ASSMANG

MANGANESE

BLACK ROCK MINE OPERATIONS

AVA Symposium

April 2024

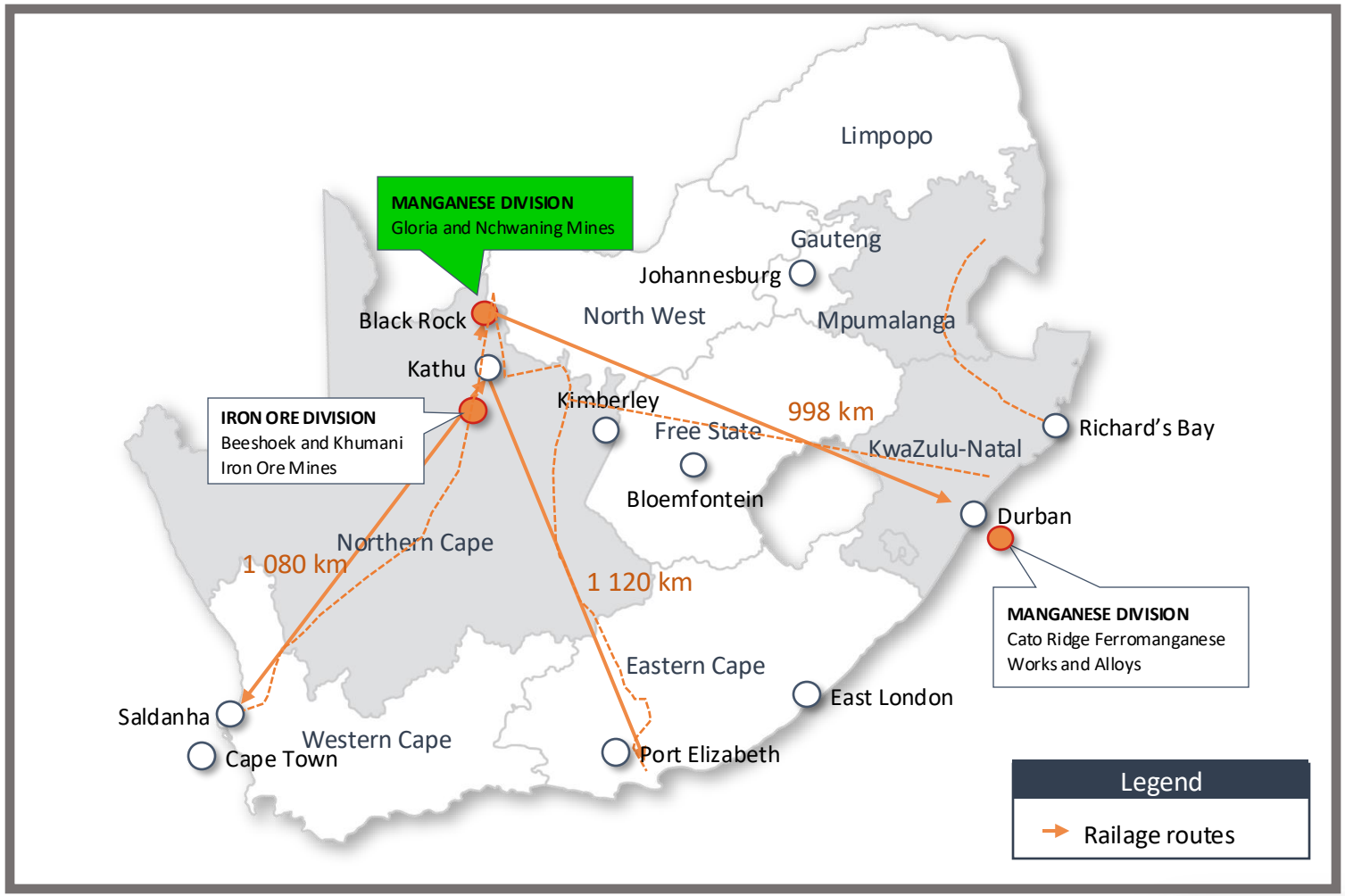
ASSMANG OPERATIONS AND LOCALITY

ARM African Rainbow Minerals 50,00% ASSORE

ASSMANG

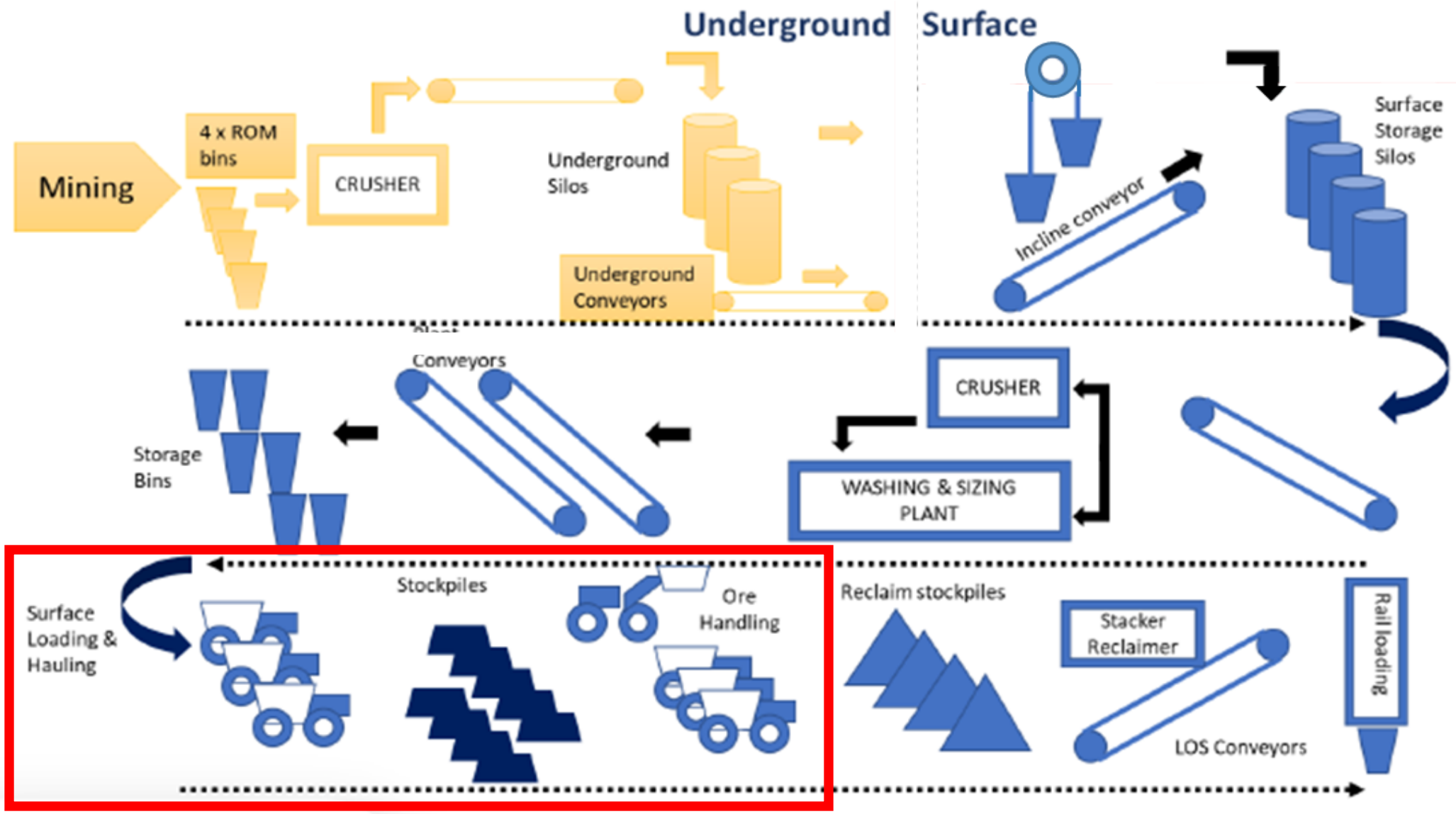
Blackrock Mine Operations Overview

- Three underground shafts
- Ore Reserves for Nchwaning and Gloria Mines is **274Mt**
- Life of Mine is **54 years**



VALUE CHAIN OVERVIEW

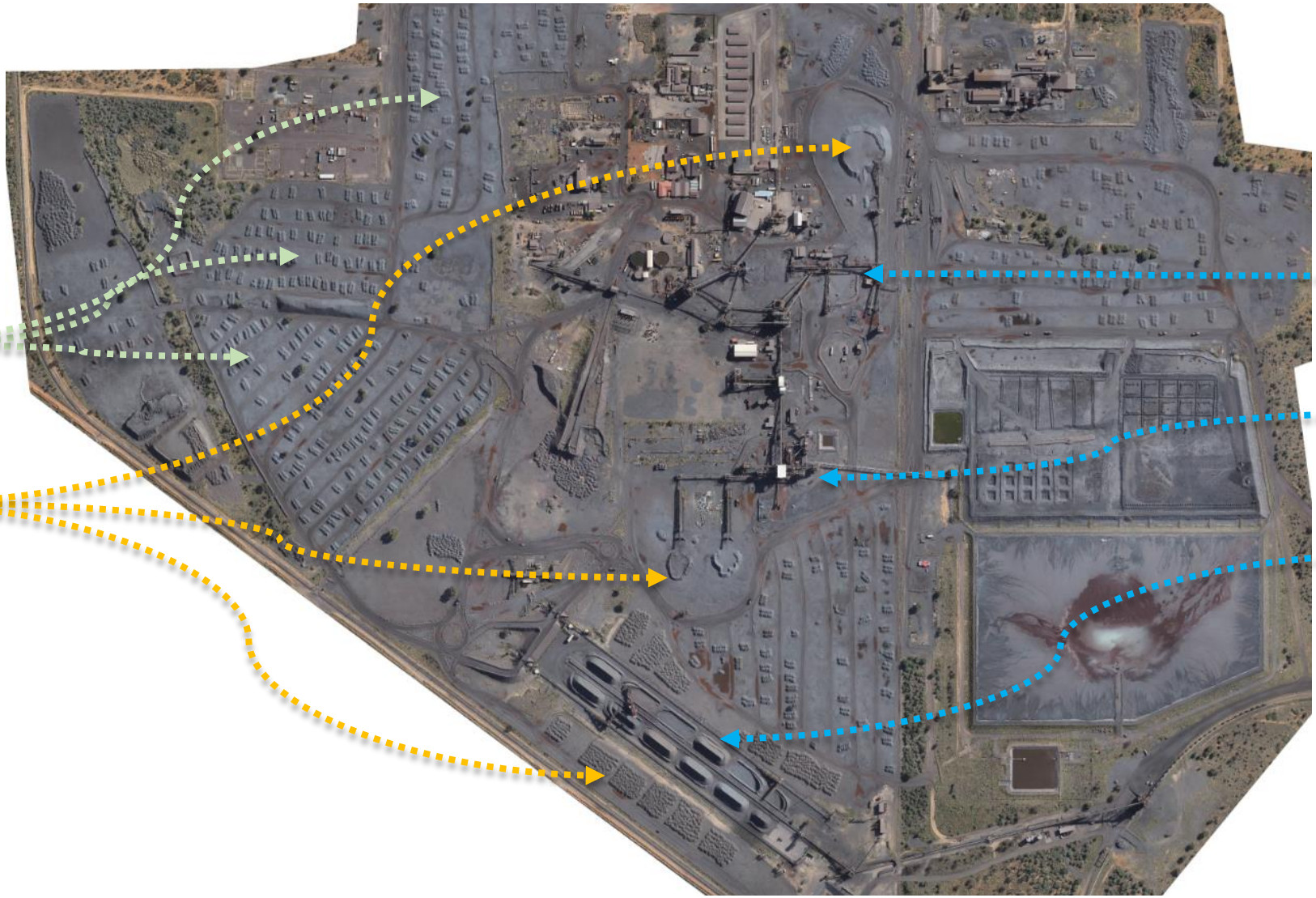
Production Area where we implemented the AVA Solution



SURFACE PLANTS

STACKER & RECLAIMER

SURFACE OPERATIONS OVERVIEW



Stack Areas

Stockpile Areas

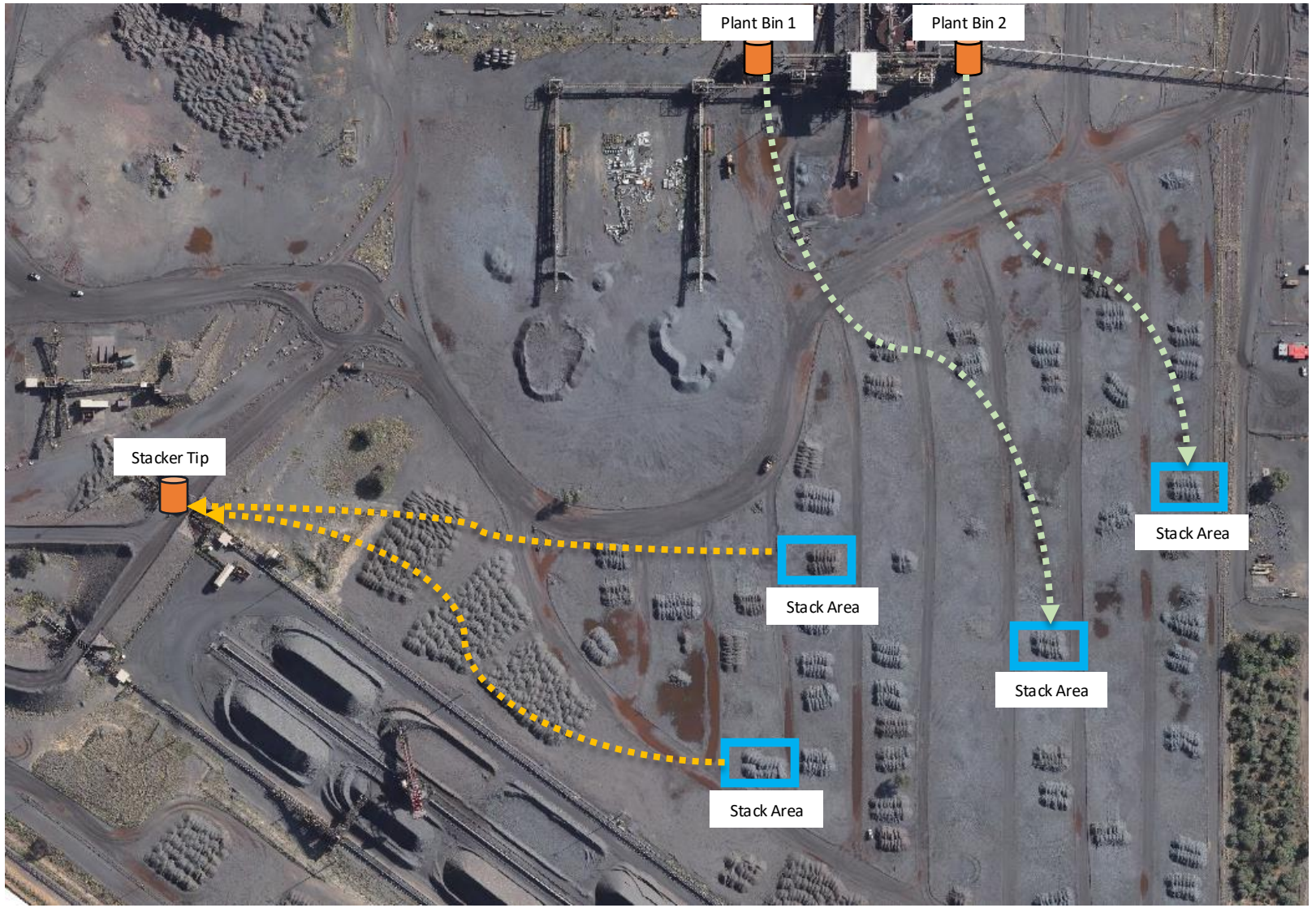
Seam 2 Plant

Seam 1 Plant

Stockyard

TYPICAL SURFACE ORE TRANSPORT ORE MOVEMENT

Loaders and Dump Trucks Blend Stacks to Stacker Bins according to Build Plan



Dump Trucks Haul Lumpy from Plant Bins to Planned Stack Areas

SURFACE ORE TRANSPORT (SOT)

TECHNOLOGY PROJECT

*Contributing to achieving the **5 year BRMO Game Plan Milestone**.*

HOW DOES IT WORK?

MAIN FOCUS AREAS:

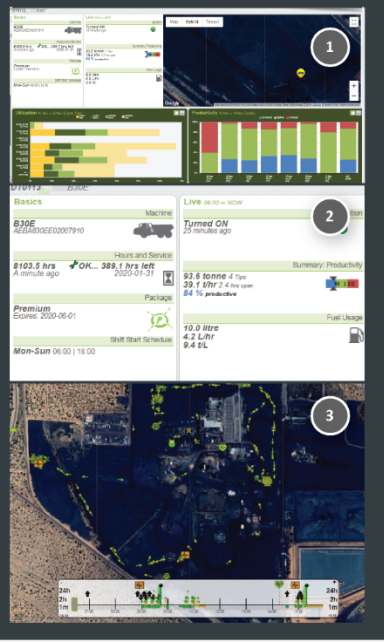
- **MACHINE DATA**
  Machine data can be extracted from the SOT machines using Canbus and processed to deliver value-added information to the end-users. Machine data include location data, health data, attribute data, measurement data and operator interface input data.

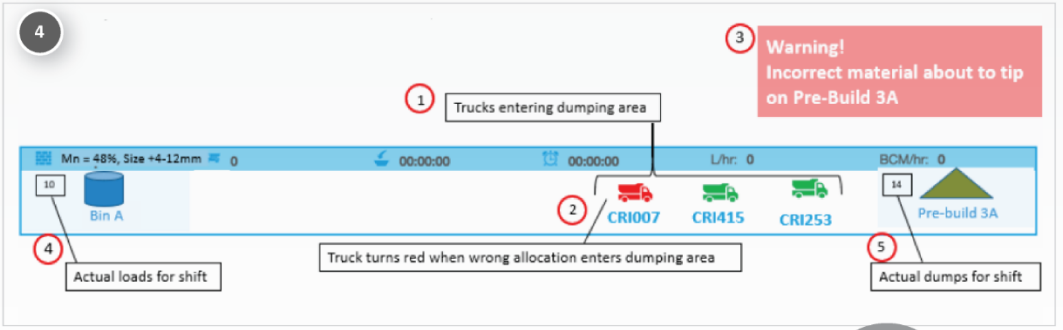
- **MATERIAL AND GRADE TRACKING**
  The ability to **plan, track and reconcile ore movement** from the three surface plants to stacks/stockpiles and from the stacks/stockpiles to the final product stockyard.

- **DISPATCH**
  The ability to **coordinate and optimise** machine activities and movements.

WHAT IS CHANGING?

1. Replacing paper-based operator reports with **digital reporting.**
2. Enabling **access to near-time machine information** to monitor SOT fleet status, availability, utilisation and production outputs.
3. Enabling **near-time tracking of ore movement** and quality from the surface plants to the different stacks and stockpiles.
4. **Implementation of a Dispatch System will enable:**
   - Creation of activity plans.
   - Optimised allocation of machines.
   - Monitoring actual vs plan.



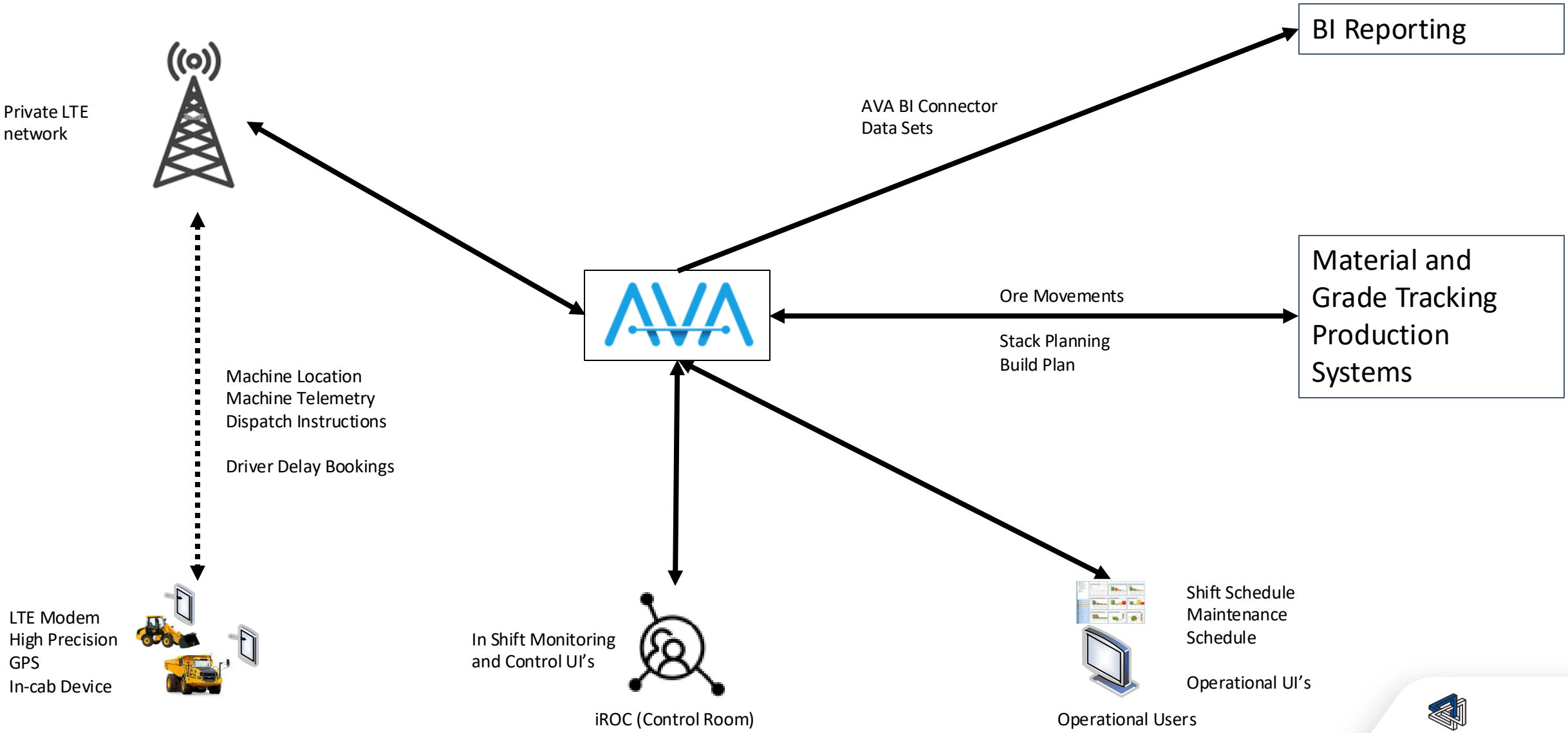


WHAT ARE THE BENEFITS?

- Improved **data integrity.**
- **Availability of value-added near-time information** for better decision making.
- Improved ore **accountability.**
- **Optimised machine utilisation** and activity management.

HOW DOES IT WORK?

SOLUTIONS ARCHITECTURE

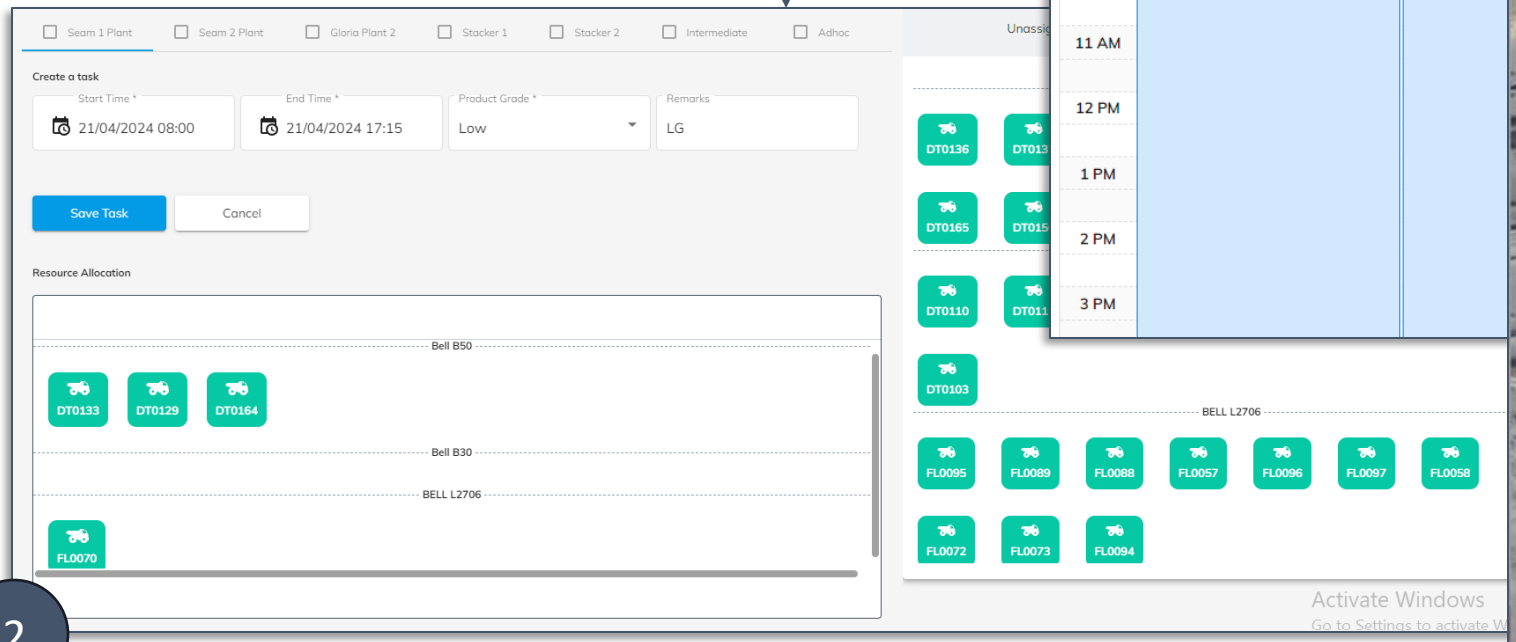


DISPATCH

Material movement plans (Stack Planning AND Build Planning) is imported from Material and Grade Tracking System

Material and Grade Tracking Production Systems

1

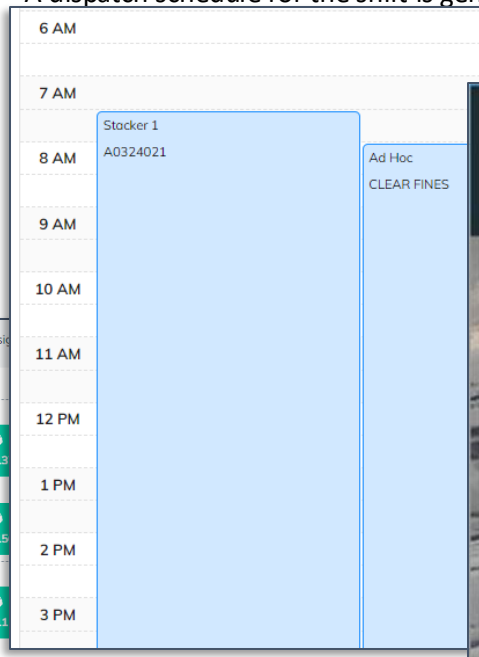


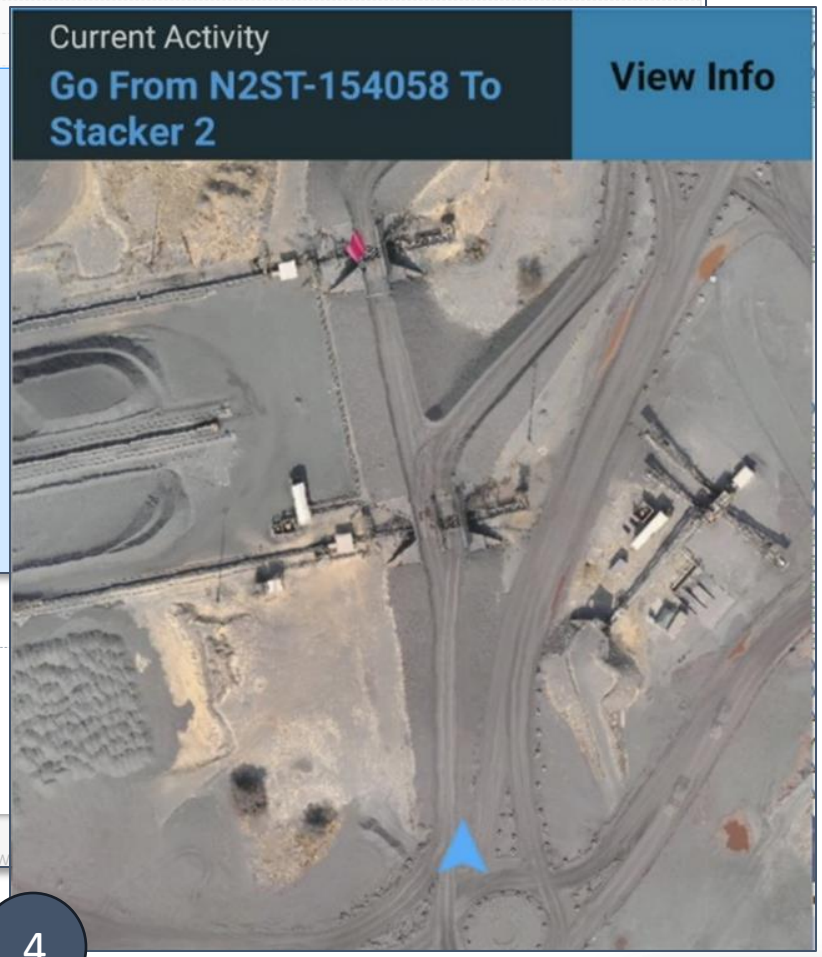
2

Material movement plans are broken down into a dispatch schedule by allocating machines and execution schedules.

A dispatch schedule for the shift is generated

3



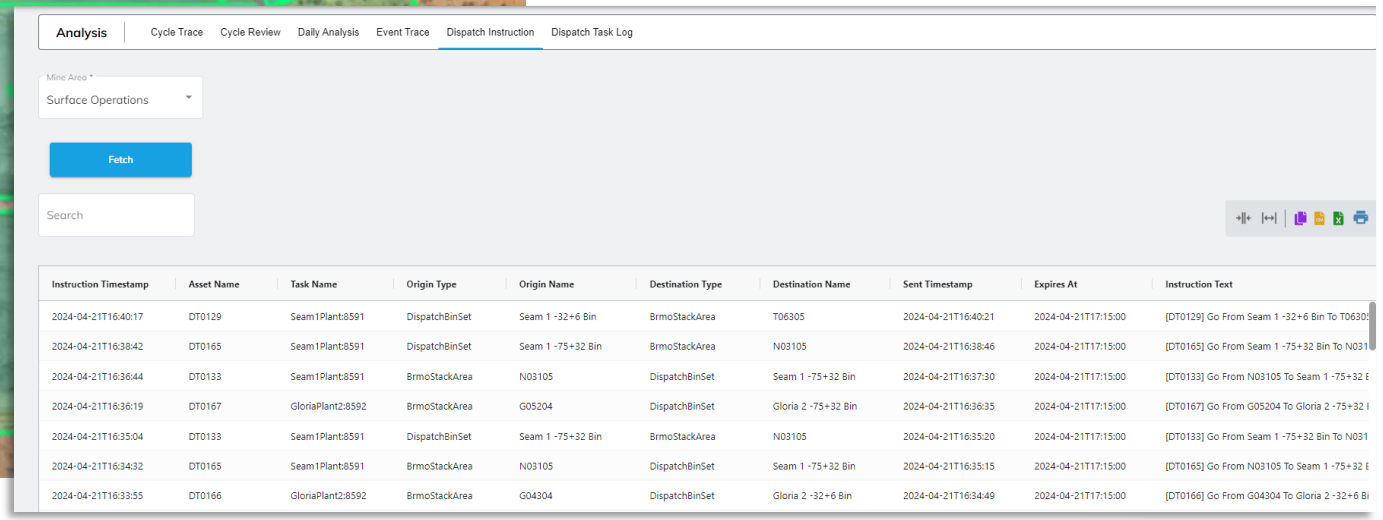


4

Trucks are dispatched using in-cab device

IN-SHIFT MONITORING AND CONTROL

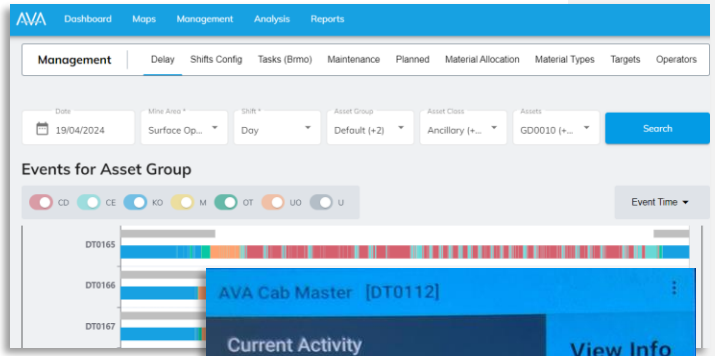
iROC (Control Room) and Operational teams can visually monitor machine activities and compliance to schedule / ore movement plans

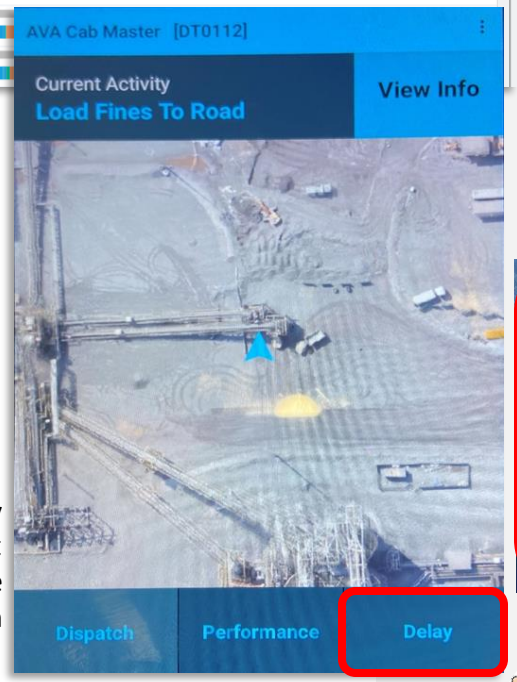


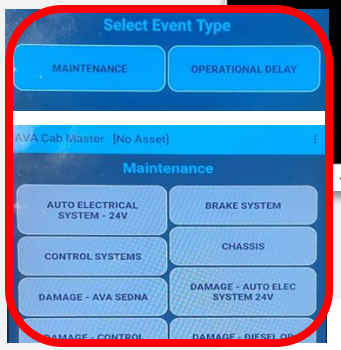
ASSET PERFORMANCE

Machine location and telemetry data is analyzed to automatically categories shift time into categories

Control Room and Operational Departments can annotate delays with additional detail

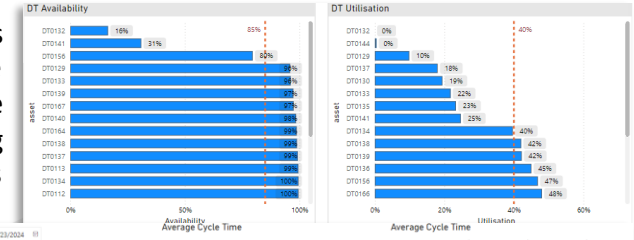


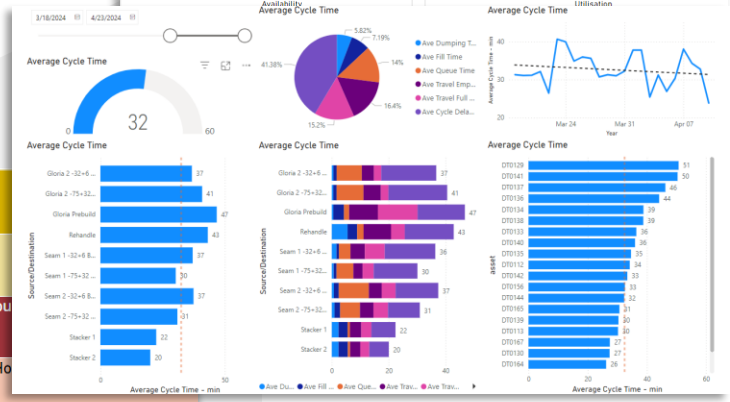


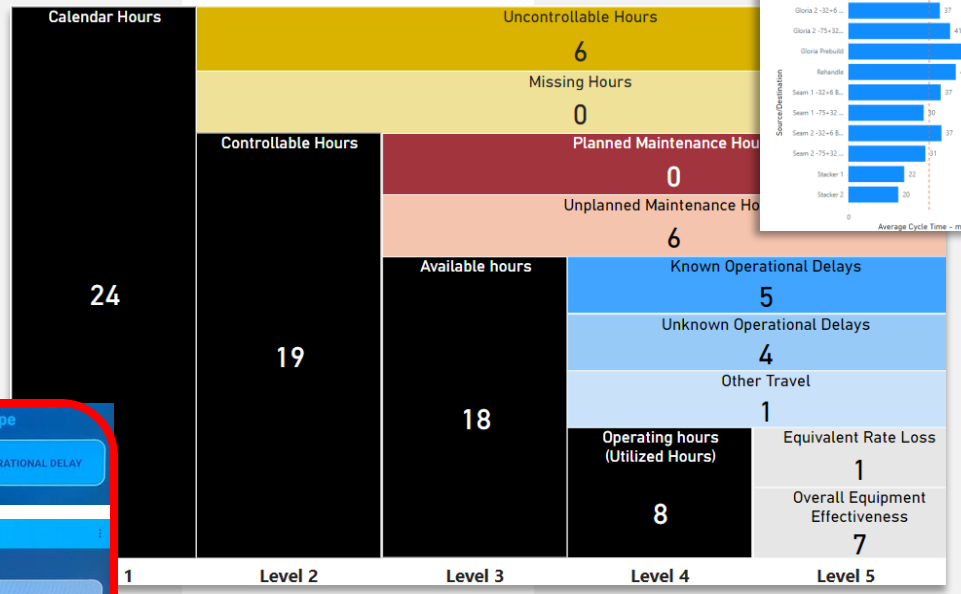


Operator Delay Booking from Tablet is used to annotate delays with additional detail

Information is streamed through the BI Connect and made available for reporting and trend analysis







An exhaustive time model is made available per machine with underlying delay code detail

CHALLENGES

CHALLENGES

1. Change management – Drivers, Supervisors, iROC (Control Room), Maintenance Team, Services Departments

2. Custom development vs off the shelf solutions

3. On-site Solution

4. Software Integration

BUSINESS BENEFITS ACHIEVED

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Live View and Cycle Replay

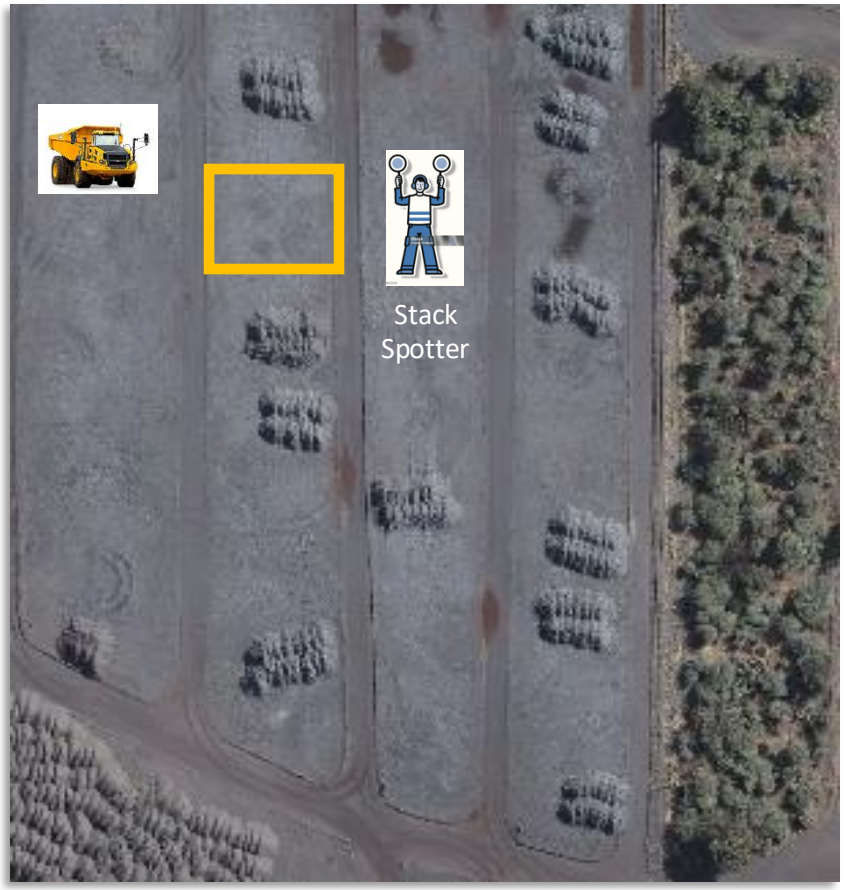
Driver Supervisors can manage their fleet without spending the day driving around

Incorrect ore movement can be linked directly to machines – efficient corrective actions can be implemented

Machine incidents can be investigated by using the Cycle Replay

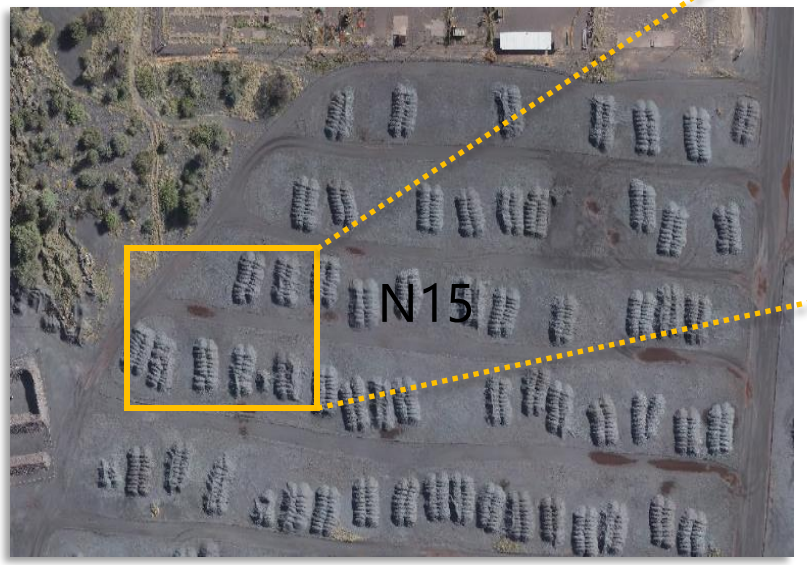
BUSINESS BENEFITS ACHIEVED

Implementation of the SOT Optimization Project enabled us to eliminate the Stack Spotter role



BUSINESS BENEFITS ACHIEVED

Implementation of the SOT Optimization Project enabled us to optimize our stack floors



NEXT STEPS

THANK YOU