


Tecnología ShovelSense® para Clasificación de Material a Granel en el Frente de Carguío en Mina Teck Carmen de Andacollo

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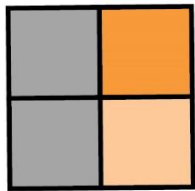
AGENDA

1. Mine Planning Present
2. Carmen de Andacollo
3. Using XRF at the Face
4. Methodology
5. Technology Quality Control
6. Conclusion

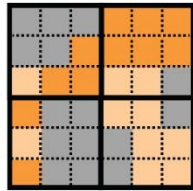


Mine Planning Present

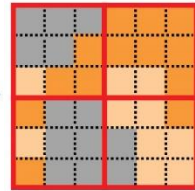
Long-Term Production Scheduling



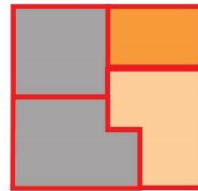
SMUs based on
Blasthole data



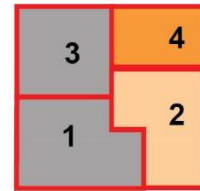
Short-Term Production Scheduling



Mining Cut
Design



Destination
Selection



Scheduling

— Blocks - - - - - SMUs — Mining Cuts

Ore Control

- Ore Loss
- Dilution
- Mixing
- Blast movement

Mine KPI

- Grades
- Tonnage
- Fragmentation

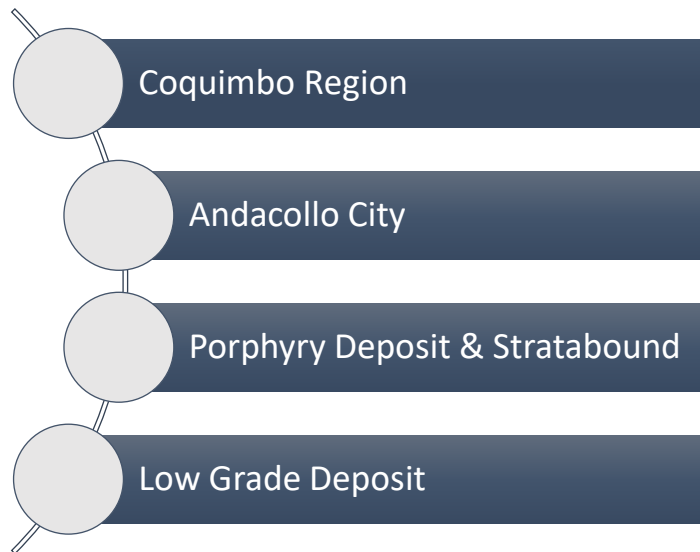


Carmen de Andacollo, Teck Resources Ltda

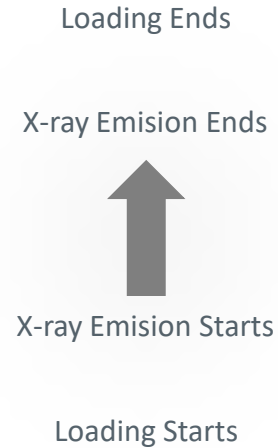


Carmen de Andacollo

Teck



Shovelsense: Each Bucket Equals A Data Collection Event



ShovelSense Clients

Mines in Operation

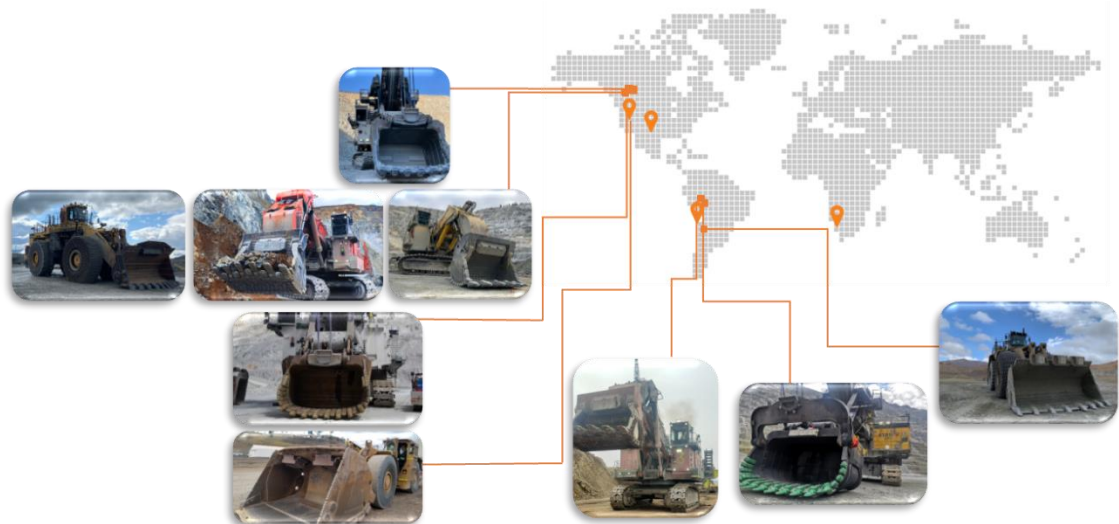
Copper Mountain (Canadá)
Taseko Gibraltar (Canadá)
TECK Highland Valley Copper (Canadá)
TECK Carmen de Andacollo (Chile)
Antamina (Perú)
Hudbay Constanca (Perú)

Mines in Industrial Validation

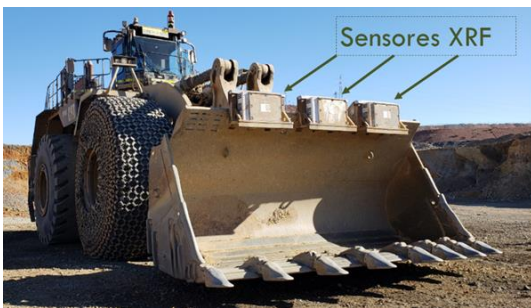
BHP Minera Spence & Escondida (Chile)
Antapaccay (Perú)
Collahuasi (Chile)

Mines in Amenability Test

Candelaria (Chile)
Los Pelambres (Chile)
Centinela (Chile)
Zaldívar (Chile)
Antucoya (Chile)



Key Performance Indicators Definitions



CAT 994

KPI

CHECKLISTS



Availability

- $\geq 80\%$ ShovelSense Availability

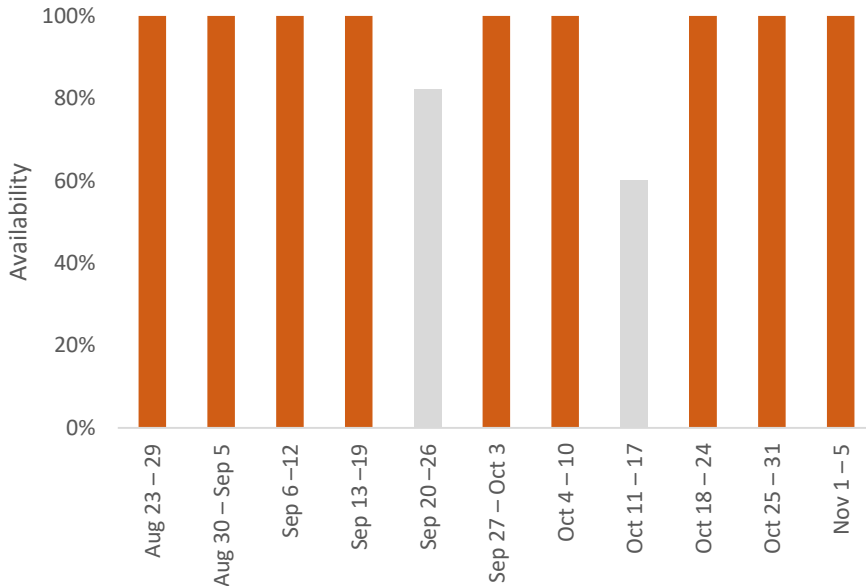
Precision

- $\leq 20\%$ Coefficient of Variation (CV)

Accuracy

- $\leq 20\%$ Mean Absolute Percentage Error (MAPE)

ShovelSense Availability



ShovelSense availability
above 80% success
criteria

96% Trial average availability

Comments

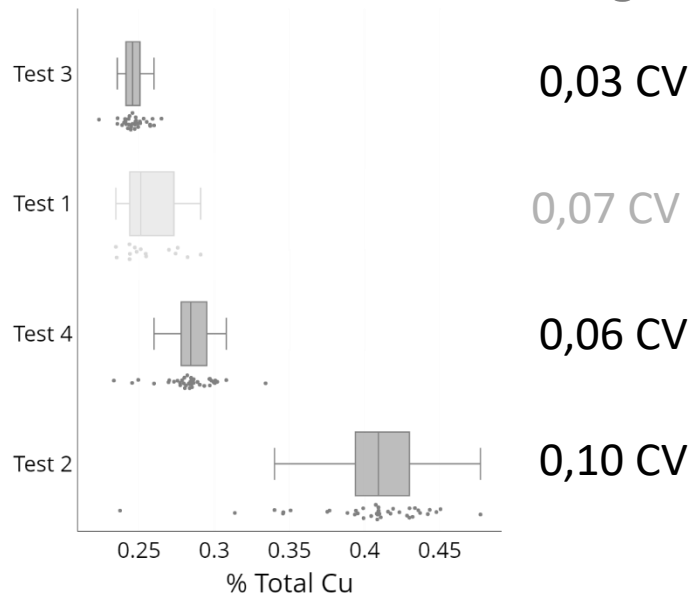
- Main communication cable damaged by rock
- Moxa AP installed; communications restored
- Head laser issues before PM, all heads replaced on scheduled PM, Shovel back online Oct 15
- Ch3 Cable damaged, other heads working well

ShovelSense Precision



All tests returned CV
below success criteria of
 ≤ 0.2

0,07 Trial average CV

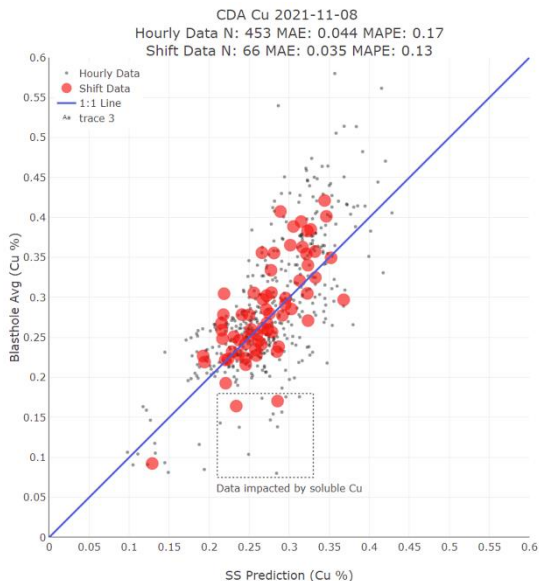


Aggregate Scale ShovelSense Accuracy

MAPE \leq 20% success criteria with the final calibrated model

13% Trial average MAPE

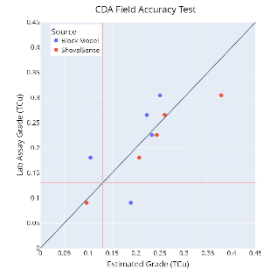
- Different dataset conditions (Pre and Post Blast)
 - Low Mean Absolute Error (MAE)
 - Low Mean Absolute Percentage Error (MAPE)
- ShovelSense performs well at the Hourly and Shift scale
 - Low Mean Absolute Error (MAE)
 - Low Mean Absolute Percentage Error (MAPE)



Final Trial Accuracy Results

	MAE	MAPE
Hourly Level	0.044 % TCu	17 %
Shift Level	0.035 % TCu	13 %

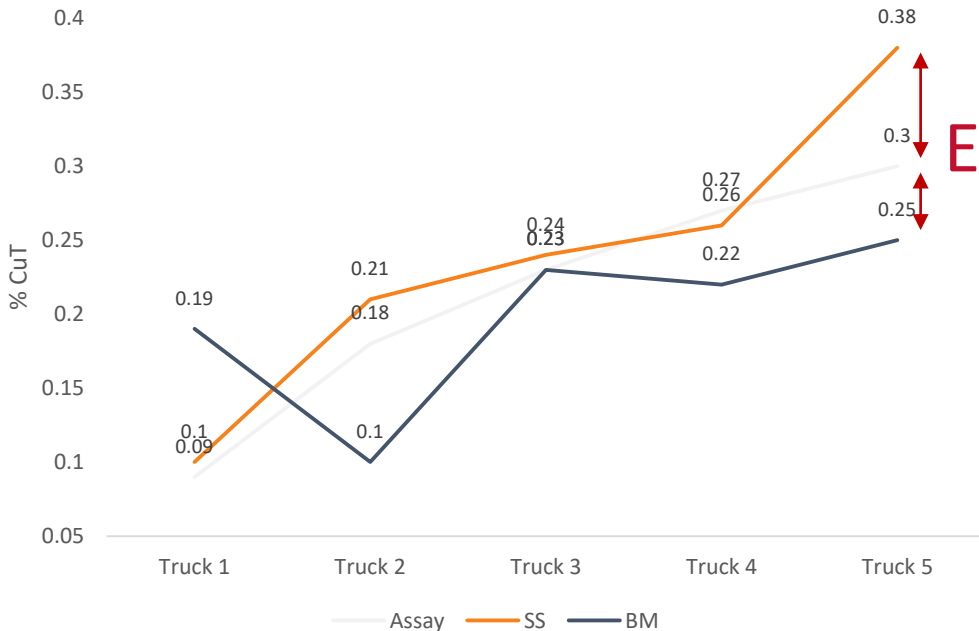
Accuracy Field Test Description



ShovelSense Accuracy Field Test

MAPE ≤ 20% success criteria with the final calibrated model

11,1% Field Test average MAPE



Error

Mean Absolute Error (MAE)

	ShovelSense	Block Model
Minimum	0,06 % TCu	0,06 % TCu
Maximun	0,074 % TCu	0,099 % TCu
Average	0,026 % TCu	0,056 % TCu

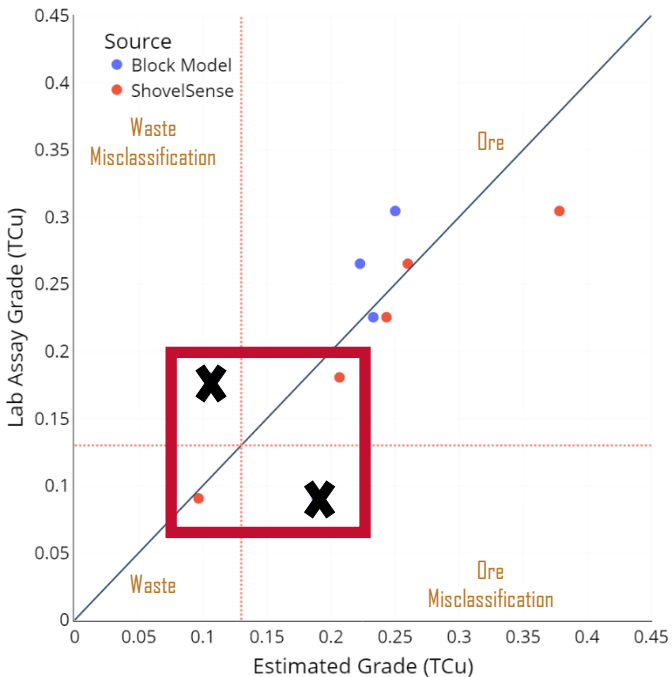
Mean Absolute Percentage Error (MAPE)

	ShovelSense	Block Model
Minimum	1,9%	3,3%
Maximun	24%	108,9%
Average	11,1%	37,66%

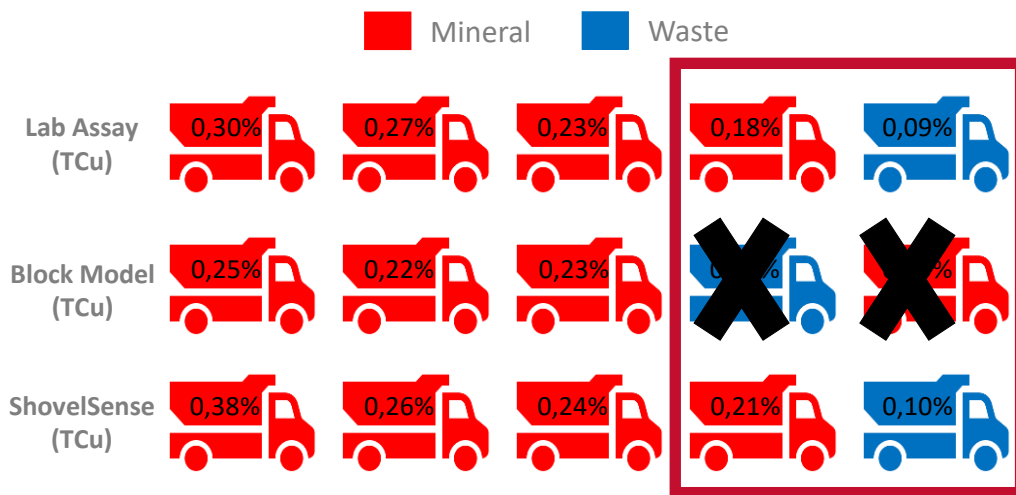
ShovelSense Accuracy Field Test

ShovelSense accuracy perfectly aligned with the lab assay results

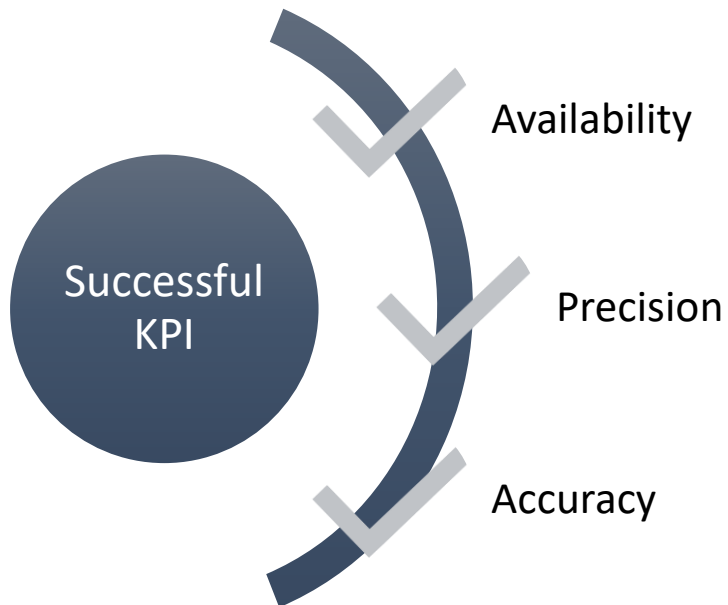
CDA Field Accuracy Test



Higher certainty in the contact zones



Technology Quality Control Summary



MineSense adds value to your orebody Transforming the Future of Mining

- ShovelSense proved to be a mechanically **robust system, that produces precise and accurate grade predictions** capable of adding incredible Value to CDA.
- ShovelSense **material classification aligned** with the lab assay results, the Block Model misclassified 2 of the 5 trucks.
- During the accuracy field test ShovelSense grades were significantly more accurate than the Block Model estimates, **25% lower MAPE.**
- ShovelSense introduces a new dataset that provides a **greater granularity that can unlock the potential of the mine and improve operational efficiency.**

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