

Innovative Ventilation Duct Installation Method

Redpath Australia Pty Limited

The Problem or Initiative

The problem involved the installation of steel ventilation duct of 1.4m and 1.8m diameter in an underground single entry heading as part of the drift development works at Kestrel Mine Extension. It was viewed early on in preconstruction risk assessments, that the installation of these sized ducts, needed to be undertaken without the direct physical involvement of people.

With limited space for people and equipment in the confines of a single entry heading, the use of standard equipment and machinery would not allow the objective of reduced direct physical involvement to be achieved. An engineered solution would be required if the goal of reducing the risk to personnel was to be achieved.

The Solution

The solution was a two part one as the planned delivery method of the works contained two excavation methods. This meant that for the installation of the ventilation duct to be undertaken and achieve the objectives set, two similar but different solutions were required.

The first solution, was for the design and manufacture of a ventilation duct installer (refer figure 1) which could be used in the drift to install the ventilation duct through a precast concrete section of the drift (part of the cut and cover boxcut) and subsequent steel set section of the drift.

The solution is simple, yet effective. And when combined with a QDS vent can jib (refer figure 2), allowed for the easy collection and transfer of the ventilation duct from the laydown area to the vent can installer.

The second solution was a little more complex. As part of the drift development works, Redpath chose to use a sliding floor to support the development of the works. As such, Redpath's engineers needed to design a solution that allowed for the transfer of the ventilation duct from the QDS jib to a mechanism that would allow the duct to be installed without physical involvement. The solution to this part of the problem can be seen in figures 3, 4 and 5 in varying stages of operation. The chosen solution consists of a specifically designed cradle which is operated by a number of hydraulic rams to lift the ventilation duct into position without physical interaction. The ventilation duct is then pushed back into position by a hydraulic slider piece that is returned into the newly installed duct.



Figure 1 – Ventilation Duct Installer



Figure 2 – QDS Vent Can Jib



Figure 3 – Ventilation Duct Installation Device



Figure 4 – Ventilation Duct Installation Device



Figure 5 – Ventilation Duct Installation Device

It is then that the 'people' part of the task begins with the installation of the vent rubbers and hanging chains. Although the solution is not complex, it is an engineered solution that Redpath had not used or been privy to prior to implementing at Kestrel Mine Extension. As such, some trial runs were undertaken in Redpath's Brisbane workshop to test and witness the movement of the cradle and hydraulic rams to ensure a bigger risk was not placed on personnel.

The final design solution was implemented underground onsite and the first of many ducts were installed without incident or injury to personnel and property. Given the need for ventilation in a coal mine and the design requirements dictating the size of the duct, the options available to eliminate or substitute the duct were limited. As such, the third element in the hierarchy of control, engineer controls, was used to reduce the risk to people.

Benefits/Effects

With over three kilometers of large diameter ventilation duct installed on the project and no injuries recorded as a result, the benefits of the system put forward a solid argument for its continued use where possible.

Noted benefits include:

- No manual handling from surface to installation and operation
- Pinch points during installation eliminated with engineering controls
- Repeated process that is familiar to all workers

Redpath does not have data available from previous works that provide information on the injury rate associated with the installation of large diameter ventilation ducting. This innovation was used by Redpath in both the Transport and Conveyor drifts as part of the drift development works at Kestrel Mine Extension.

Transferability

The method in which these ducts were installed is transferable however, the cradle designed for mounting onto the sliding floor would need an alternative base structure if a sliding floor was not to be used. This could be done by some adaptation of a bridge conveyor or moveable structure mounted to the rib.