

Description: Bolting Platform for installing roof support above an operational conveyor system.

Organization: Glencore – Oaky North Mine

The Problem

Strata conditions over the main trunk conveyor system at Oaky North Mine were deteriorating due to age-related weathering of the roadway the installed support. The deterioration of the installed support would best be described as corrosion of the roof mesh/roof bolts, resulting in a loss of roof confinement along the main trunk system. Additionally, the structure hanging bolts from which the conveyor system is slung were also showing significant signs of corrosion.

Failure of roof integrity in any underground mine could have catastrophic impacts to the health and safety of Coal Mine Workers and the business's finances. A failure of the conveyor system hanging bolts also has the potential to cause a negative health and safety/financial impacts on the operation.

The need to remove/reduce these threats to our workforce and the business was identified using established risk management practices. To successfully manage the risk to persons and the business consideration needed to be given to:

- Ensuring any remediation program did not put the safety of the Coal Mine Workers installing the new support at risk at any time.
- The work conducted needed to ensure the long term stability of the mine road ways.
- The impact on the business through a loss of production would ideally be eliminated or, at worse, negligible

Using these guiding considerations, Oaky North has designed equipment and a methodology that allows Coal Mine Workers to safely remove degraded roof support mesh/straps and scale loose roof material onto the running conveyor system that takes the material from the mine while re-supporting the exposed area. This has been achieved using a single piece of equipment: the MK1 Mobile Bolting Platform.



The Solution:

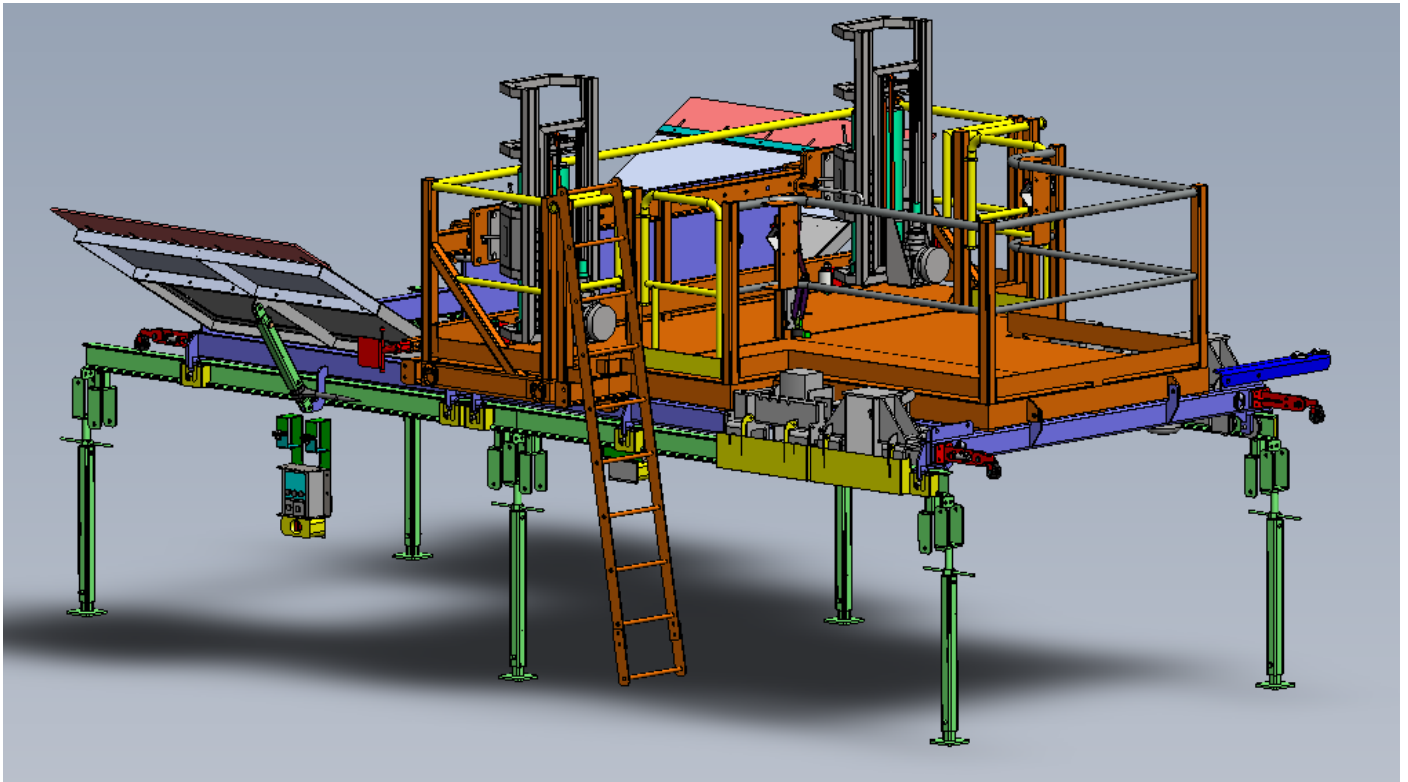
In collaboration with HD Mining and Jet Engineering, Glencore designed and engineered the MK1 Mobile Bolting Platform system that is currently operating at Oaky North Mine. The Bolting platform is a man basket system that has been custom-designed and manufactured for the installation of roof and rib support above an operating conveyor belt.

The Mobile bolting platform system consists of:

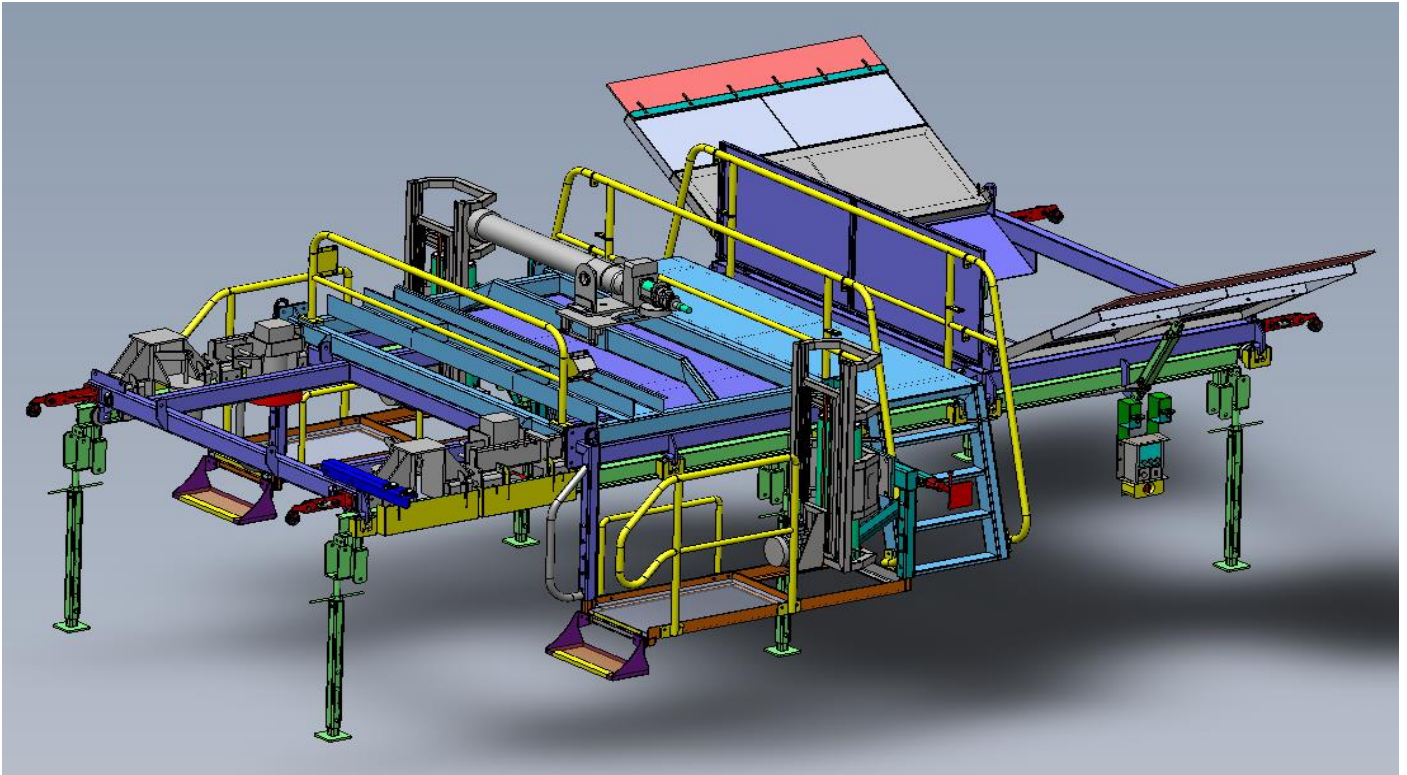
- Pneumatic traction drive system.
- Pneumatic drill rigs x 2 (High Seam).
- Pneumatic drill rigs x 3 (Low Seam).
- Monorail Beams and support legs
- Chassis.
- Mobile Bolting Platform – high seam configuration.
- Mobile Bolting Platform – low seam configuration.
- Bleed chute.
- Cross-Over Platform.
- Install Frames x 2.
- QDS Bolter Transport Pods.
- QDS Rail Transport Pod.
- Conveyor Support Legs.
- DAC Mounting Brackets.
- Limit/End or rail safety switches.
- Emergency stops.
- Warning Alarm (Audible alarm when machine starts to move).
- Mode selector (Can only be in bolting mode or traction mode, not both).

The bolting platform operates on a monorail system that is installed along the top of the conveyor and is powered by compressed air. Air supply is via a 50mm bull hose, which is secured to a tow arm at the outbye end of the mobile bolting platform. The tow arm can be adjusted to either the left hand side or right hand side, depending on the location of air and water services.

The control system provides two distinct operating modes: Flit mode and Bolt mode. The mode selection valve only allows the platform to be in one mode at any one time. This ensures that there are no unplanned movements when the bolting rigs are in use.



General View of Mobile Bolting Platform (High Seam Configuration)



General view of Mobile Bolting Platform (Low Seam Configuration)

The result

- A roof bolter platform that can safely operate whilst the conveyor system is running.
- A configuration for both high and low areas from one standard chassis.
- A platform operating on a monorail system moving independently of the conveyor.
- 2 or 3 drill rigs configuration depending on the operational height requirements.
- Storage spaces for all the materials, tools and equipment needed.
- Structure hanging chains are removed and legs installed to support the platform over the section of conveyor where the bolter is operating.
- Structure hanging chain removal and leg supports are installed on maintenance days when the belt is not operating to ensure personnel are not exposed to an unacceptable level of risk of a moving conveyor, the current strategy consists of bolting on D/S 7/7 roster with 2 x 10hr maint windows Tuesday and Thursday's where the leg and monorail moves are completed.
- The front of the platform has bleed Chutes (wings) that can flow the loose roof material onto the conveyor without the need for the material to fall to the floor where it would require double handling.
- 2 wheels/safety switches at the front and rear of the platform run along the mono rail - should any of these wheel/safety switches drop down off the edge or contact an issue with the monorail continuity the machine shuts down.
- A collaborative approach to this problem between Glencore, HD Mining services and Jet Engineering services meant that many issues were discussed and addressed during the design phase of the project which has made the platform successful.
- As well as the operational aspects of the unit a significant amount of thought was given to developing systems to store and transport the unit and components between conveyor systems. A set of specially built forks were designed to be able to pick up and move the platform along with transport pods for mono rails and legs, ladders and cross over platform as well as carry additional supplies.

The successful operation of the bolting platform commenced at Oaky North Mine in February 2018.



Bolter positioned and operational over TC01 main trunk conveyor.



Bleed Cute or main Chassis transportation pods.



Forks for installation and transportation.



Monorail and leg transportation pods.



Mode selector Valve and Shut off Valve



End of Rail Limit Switch.

Methods of Trialling and Testing

- The platform was 'mocked up' in the workshop for installation on the conveyor system structure to ensure measurements and heights were correct.
- A full engineering assessment was conducted in consultation with the Oaky North Mine workforce.
- Independent engineering input was also obtained as part of the design phase, taking into consideration the health and safety of Coal Mine Workers and engineering factors. These factors included, but were not limited to, the weight and forces imparted during the drilling and bolt installation process and the capacity of the conveyor structure to withstand the forces exerted
- An introduction to site processes was developed and implemented.
- A mock up installation of the conveyor system structure was built on site and the Bolting platform assembled as if in use and all functions tested for compatibility
- Functions tests included cycling of traction drives and drill rigs and this resulted in purpose built, training packages and work instructions for the safe operation of the Bolting platform.

Following these compatibility trials additional controls were installed including

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- Knock down switches were installed on the inbye side of bolting platform prior to installation. This ensures that if material large enough to strike the bolting platform comes through on the conveyor system, the conveyor belt system will trip prior to this material reaching the platform. (Work order driven).
- Brake test is conducted weekly (Work order driven).
- Gauges fitted to the pressure side of drill rigs to measure incoming air supply available to the drill rigs.
- 3D Modelling was utilized to develop the prototype prior to going to fabrication to identify any fatal flaws in the design.

Benefits/Effects:

There are many benefits/effects in using the bolting platform including;

- Allows re-support of area of the mine (over conveyor belts) that are traditionally very difficult to access, irrespective of whether you have a running conveyor or not.
- Using this Bolting platform allows Coal Mine Workers to work from under newly supported ground ensuring that operators are never required to work from unsupported ground. This removes the hazards associated with unsupported roof.
- The platform is pneumatically powered, running off compressed air and water infrastructure that is available throughout the mine, offering flexibility not afforded by an electrically powered unit.
- The Bolting platform reduces manual handling in what is already a confined work space. The bleed chute channels waste material to the conveyor belt system and out of the mine, eliminating the need to manually remove the material (shovelling).
- The Bolting platform affords a considerable reduction in diesel movements underground and therefore resultant diesel particulate matter generation. By the use of the bleed chute channeling waste material to the conveyor belt system and out of the mine, diesel vehicle movement underground is reduced.
- The Bolting platform affords a considerable reduction in diesel movements underground and as a result removes the inherent risk of vehicle to vehicle/vehicle to infrastructure and/or vehicle to people interaction. By the use of the bleed chute channeling waste material to the conveyor belt system and out of the mine, diesel vehicle movement underground is reduced.
- By use of the bleed chute, material can be dislodged and caught from the roof allowing material to drop onto the conveyor belt. This substantially reduces the instance of material dropping onto the safety lanyard and stopping the conveyor system, which requires personnel to reset.
- There has been a noted productivity increase and associated morale increase for what has been traditionally a less than desirable task. This is due in part to the provision of flat, even, stable work area/platform for operators to work on.

Transferability

The Bolting platform is easily transferable to any underground mine above 2.2 metre seam height, however it would not be difficult to produce a unit for seam heights lower than this.

Additional considerations may need to be given to the following

- Proximity to compressed air and water infrastructure.
- Engineering assessment must be conducted on the type of conveyor system/structure that is in use to determine compatibility and the ability of the system to handle the weight of the platform and the forces that are transferred during the bolting operations.
- Depending on seam height and belt offset there is potential to install secondary support in front of the longwall while the longwall is retreating. This decouples the secondary support process from the development process and may allow for a potential increase in development rates due to a reduction in roof support on the advance (not withstanding geotechnical requirements).

Innovation

The concept of working over conveyors both moving and stationary has been an issue for the underground mining community for many years. As a result, there have been attempts to produce similar units to the Oaky North Mine bolting platform. Oaky North Mine, however, have used the best of previous designs to produce a unit that, is self-contained and has additional safety and operational features.

These features include:

- A work platform that has fixed mounted bolters, negating the need for manual handling and resultant reduction in the potential for manual handling injuries.
- Being self-propelled there is no reliance on cables and winches removing 'line of fire' risk.
- High seam and low seam configurations of the one base chassis makes it a versatile machine for various seam heights and bolting configuration.
- When set up for higher seams, the side shifting capacity of the front work platform compensates for any instances of offline driveage and/or excessive rib spoil
- Coarse adjustment and fine adjustment on legs for various conveyor heights gives a wide range of operating heights.
- Adjustable bleed chute wings compensate for any instance of offline driveage and/or conveyor offset that maybe encountered.