

The Strongback Power Lift

MMG Century

The Problem or Initiative

A series of gusseted steel plates, or belly guards, are used to prevent damage to the underside of a bulldozer (dozer). The belly guards for the Caterpillar D10 and 11 equivalents weigh in excess of 215 kg each, not including accumulated oil, grease, soil and rock product.

The removal and refitting of belly guards is a common task within Century's Mine Maintenance Workshop (MMW), necessary to carry out routine services or inspections, or to change-out under-body components. It is a task that cannot be avoided, and one that can be required in a workshop or field environment.

The Caterpillar SIS stipulates that a hydraulic jack/trolley be put into position to assist with the safe removal of the belly guard. While this tool is recommended for both workshop and field applications, it is not well-suited for uneven ground surfaces often found at mine sites.

To complete the task, a tradesperson is required to:

- manoeuvre themselves under the equipment with air operated tooling
- inspect the condition of the belly guard and retaining bolts
- position a supporting hydraulic jack/trolley under the belly guard
- remove the retaining bolts
- lower the guard, under control, onto the hydraulic jack/trolley
- fix the belly guard to the hydraulic jack/trolley; and
- remove the hydraulic jack/trolley and belly guard from under the dozer.

With the belly guard mounted on the trolley, it is removed from under the dozer by pushing and pulling it either under the front mounted dozer blade, or via the rear of the bulldozer, adjacent to the ripper.

Even with all safety controls in place, the removal or refitting of belly guards is a high risk task. Serious injury or death could occur as a result of being crushed by a belly plate that has been dislodged while unbolting, while being extracted from under the dozer or during refitting.

A method of reducing the risk to a person while under a dozer or when near the trolley mounted belly guard needed to be developed.

The Solution

This innovation aims to reduce the exposure to a person tasked with removing or refitting a belly guard.

Due to the design of the dozer, we cannot eliminate the need to be under the machine to inspect the belly guard, position the hydraulic jack/trolley, unbolt the belly guard or secure the part. As a result, the focus moved to improving the way we carried out the task.

An activity study identified that these risks could be reduced by:

- Reducing the physical effort involved in the task
- Providing a hydraulic jack/ trolley/support platform with a low centre of gravity
- Removing the need for a person to extract or reposition the loaded hydraulic jack/trolley while still under the bulldozer
- Providing a stable hydraulic jack/trolley/support platform
- Improving the stability of the hydraulic jack/trolley in any ground situation

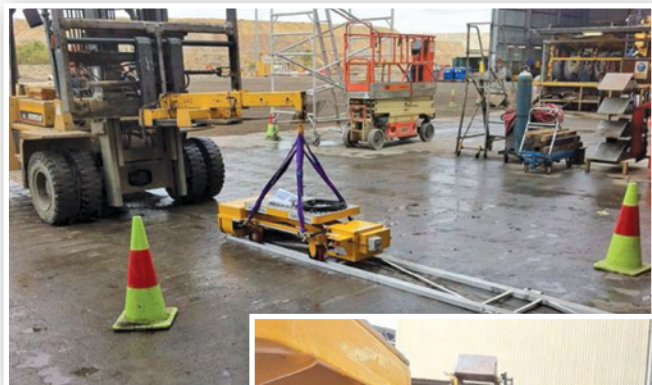
We identified that by using a remote-controlled support platform a tradesperson would not need to work beneath the dozer while extracting or refitting the belly guard. This also reduces the physical effort involved in the task. By observing the task performed on a number of occasions, it also became clear that any solution needed to have a low centre of gravity and tracks to guide and ensure the stability of the unit.

The tracks ensure that the unit can be operated safely on sealed (workshop) or unsealed (pit) surfaces. There is sufficient flex and support in the tracks to accommodate the surface irregularities of the mine shut pads.

On determining the required specifications, a basic hydraulic jack/trolley was provided to an external engineering agency with clear guidelines on what to build, including budgetary guidelines. The consultant was able to design and build a platform that met the specifications, with some trial and error. The early prototype required fine adjustment of the hydraulic system to hone its operations.

The unit developed is known as the Strongback Power Lift and is able to:

- Be remotely driven into position beneath the dozer
- Lift the platform into position
- Lower the platform and detached belly guard to a travelling position
- Be remotely driven from under the dozer along guide tracks:



Due to its weight, a forklift is used to manoeuvre the unit onto its tracks



Tradespeople positioning the Strongback Power Lift into place underneath the dozer

The unit is operated by remote control



The pilot program for the Strongback Power Lift commenced in early June 2011 and will continue throughout 2011. Any refinements to the unit will be carried out as necessary.

A training package has been developed to assist tradespeople to safely operate and maintain the unit.

The prototype cost approximately \$27,000 to develop.

The cost to manufacture a single unit is expected to be approximately \$12,000.

Benefits/Effects

Initial feedback from tradespeople in the Mine Maintenance Workshop about the design and early use of the unit has been positive with it considered easy to operate and appropriate for the task.

In commissioning this unit the Hierarchy of Controls methodology has been utilised and demonstrated. We chose to engineer a solution to eliminate a high risk task. No longer does a tradesperson need to remain with a hydraulic jack/trolley unit while it is extracted from under a bulldozer. The task is now performed from a position where a person has full visibility of the unit and is clear of the raised dozer blade. The task can be done by one person, although it is preferred to have two persons on the task for safety reasons.

Unit development required the application of engineering principles to develop suitable hydraulic and electronic circuitry, and for certification of load carrying capacity. The following table provides a summary of the unit's intended benefits and effects.

Benefit	Effects
Reduces physical effort involved in the task and need to manoeuvre under the dozer	Reduces potential for manual handling associated injuries
Enables the operator to carry out the task from a remote position	Eliminates risk of belly guard falling and causing injury
Reduces the need to handle the belly guard	Reduces potential for strains and crush injuries

The Strongback Power Lift takes a basic trolley and adds mobility, reduces physical effort and enhances the safety of the belly guard removal and replacement activity.

Transferability

Although the Strongback Power Lift has been purpose-designed and built to perform a particular task, the principles and circuitry can be applied to a number of similar lifting and relocation activities within a workshop or field operation.

Other equipment types also have heavy components that need to be lowered and relocated and the Strongback Power Lift could easily be adapted or modified to suit these tasks. This means that there is great potential for the unit to be used throughout the industry in numerous applications.

Innovation



The Strongback Power Lift carrying a removed belly guard

There was no similar unit to the Strongback Power Lift available in the commercial market place. This unit has been created through the development of appropriate site-generated specifications and the support of an offsite engineering consultant.

The Strongback Power Lift has used innovative engineering principles to bring to fruition an item that meets the needs of tradespersons and reduces the risks of serious injuries associated with removing or refitting belly guards from dozers.