



ASSMANG

MANGANESE

BLACK ROCK MINE OPERATIONS

AVA Symposium

April 2024

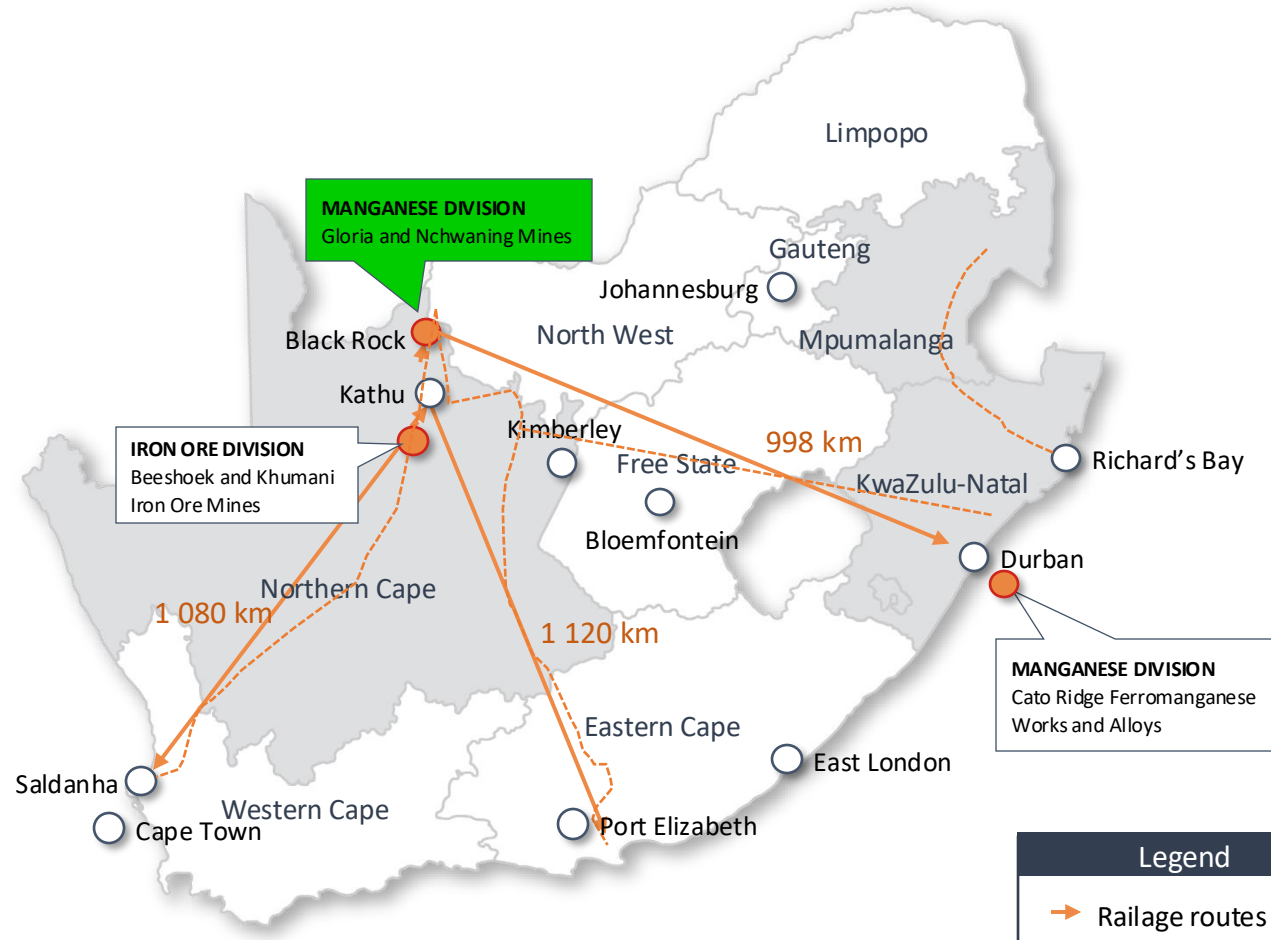


ASSMANG OPERATIONS AND LOCALITY

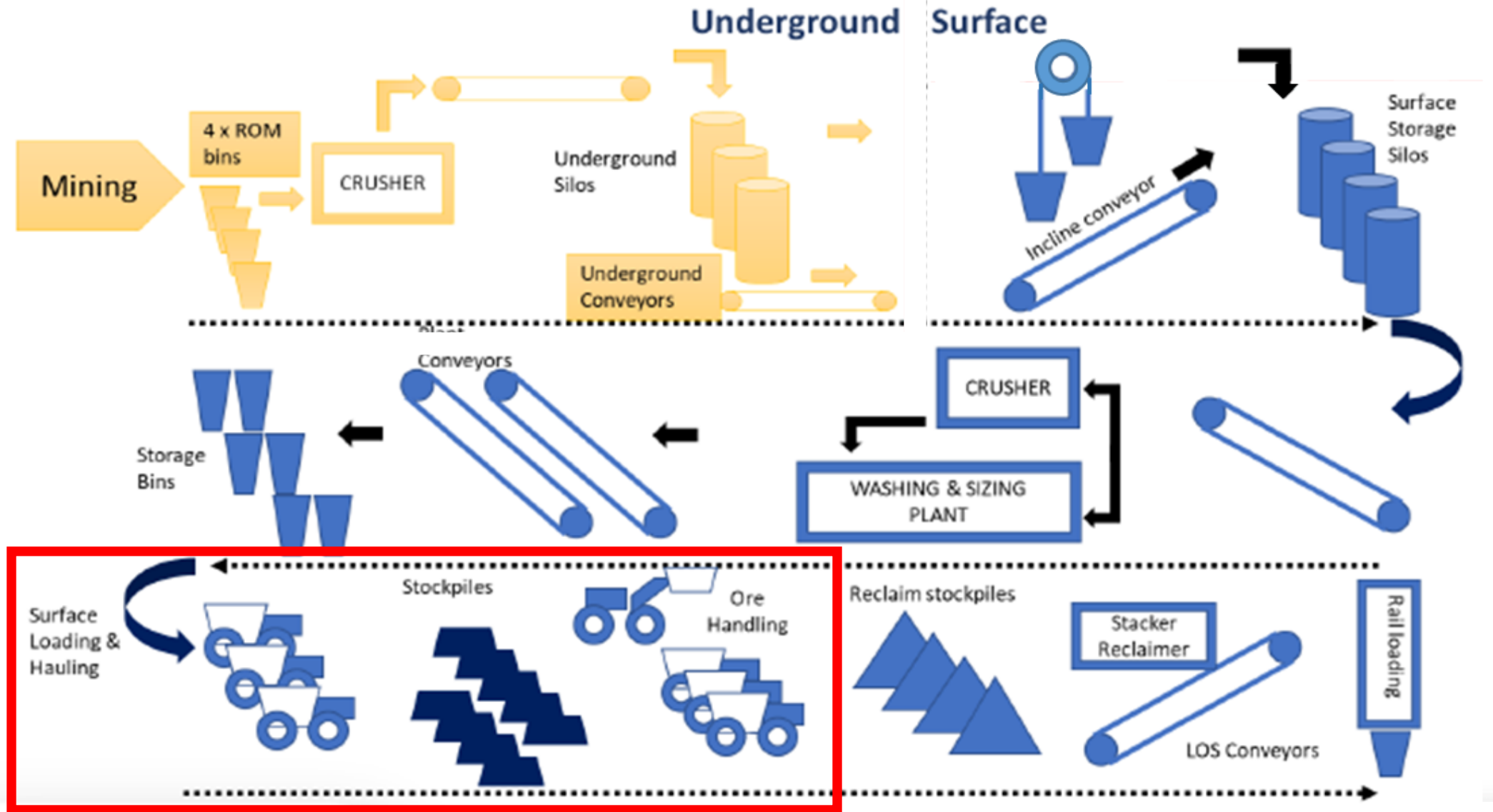


Blackrock Mine Operations Overview

- 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

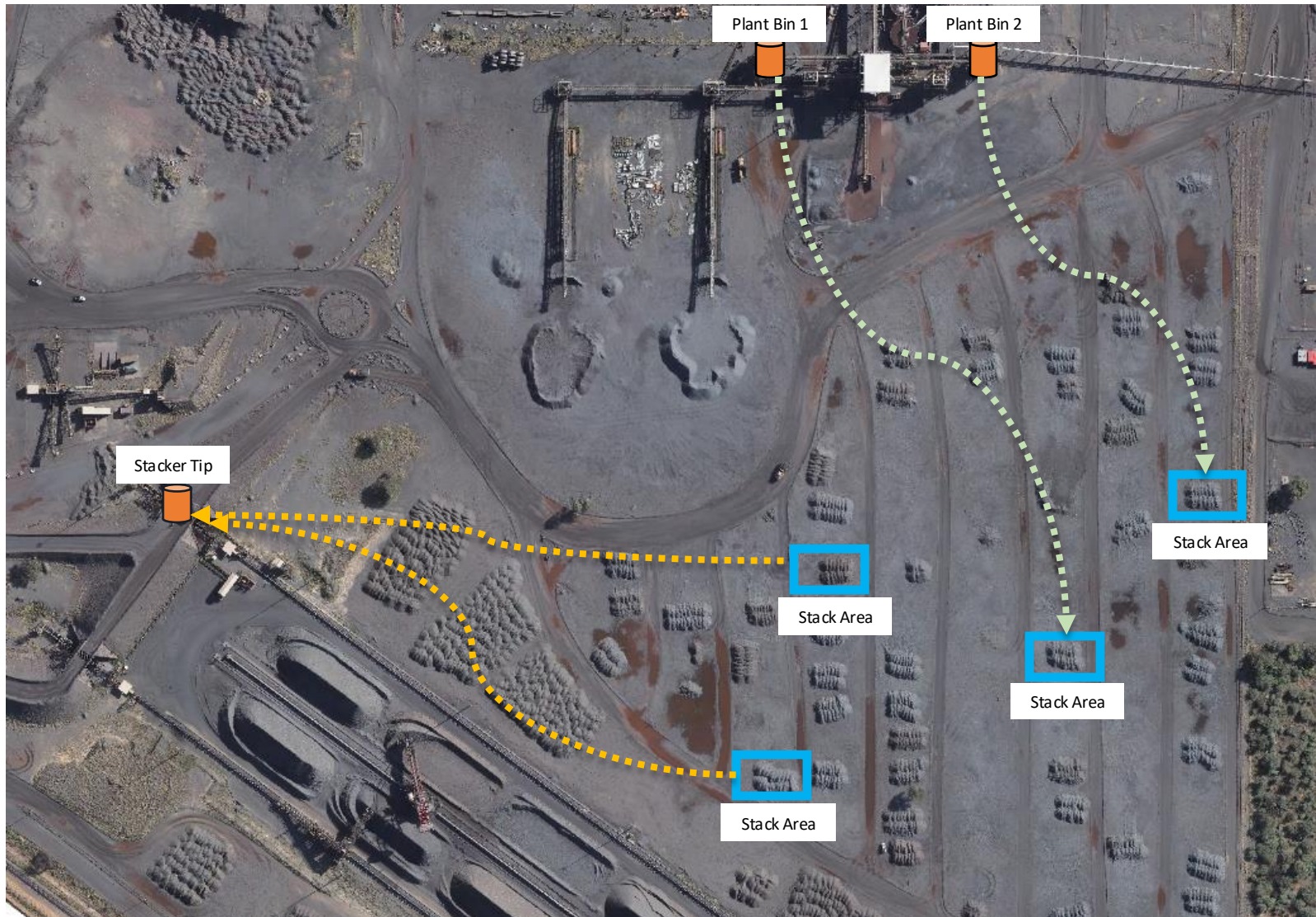


SURFACE OPERATIONS OVERVIEW



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.

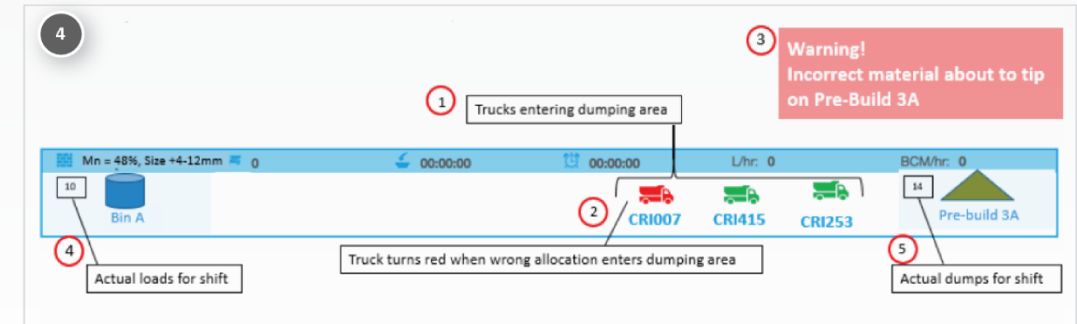
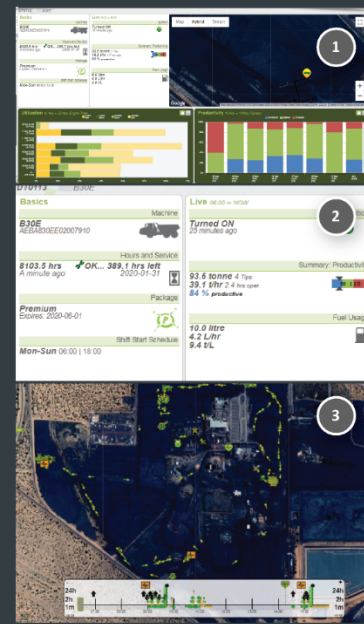
■ DISPATCH

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.



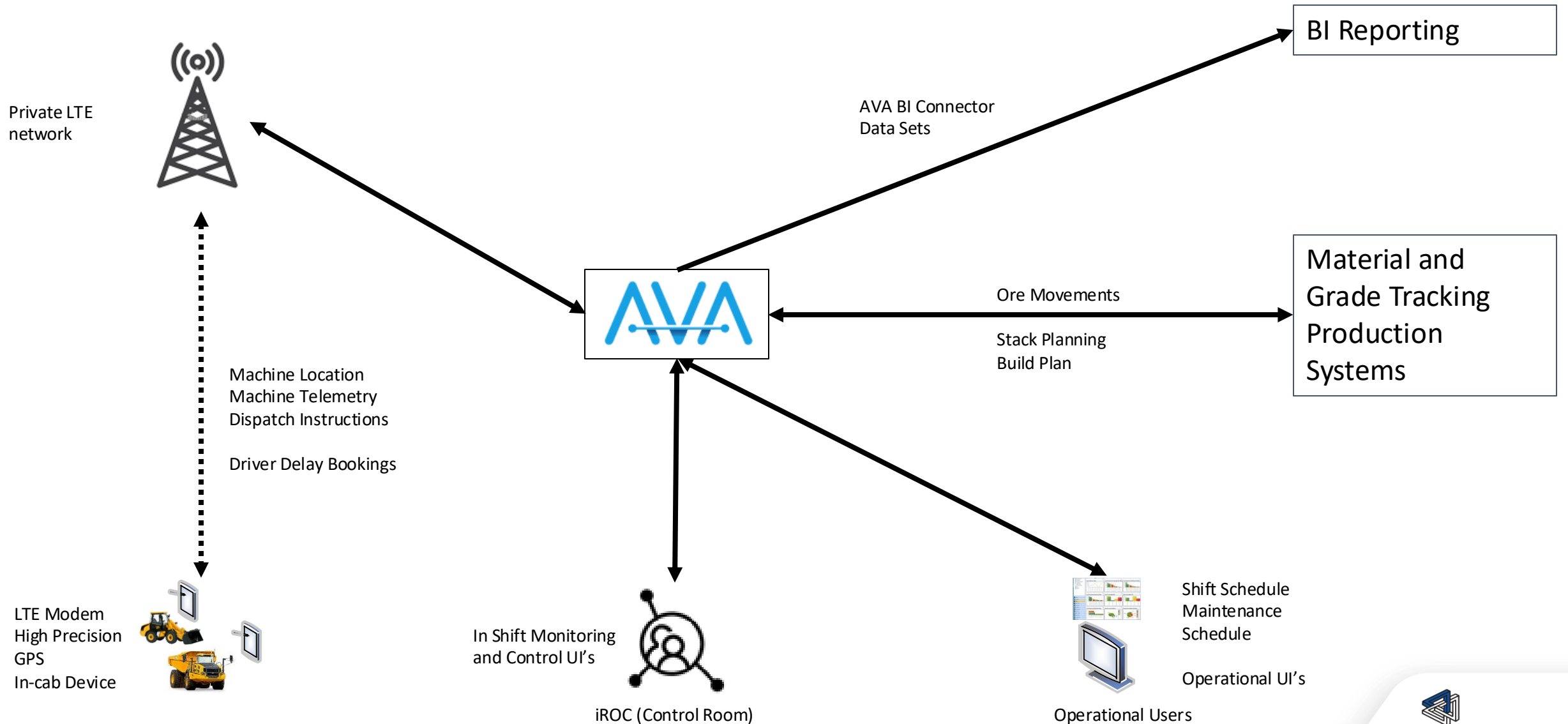
WHAT ARE THE BENEFITS?

- ✓ 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

The screenshot displays the 'Create a task' form with the following fields: Start Time (21/04/2024 08:00), End Time (21/04/2024 17:15), Product Grade (Low), and Remarks (LG). Below the form is the 'Resource Allocation' section, which shows a list of resources (DT0133, DT0129, DT0164, FL0070) assigned to different bells (Bell B50, Bell B30, BELL L2706). A 'Save Task' button and a 'Cancel' button are also visible.

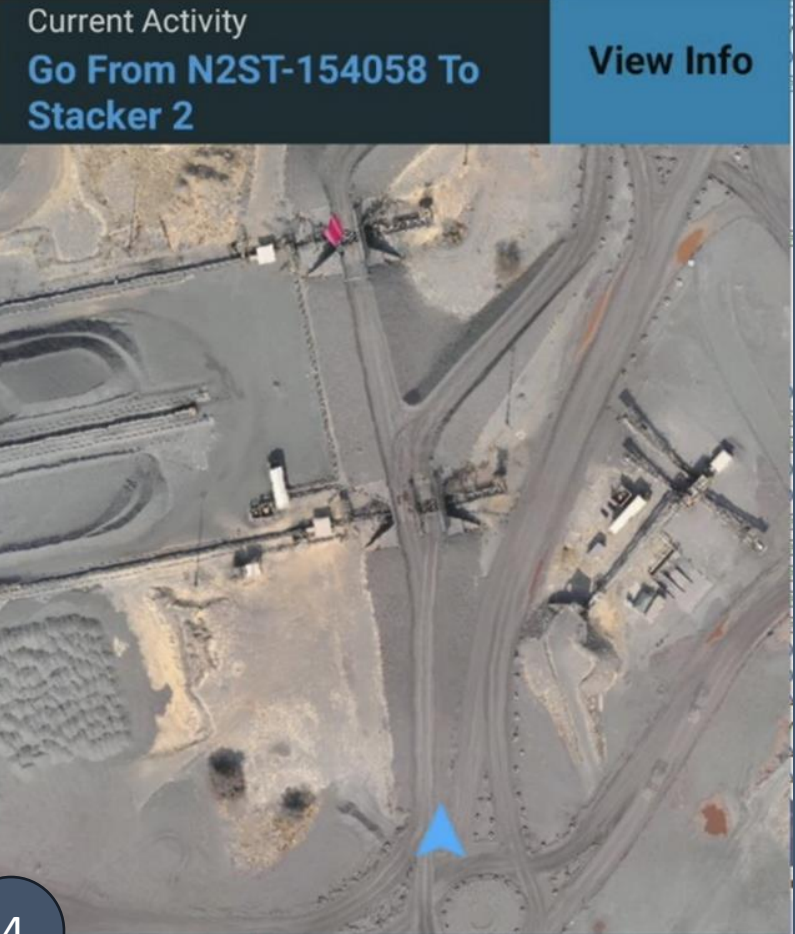
2

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

A dispatch schedule for the shift is generated

6 AM	
7 AM	
8 AM	Stacker 1 A0324021
9 AM	Ad Hoc CLEAR FINES
10 AM	
11 AM	
12 PM	
1 PM	
2 PM	
3 PM	

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

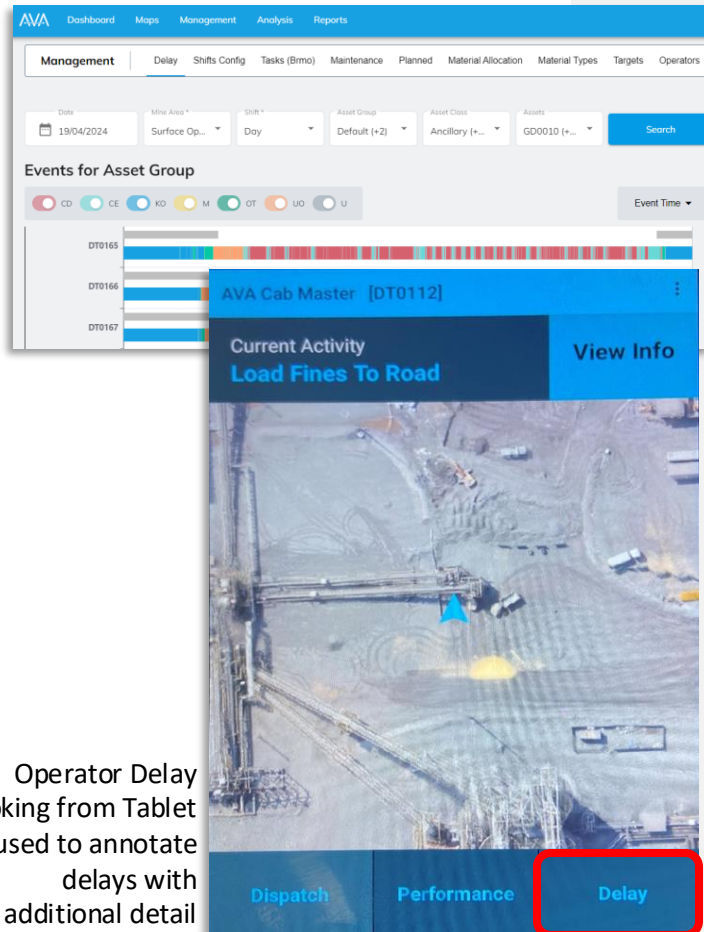


Analysis Cycle Trace Cycle Review Daily Analysis Event Trace Dispatch Instruction Dispatch Task Log									
Mine Area *									
Surface Operations									
Fetch									
Search									
Instruction Timestamp	Asset Name	Task Name	Origin Type	Origin Name	Destination Type	Destination Name	Sent Timestamp	Expires At	Instruction Text
2024-04-21T16:40:17	DT0129	Seam1Plant:8591	DispatchBinSet	Seam 1 -32+6 Bin	BrmoStackArea	T06305	2024-04-21T16:40:21	2024-04-21T17:15:00	[DT0129] Go From Seam 1 -32+6 Bin To T06305
2024-04-21T16:38:42	DT0165	Seam1Plant:8591	DispatchBinSet	Seam 1 -75+32 Bin	BrmoStackArea	N03105	2024-04-21T16:38:46	2024-04-21T17:15:00	[DT0165] Go From Seam 1 -75+32 Bin To N03105
2024-04-21T16:36:44	DT0133	Seam1Plant:8591	BrmoStackArea	N03105	DispatchBinSet	Seam 1 -75+32 Bin	2024-04-21T16:37:30	2024-04-21T17:15:00	[DT0133] Go From N03105 To Seam 1 -75+32 Bin
2024-04-21T16:36:19	DT0167	GloriaPlant2:8592	BrmoStackArea	G05204	DispatchBinSet	Gloria 2 -75+32 Bin	2024-04-21T16:36:35	2024-04-21T17:15:00	[DT0167] Go From G05204 To Gloria 2 -75+32 Bin
2024-04-21T16:35:04	DT0133	Seam1Plant:8591	DispatchBinSet	Seam 1 -75+32 Bin	BrmoStackArea	N03105	2024-04-21T16:35:20	2024-04-21T17:15:00	[DT0133] Go From Seam 1 -75+32 Bin To N03105
2024-04-21T16:34:32	DT0165	Seam1Plant:8591	BrmoStackArea	N03105	DispatchBinSet	Seam 1 -75+32 Bin	2024-04-21T16:35:15	2024-04-21T17:15:00	[DT0165] Go From N03105 To Seam 1 -75+32 Bin
2024-04-21T16:33:55	DT0166	GloriaPlant2:8592	BrmoStackArea	G04304	DispatchBinSet	Gloria 2 -32+6 Bin	2024-04-21T16:34:49	2024-04-21T17:15:00	[DT0166] Go From G04304 To Gloria 2 -32+6 Bin

ASSET PERFORMANCE

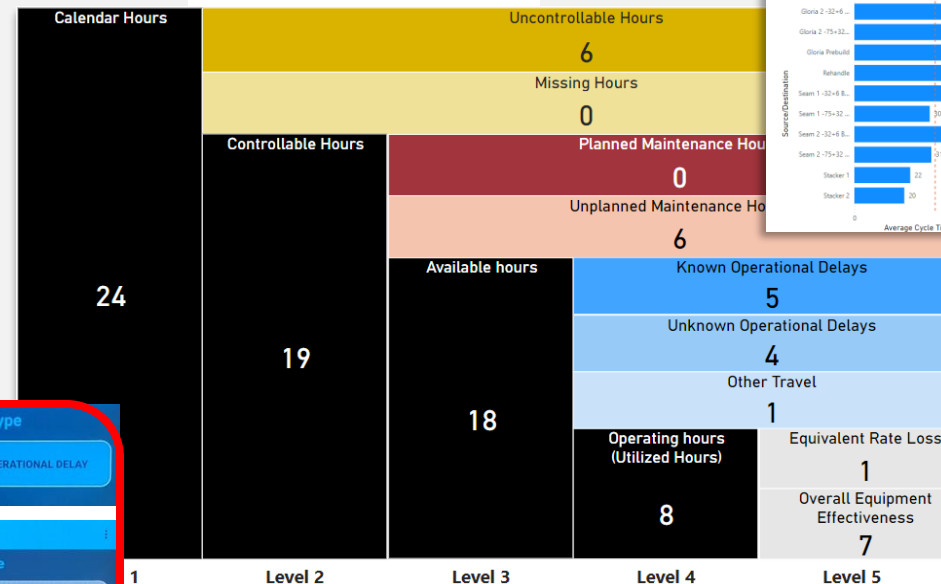
Machine location and telemetry data is analyzed to automatically categorize shift time into categories

Control Room and Operational Departments can annotate delays with additional detail

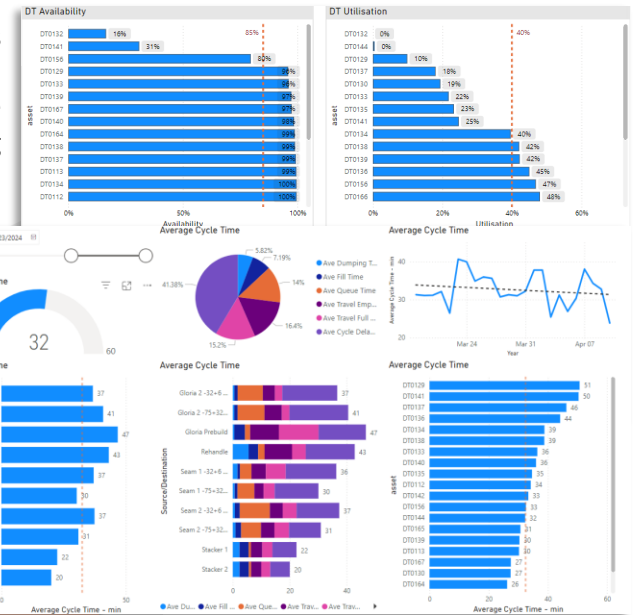


Operator Delay Booking from Tablet is used to annotate delays with additional detail

The screenshot shows a 'Select Event Type' form. It has two main categories: 'MAINTENANCE' and 'OPERATIONAL DELAY'. Under 'MAINTENANCE', there are sub-categories: 'AUTO ELECTRICAL SYSTEM - 24V', 'BRAKE SYSTEM', 'CONTROL SYSTEMS', 'CHASSIS', 'DAMAGE - AVA SEDNA', 'DAMAGE - AUTO ELEC SYSTEM 24V', 'DAMAGE - CONTROL', and 'DAMAGE - DIESEL OP'. The 'Delay' button from the previous screenshot is pointing to this form.



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

BUSINESS BENEFITS ACHIEVED

Live View and Cycle Replay

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

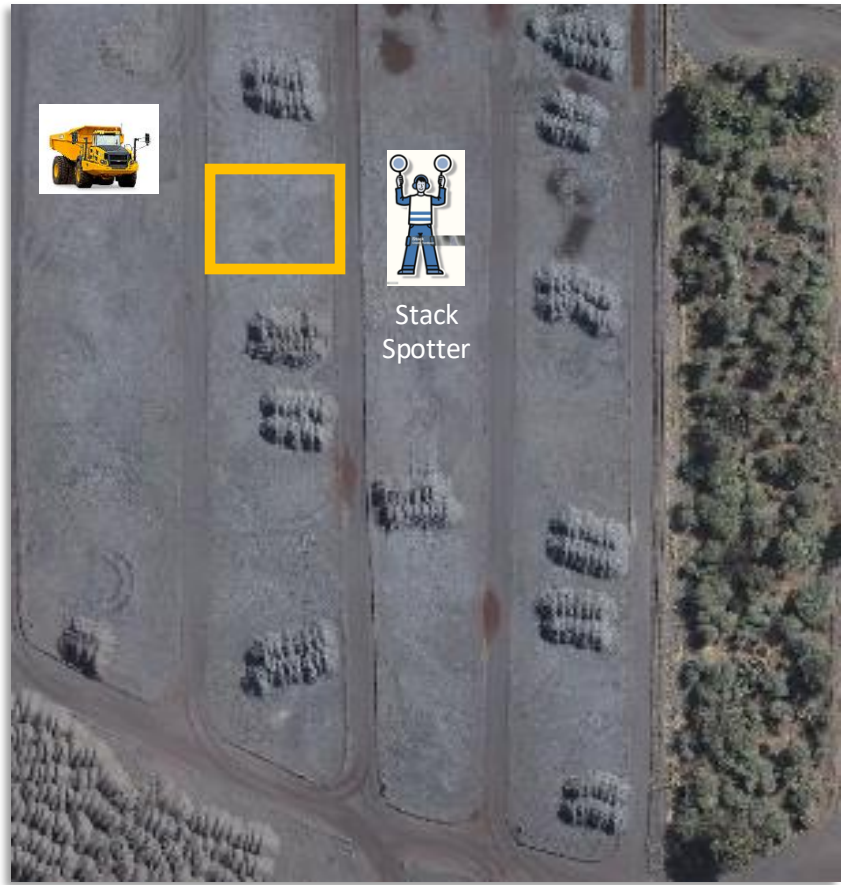


Incorrect ore movement can be linked directly to machines – efficient corrective actions can be implemented

Machine incidents can be investigated by using the Cycle Replay

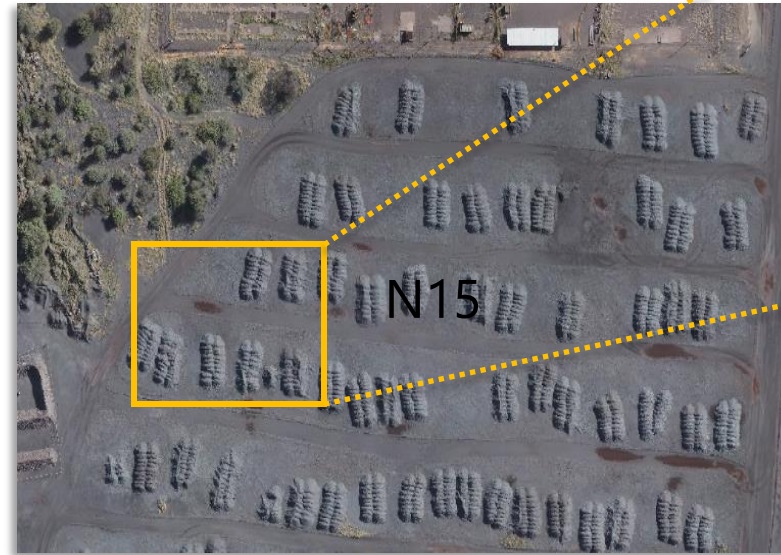
BUSINESS BENEFITS ACHIEVED

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