

Trucks vs. pocket belt conveyors

Currently, trucking is the most common method used for moving ore and overburden from a deep pit to a crushing plant at the surface in open pit mining. But Saviz Nekoufar, who finished his postgraduate study in Engineering Management at the Queensland University of Technology in 2009, says pocket belt conveying could be the way to go for a large portion of operations.

The transportation of product from the bottom of a pit can be one of the most challenging operational tasks in open pit mining.

The main determinants of finding the most suitable bulk material handling method in open pit mining are cost, safety and time. By weighing up these factors, operators can decide between the two key methods of moving material from the bottom of an open pit, to the surface: haul trucks and pocket belt conveyors.

In order to perform a comparison between trucks and a pocket belt conveyor, I assume an open pit mine 200m deep and transport capacity of 2500 t/hr of ore from bottom of the mine to surface. By using an example truck carrying a 180 tonne load and engine power of 1500kw, the technical comparison will be as follows:

Haul trucks

- 14 trucks with 180t load
- Together are able to transport 2500tph from the bottom of the pit to the surface
- Each truck weighs 150t unloaded
- Fuel consumption is 250L/h for each truck, with a total cost of \$5180/h

Pocket belt conveyor

- Capacity of 2500tph from pit to surface
- Belt speed of 3m/s
- Belt width of 1500mm
- Power consumption of 1500kW (calculated by performing power calculation for conveyor belt)
- Electricity price of 0.3 kWhr is \$450/h

While truck manufacturing companies do not welcome this idea and comparison, by performing an economic comparison between these two means of transportation, we find the pocket belt cost is \$450 per hour, and haul truck cost is \$5180 per hour, in terms of energy costs alone.

Other advantages of utilizing pocket belt conveyors:

- Lower initial capital investment – pocket belt conveyor would cost around \$500,000, while 14 trucks would cost in the region of \$1.2m each, totalling just under \$17m in capital investment for this operation.
- Less operational personnel – unless automation is used, 14 personnel are needed for the haul truck operation, while generally only two are needed to operate the pocket belt.
- Reduction in energy consumption has an environmental benefit.
- More safety for operational crew and reduced safety costs.
- Eliminating cost for building roads and trucks maintenance.

Disadvantages of haul truck material handling system:

- Diesel efficiency is around 45%, compared to drive unit efficiency, which is around 92%.
- Trucks have to carry the weight of their own body.
- Diesel engine efficiency reduces as altitude increases.
- Using trucks on mine roads, especially at night, requires strict safety and human resource practices.



The use of haul trucks is currently the most common method of getting product out of an open pit mine. But engineer Saviz Nekoufar says pocket belt conveyors could be a better way of doing things.

Recognising the advantages of pocket belt conveyors is not enough, however. To truly realize the full potential of this method, the following considerations must still be made:

1. If the conveyor is installed vertically, the structure of the pocket belt needs to be supported from side walls, from the top and also anchored to a concrete wall. However, usually these pocket belts will be installed at an inclined direction in most mines.
2. The structure and conveyor should be designed in a manner that is capable of extending from the bottom of the pit in preparation for the time that the mine goes deeper.
3. The length of vertical take-up should be long enough to compensate for extending the conveyor length, when the mine gets deeper.
4. It is better to have at least two pocket belt conveyors instead of a single one. In case of any extension of length or other maintenance, the other conveyor belt could do the job.
5. Length of horizontal section of the conveyor on the ground and inside the pit is also flexible and could extend to any length, which is another advantage.

Conclusion

Utilising pocket belt conveyors as a means of material handling in open pit mining is a strong option compared to trucks. Pocket belt conveyors have advantages that mine operation companies may want to consider:

1. Reduced operational cost compared to trucks
2. Increased safety
3. Reduced initial capital outlay
4. Lower maintenance cost for pocket belt
5. Ease of operation
6. Better manageability

Contact: saviz.nekoufar@gmail.com