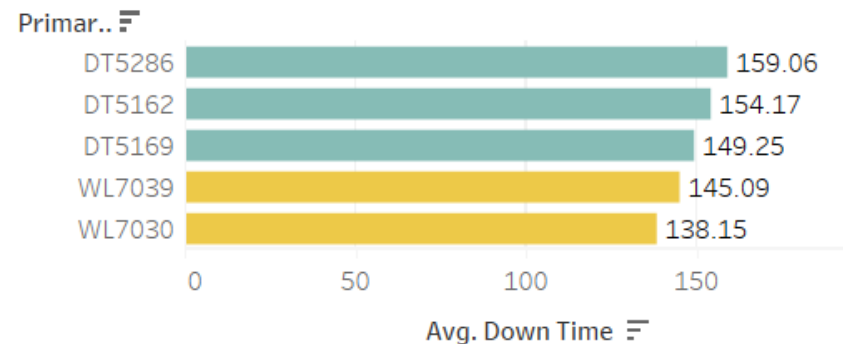
Average Payload Per Second



Operating Time Vs Idle Time



Average Down Time of Loader, Shovel and Truck Classes

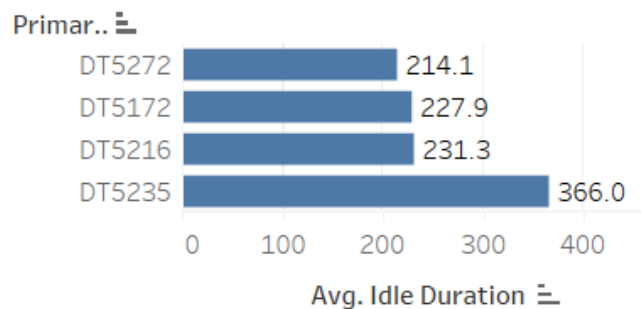




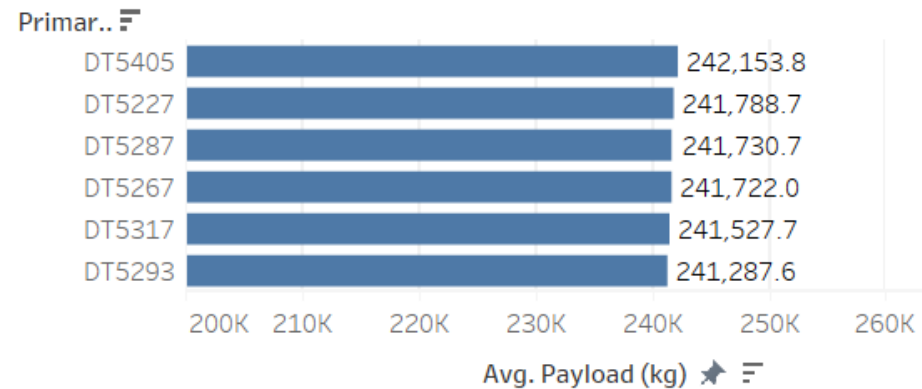
# Key Findings – Top Performing

- The trucks carrying the highest amount of payload
- The trucks carrying the highest payload per second/tonnes per hour
- DT5235 takes 152 seconds more than the least average idle time

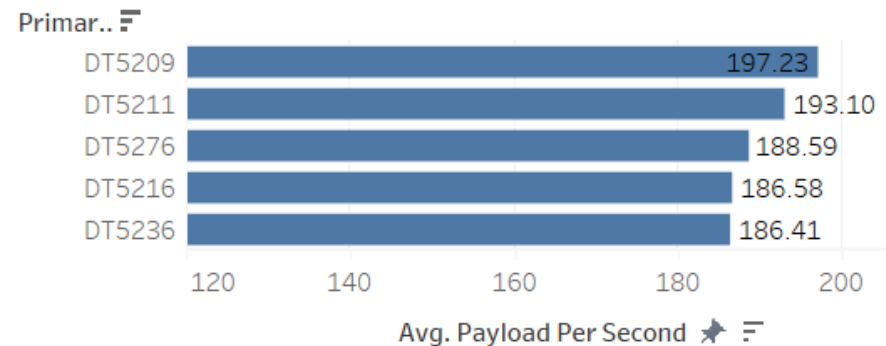
Truck idle Time



Avg Payload (truck class)



Average Payload Per Second



# Key Findings - OEE

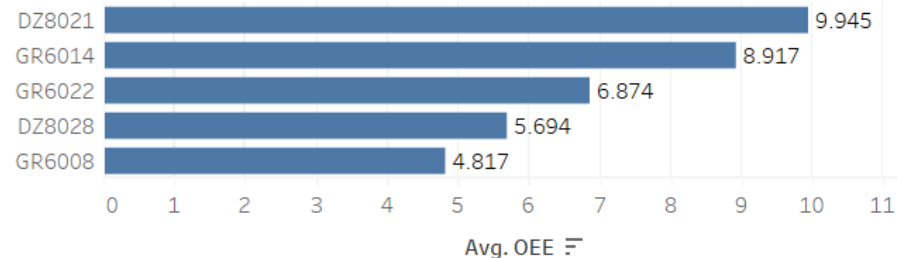
The Overall Equipment Effectiveness:

- Availability
- Performance
- Quality

We get OEE by multiplying the 3 factors

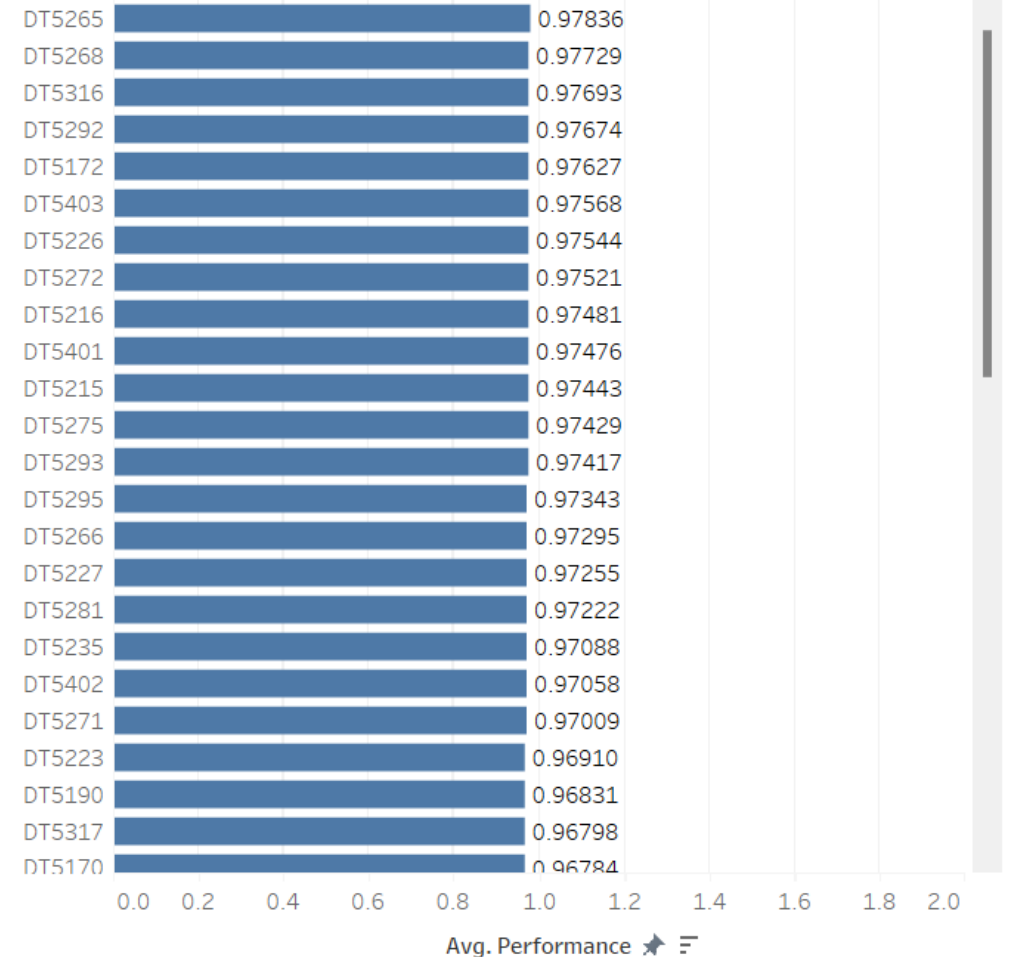
OEE

Primar..



OEE - performance

Primar..



# RECOMMENDATIONS

- Replace machines with average downtime above 149 seconds (DT5286, DT5162 DT5169)
- Replace machines with a OEE below 0 (especially DZ8083 & GR6016)
- Possibly transfer production resources and equipment from source locations with idle time above 350 seconds to other source locations

# APPENDIX

- Data Methodology: Data was cleaned in Jupyter Notebook, analysis was done on MySQL Workbench 8.0 and all visualizations on Tableau Public.
  - Some outliers were removed from the dataset
  - There are a total 44522 rows in the cleaned dataset
  - Stored procedures were made on MySQL for cycle data, location/movement data, delay data, OEE etc.
  - Some calculated fields were created on Tableau eg. OEE, performance etc.  $\text{Payload per second} = \text{Payload (kg)} / \text{Cycle Duration}$
- Assumptions
  - Net available time (AT available time (imine) - idle duration)
  - Net operating time (operatingtime (cat) - idle duration)
  - Equipments with downtime are assumed to have gone through maintenance

# Links

- Link to the tableau dashboards:
- <https://public.tableau.com/app/profile/arindam.bhattacharya8105/viz/CapstoneProjectSupplyChain1/AvgCycleDurationPayloadLSC?publish=yes>
- Link to the ppt video:
- [https://drive.google.com/file/d/1X6\\_oSgFLuZrxU6rdAsqcBGvzj8e9HFRO/view?usp=share\\_link](https://drive.google.com/file/d/1X6_oSgFLuZrxU6rdAsqcBGvzj8e9HFRO/view?usp=share_link)

**Thank You**