



# Outlook on MacLean ground support solutions

WSN's 2023 Mining Health and Safety Conference  
April 20, 2023







## History

- Founded in 1973 in Ontario, Canada, remains privately held
- 1100+ employees globally, ~150 in engineering
- 2400+ units commissioned to date

## Value proposition

- Extensive hard rock mining experience
- Multi-discipline engineering
- Integrated design, manufacturing and assembly
- International sales, customer service and support





-  MANUFACTURING
-  BRANCHES
-  DEALER NETWORK
-  SALES & SUPPORT
-  DUCKY DECLINE  
MacLean Research & Training Facility





# MacLean product lines



## Utility Vehicles & Attachments

- Material and Personnel Transport
- Elevated Work Platforms
- Grader
- Forklift (*In Development*)



## Bolting

- Bolters
- Small section bolters
- ABI Bolter (*in Development*)



## Shotcrete

- Sprayers
- Transmixers
- Agitator trucks & mobile batch plant



## Ore Flow

- Explosives (emulsion/anfo) loading units
- Scalers & rock breakers
- Secondary ore reduction drills
- Hanguap removal drills and water cannons



# Four pillars in our Advanced Vehicle Technology team

## Remote Systems



- 3 levels of remote
- Commonality of hardware
- Mode switching
- Interoperability

## Digital Systems



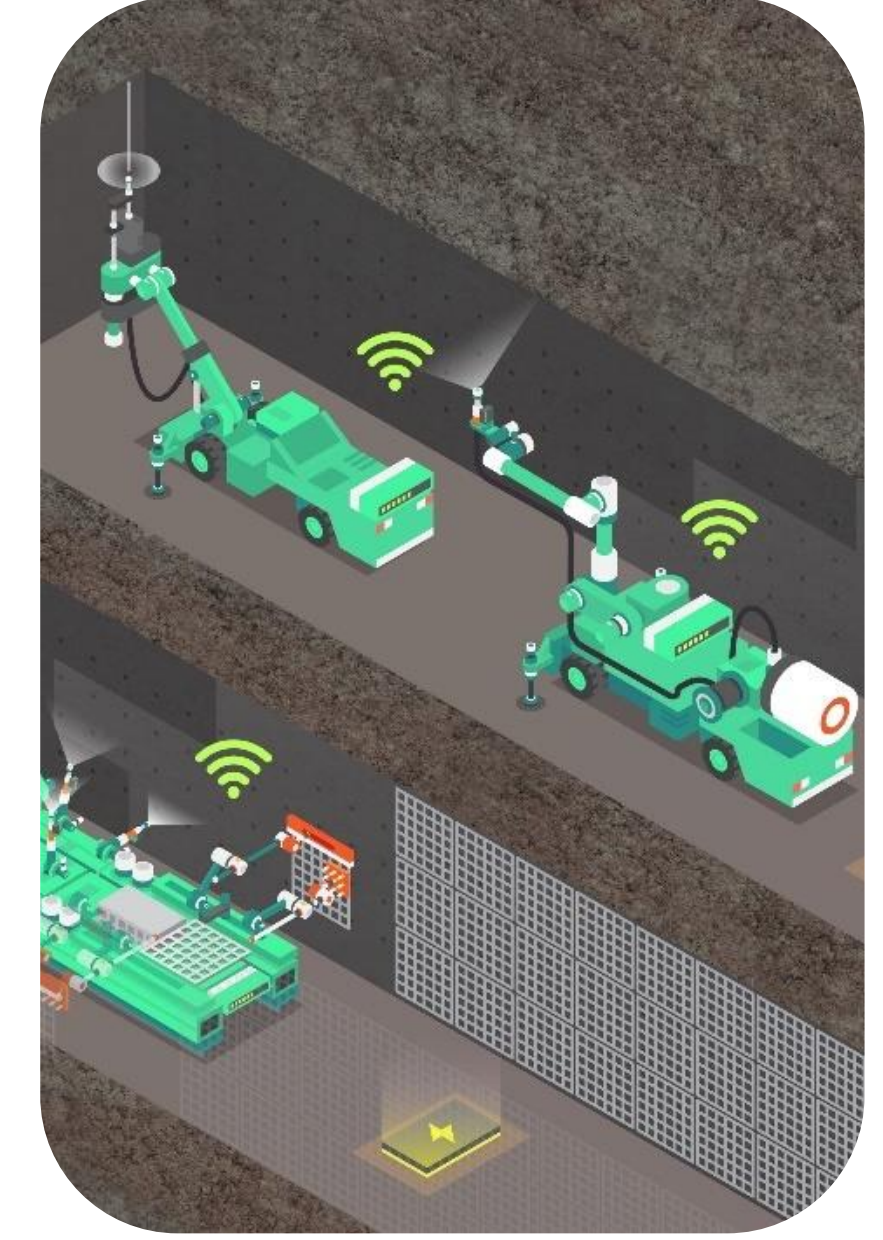
- Vehicle Telemetry
- Machine Control (5 Series)
- Customer Portal
- Data Analytics & Security
- VR Training Simulator

## New Vehicle Systems



- Equipment Design
- Robotic Design
- Powertrain Design
- Application Design

## Autonomous Systems



- Localization, Auto Tram & Intelligent Boom Control
- Machine Vision, Sensing & Encoding
- 3D Mapping
- Safety System





# Where the “MacLean bolter” started

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# Facts on the MacLean scissor bolter

- 30+ years of operations, primarily in Ontario and Quebec
- Over 500 bolters sold
- Always working directly under supported ground
- The most productive bolter on the market for resin rebar – around 12 solid resin rebar per hour & 20-25 split sets per hour
- Use the last row of bolts from the previous round to put the right number of bolts in & no more
- Safe rehabilitation of ground support
- Load up for the entire round, safe, easy & fast changes between bolt types
- Prescribed bolt spacing dictates size of screen, quality of ground support installation and ability to install heavy gauge strapping.
- Easily extend services while on the deck, take safety bays, drill cable bolt holes, mark up miss holes & bootlegs effectively, etc etc

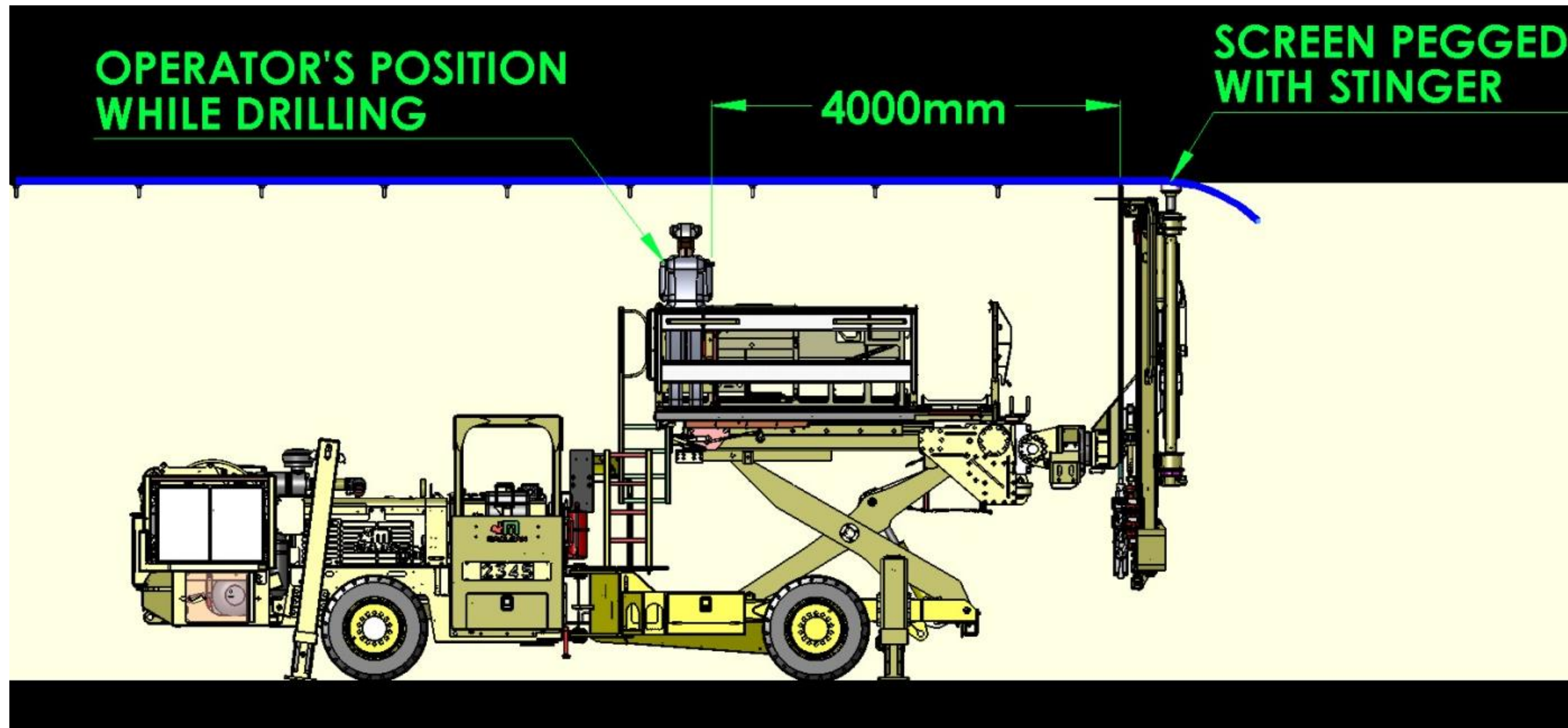


928 Scissor Bolter at INCO Creighton



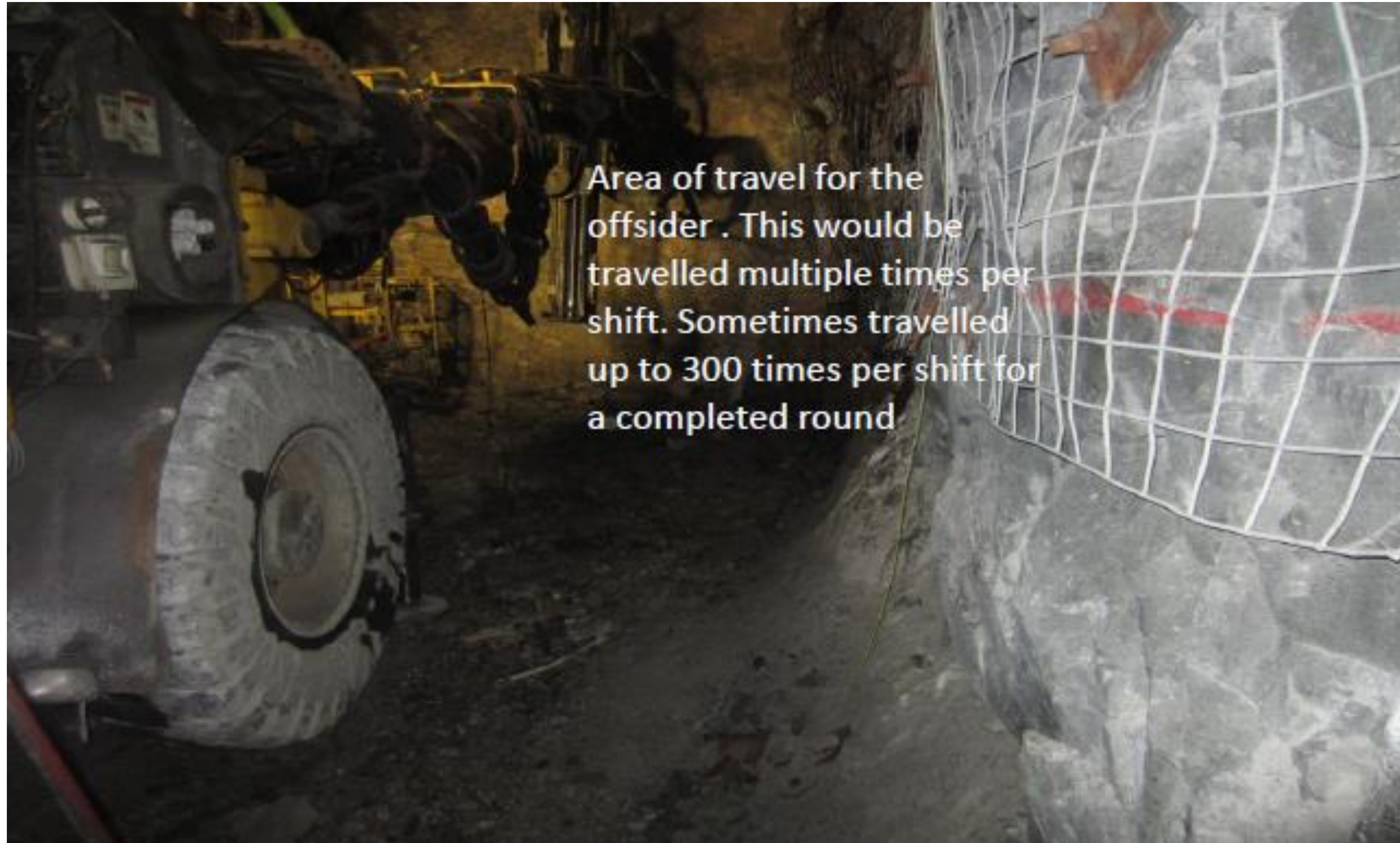
# Why is scissor bolting safe?

- The operator is right under supported ground, at a safe distance from unsupported ground
- Everything the operator needs to complete the job is on the deck in arm's reach



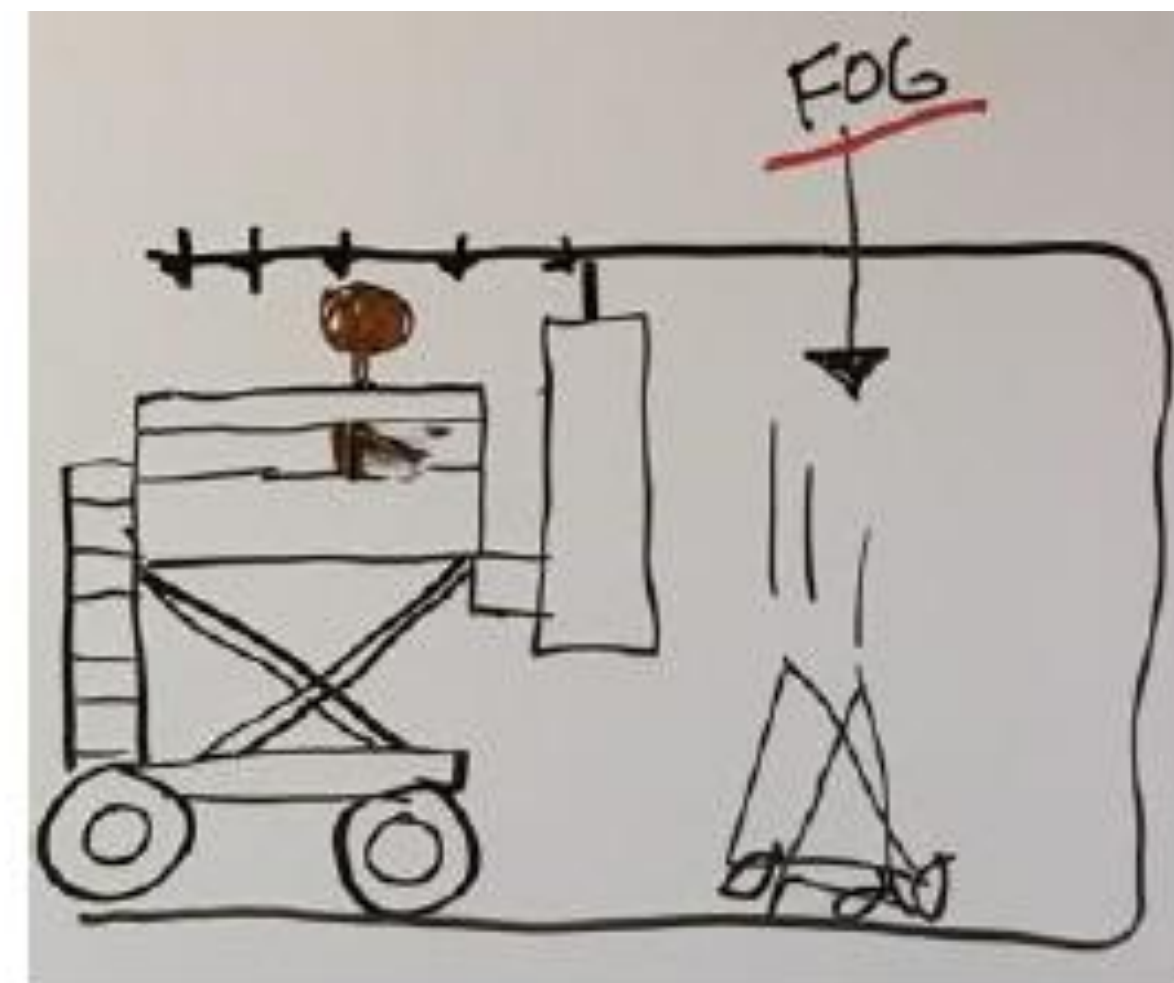
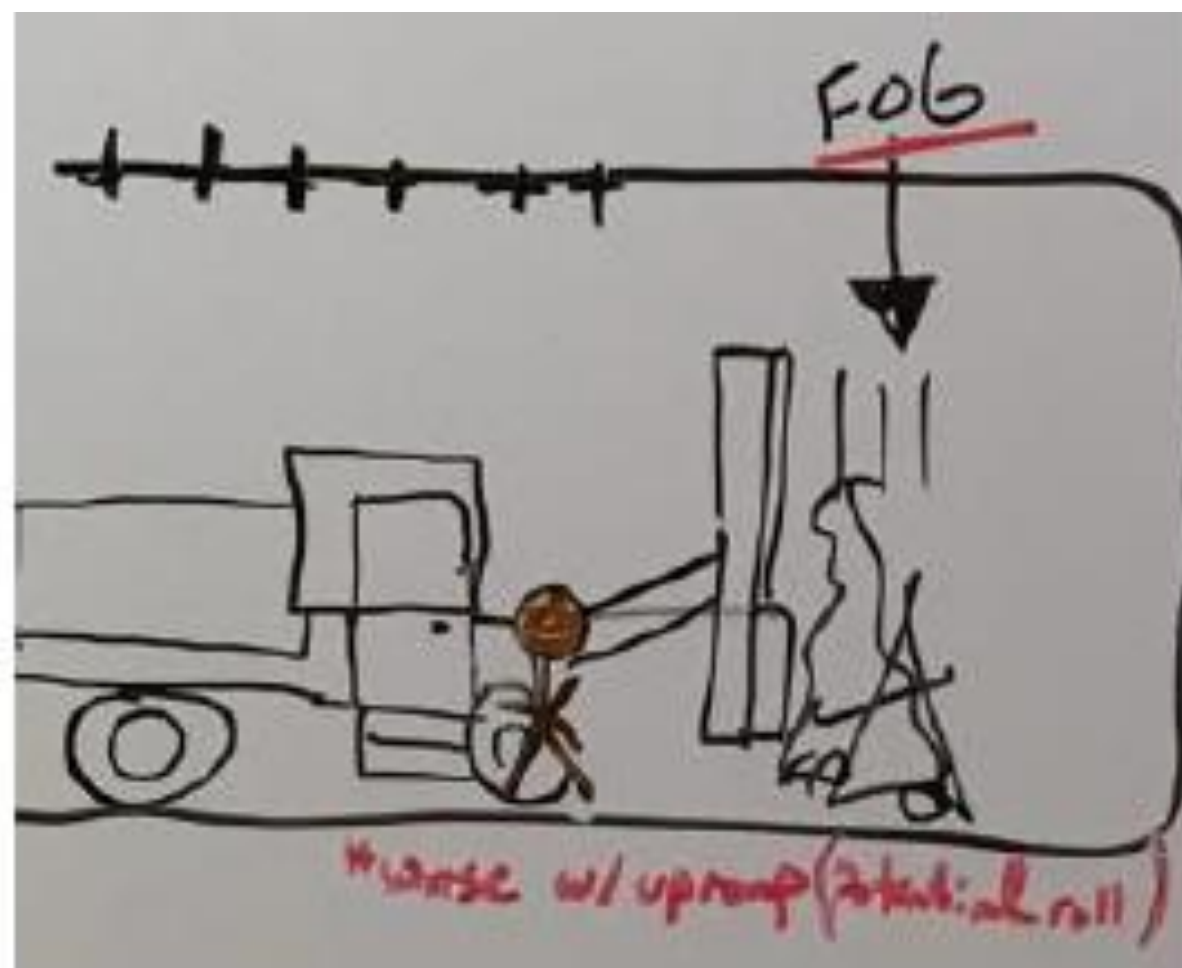
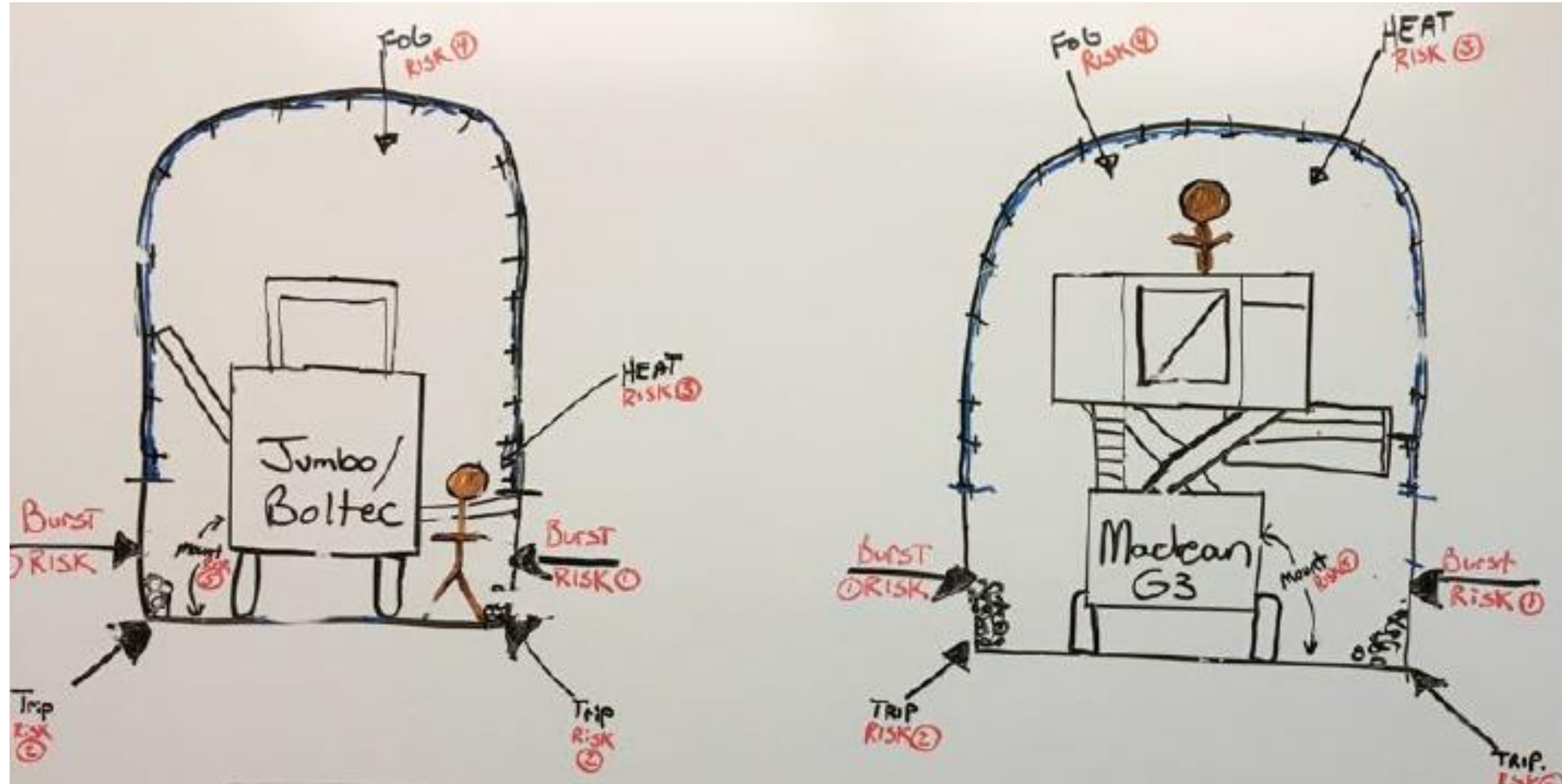


# Observations with other styles of bolting





# Fall of ground & bursting scenarios





# The MacLean bolter evolution; 985 Abi

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- We heard concerns from industry about operator exposure to the environment.
- There are sites where the concerns are on extreme seismicity, ambient heat, travel times or a combination of all the above
- This resulted in a requirement to put the operator in a ROPS/FOPS airconditioned and air filtered cab
- Obviously, this would be hard to achieve with the operator on the deck.
- We found a way to continue the same philosophy that worked for our customers for the last 30 years





# 985 Abi – Next Generation Bolter





# 985 Abi New carrier design





# SS5 Shotcrete sprayer

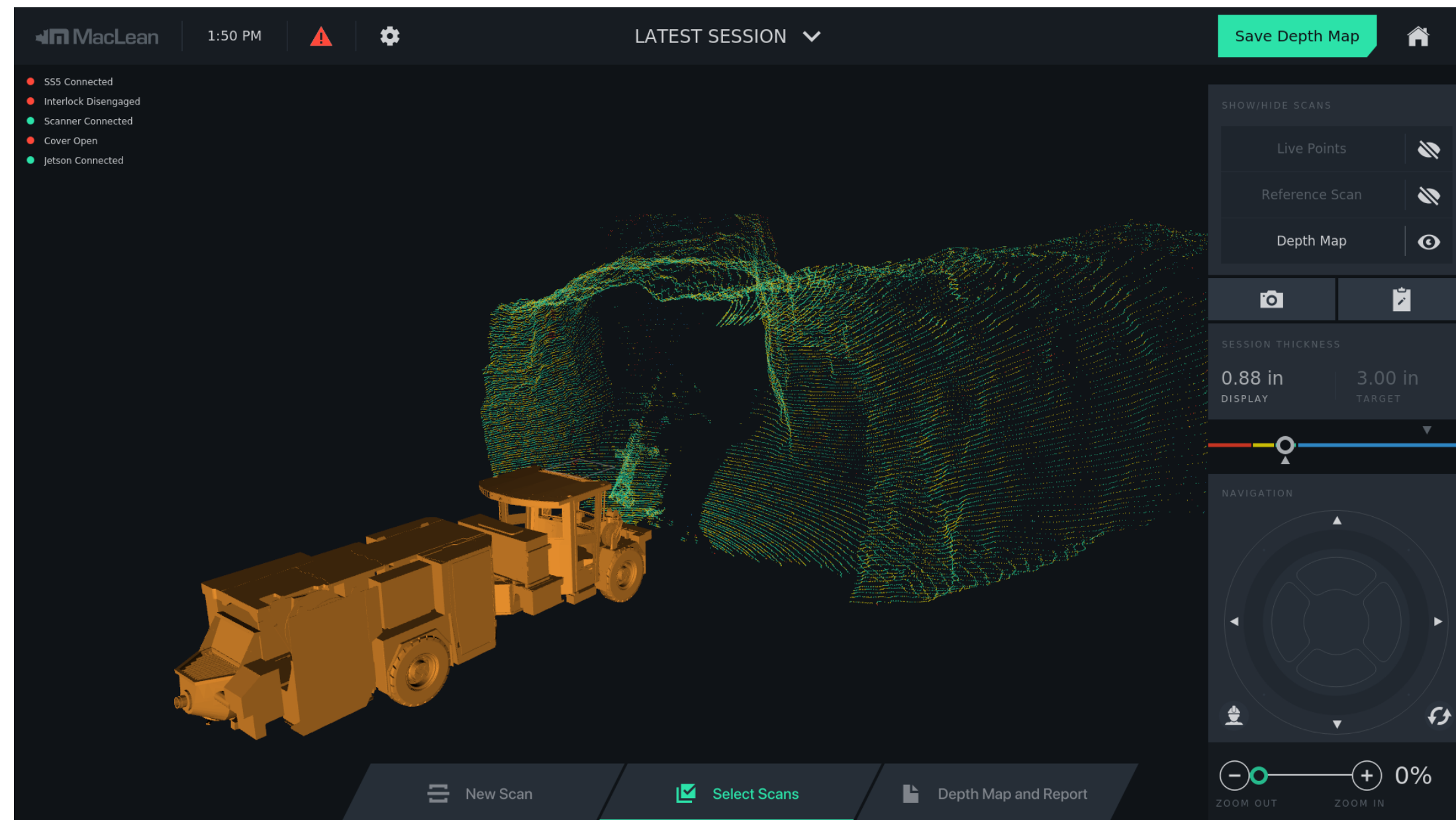
- Spray from the cab! Air conditioned & HEPA dust filtered air, removing the operator from harsh environmental conditions
- Autodose option – accurate record keeping of pump rates both for shotcrete and additives & tight control on additive limits
- Powerful shotcrete pump capable of 23 m<sup>3</sup>/hr and able to handle concrete aggregate – use your sprayer as a pump truck for construction jobs
- Ability to adjust the hopper for varying ramp grades





# SS5 - Continued

- Options include a parallel lancing boom & associated controls for ease of spraying
- Water scaler option available
- Powerpack available
- Available with Mercedes 904 (T3), Volvo (T4f) or battery electric powertrains
- On-board compressor available
- Can shoot ~12-15m<sup>3</sup> on battery if mine air is available
- Quicksan package available, will be demonstrated at CIM, or can be seen at our test site in Lively by appointment.



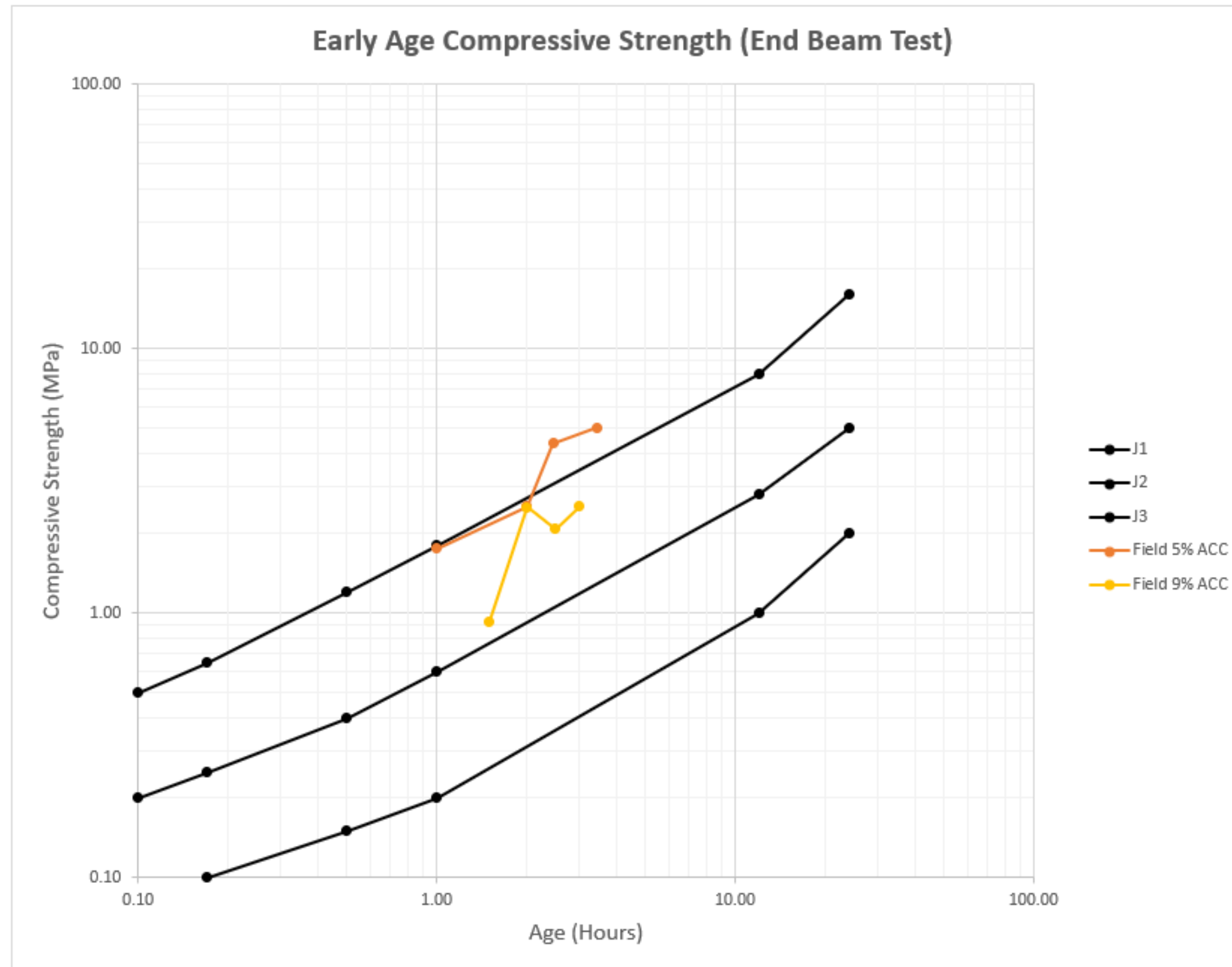


# Chemsave





# ChemSave Prototype Trials – End Beam Testing



Compressive Strength Result at 3% Accelerator	
Age at Test (Days)	Corrected Compressive Strength (MPa)
1	17.3
3	27.6
7	40.1
28	65.5

Compressive Strength Result at 5% Accelerator	
Age at Test (Days)	Corrected Compressive Strength (MPa)
1	16.6
3	32.9
7	44.3
28	N/A

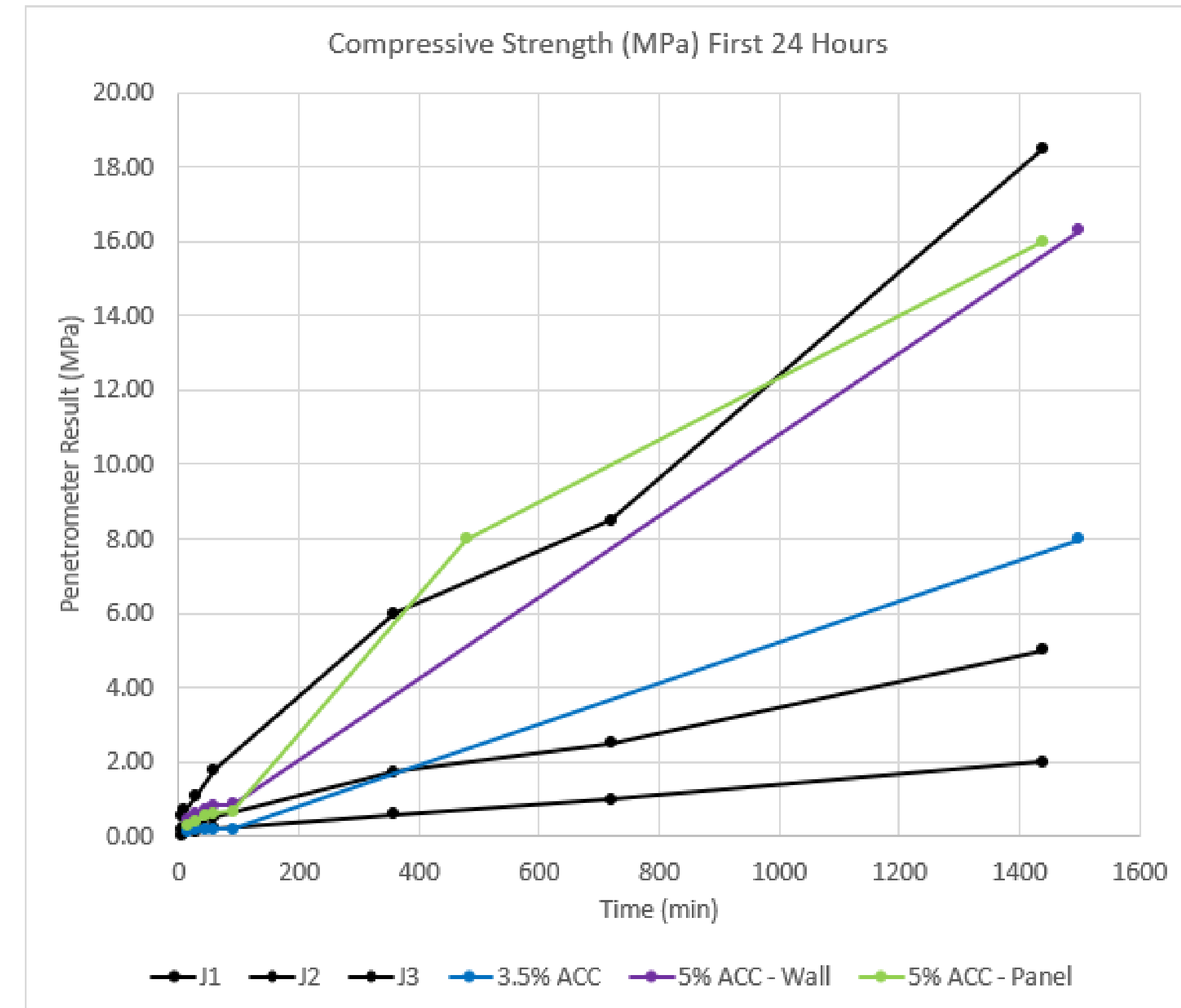
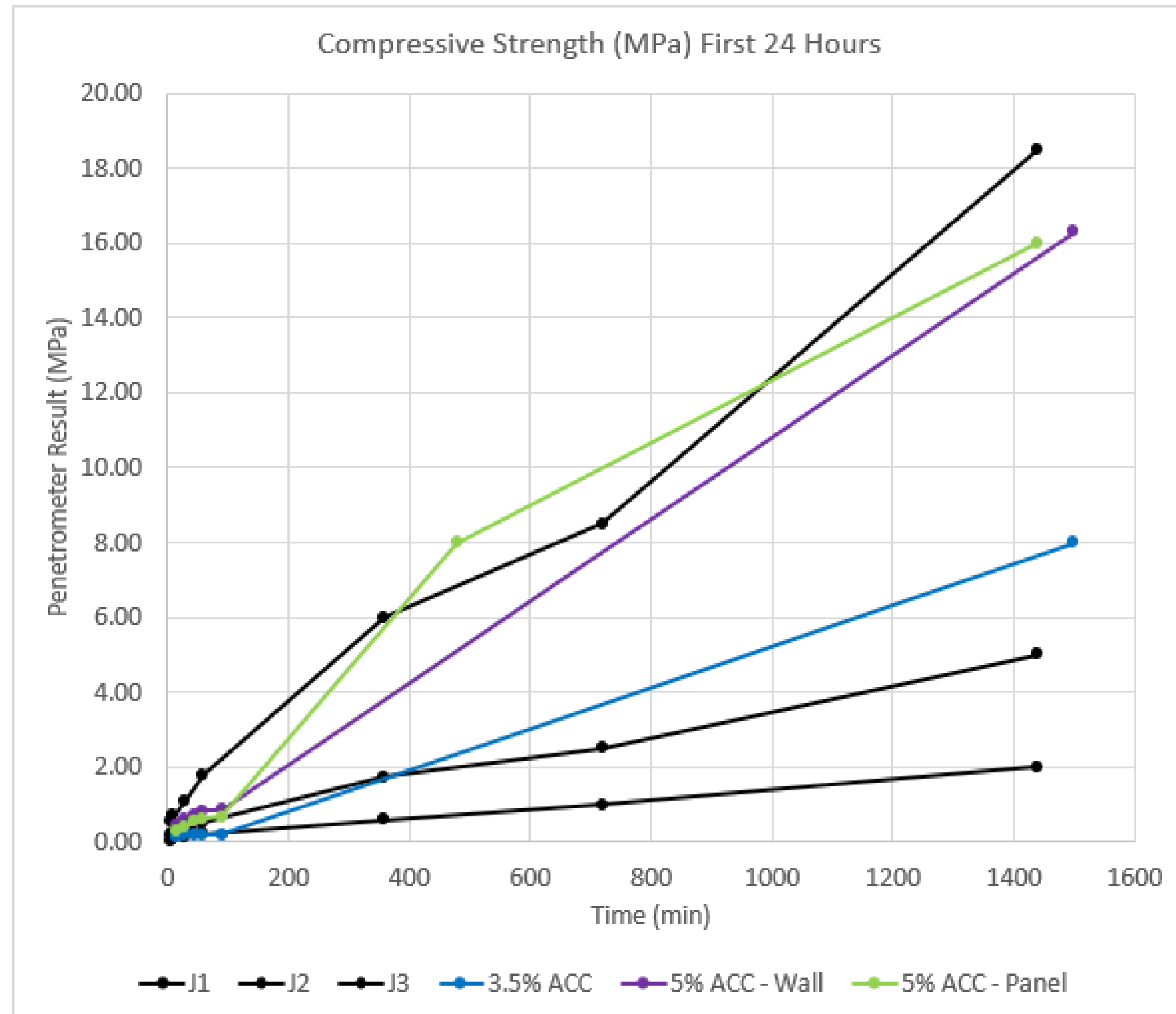
Key points:

1. Improved early strength development achieved at nearly half the accelerator
2. Exceeds J3 curve in Austrian guidelines for sprayed concrete, which is typically not required and indicates cement savings can be achieved
3. Final strength exceeded target by >25MPa, resulting in a less elastic or more brittle material which was not specified by geotechnical engineering.





# ChemSave Penetrometer Testing with Sika



## Key points:

1. For in cycle shotcrete re-entry times can be significantly reduced (from 1-2 hours to ~20 minutes?) without overdosing the shotcrete by increasing the dosage back up towards 7-9% and using chemsave. Pending test additional tests.





# BP3 Batch Plant – Agilis system

- Alternative to the AG3 agitator truck
- Benefit from dry shotcrete logistics and wet shotcrete quality
- Ability to stage work sites ahead of time
- “Mix on demand” means no need to dump half loads and cause issues in sumps and on travelways
- Future plans for integration with SS5 sprayer
- First one sold, second one in the schedule





# Verify system on transmixers

- Currently working with a local college on implementing the Verify system on our transmixers and agitator trucks
- GCP Applied Technologies' Verify system is widely used on surface Ready-Mix trucks in North America
- The system will continuously monitor the load, and can adjust with water and/or chemicals to deliver consistent shotcrete to the sprayers & save drums
- Further integration of the data with the SS5 Autodose system in the future
- Expected to be available Q2 2023





# Key takeaways

- MacLean has grown significantly over the last 10 years. We are still a Canadian family-owned company.
- MacLean will continue to innovate ground support equipment to make underground operations safer and more productive, while giving geotechnical engineers the versatility they need for increasingly challenging conditions.
- The 975 MacLean bolter is a safe and productive bolter and has been for the last 30 years. We are proud of our heritage and stand behind our philosophy as we look to the future.
- There is a need for more innovative products in shotcrete, and we have been working hard bringing new technology to market.
- We have a lot of development projects, follow us on social media to stay up to date!





# Thank you!

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