

Dipper Trip System Improvement Project

BMA – Goonyella Riverside Mine

The Problem

The electric shovels at Goonyella Riverside were regularly experiencing production delays caused by the dipper trip mechanisms jamming up and failing to release the load or latch the door correctly.

These issues can cause the shovels to be rendered inoperable if the doors are unable to latch or release as required, potentially shutting down the entire prestrip circuit associated with that shovel until maintenance personnel can rectify the situation.

Each time the system requires repairing, the associated maintenance personnel are exposed to risks associated with handling and fitting the heavy equipment and parts involved with the dipper trip system.

The Solution

Field Maintenance employee Brian Mann noticed that the shovels at Goonyella Riverside were experiencing dipper door latch problems and worked to find a solution. The Dipper Trip System Improvement Project was concerned with examining all of the equipment and maintenance processes associated with Dipper Trip Systems on P&H 4100 series Electric Shovels in order to identify and implement potential personal safety and reliability improvements.

Several improvements to the equipment and maintenance processes were made in the following areas:

1. The substitution of certain system component materials with more appropriate materials e.g. the substitution of steel latch bar tongue guides with lubricated nylon guides which are much lighter (approx. 40kg) and cheaper (approx. \$500 AUD) whilst also being safer and quicker to exchange and more reliable in operation.
2. The design and fabrication of Latch Bar Rebuild Stands which make the task of rebuilding Latch Bars much safer and ergonomically comfortable for the employee than the previous method of suspending the Latch Bars from a crane.
3. Redesigning the maintenance schedules associated with maintaining the system, thereby reducing the frequency that the shovel operators need to make shimming adjustments to the mechanism and reducing a large part of the manual handling risk associated with operations personnel having to frequently interact with the system.
4. The design and fabrication of a Dipper Mechanism Maintenance Pod to contain all of components associated with maintaining the system, thereby reducing much of the manual handling risk presented by handling these components individually.
5. The redesign and modification of the Door Buffer Blocks Retaining System including the substitution of the existing rubber based buffer blocks with nylon based buffer blocks. These changes ensure that buffer block replacements

are much quicker and safer e.g. by eliminating the fire risk associated with the combination of rubber buffer blocks and oxy acetylene torches used for cutting.

The project included extensive consultation with trades' people, Original Equipment Manufacturer's (OEMs), Materials Engineers and Equipment Operators. In addition, extensive prototyping was undertaken throughout the course of this project i.e. redesigning a system, developing a prototype, engaging in real world testing of the prototype, making the necessary modifications based upon performance observations and repeating the entire process over again.

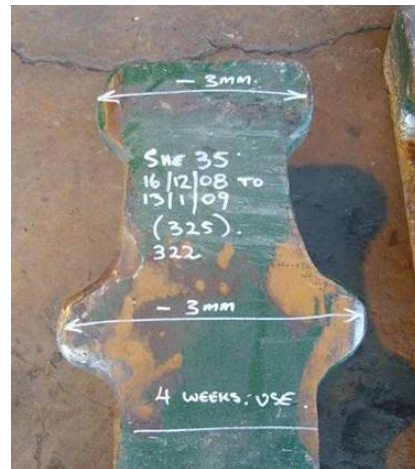
The project produced a more reliable system of operation which reduced the frequency of the trips and therefore, lessened the risk of injury to maintenance employees and production delays.



Brian Mann with his Dipper Trip System Testing Rig



Latch lever wear before doors were realigned



Latch lever wear after doors were realigned



Latch bar stand

Benefits/Effects

This project has significantly reduced, and in some cases eliminated the substantial manual handling and materials risks which were associated with the P&H 4100 Series Electric Shovel Dipper Trip Systems and associated components. In some areas, these changes have also improved system reliability whilst reducing component changeover times (hence reducing machinery downtime periods). In addition, this project has reduced the cost of consumables necessary to maintain the system on an ongoing basis.

Benefits were also achieved with change out time. The time taken to perform the latch bar change has reduced from approximately 3 hours to 1.5 hours and the time to perform the latch bar guide change out reduced from approximately 40 minutes to 10 minutes.

All of the realised benefits of this project have been achieved whilst reducing ongoing maintenance process labour and consumables costs.

Transferability across Industry

All of the enhancements identified in this project can be directly applied to all other P&H 4100 series Electric Shovels and their associated maintenance practices throughout the mining industry. In addition, many of the enhancements are also directly applicable to various other series of P&H Shovels fitted with similar Dipper Trip Mechanisms e.g. 2800 series.

Goonyella Riverside Mine have provided the designs to other BMA sites for implementation to decrease potential injury exposure and production down time.

Innovation

This project demonstrates an extremely high level of resourcefulness and innovation. This style of Dipper Trip System has been in service for over 15 years whilst posing the same high levels of inherent manual handling and materials risk and have undergone virtually no system improvement or refinement throughout this period.

The modifications and enhancements identified throughout this project demonstrate such high levels of innovation that the OEM is incorporating many of these enhancements into their standard Dipper Trip Systems going forwards.