OPTIMIZATION OF CONDITIONS FOR TRANSPORTATION OF ORES

Stefurak A.D.
Scientific advisor senior lecturer Rozanova Ya.V.
National Research Tomsk Polytechnic University, Tomsk, Russia

In fact, the process of ore mining is quite complicated and technologically-advanced due to the fact that extracted ores need to be processed which is a multi-stage cycle. Moreover, it often appears to be unavailable to construct a new, innovative full-cycle plant instead of an existing one which has functioned for years, especially at the ore extraction spot. Therefore, ores mined from the deposit must be transported with help of special vehicle to the place of their further treatment for waste rock separation. The prevalent means of transport used for these purposes is a dump truck and trains mainly applied for transportation at long distances. As regards to the issue related to selection of the transportation mode over short distances (from 3 to 5 km), such innovation as the trunk conveyor system, designed to increase the productivity of an industrial enterprise, is quite perspective and actual. The advantage of the innovative system, which is the main focus of the present paper, consists in the development of a conveyor system with preliminary complex of ore crushing directly at the quarry and feeding ores to trunk conveyors with bulk units at a distance of 5 km.

The conveyor belt is a welded frame, at the upper end of which there is a drive drum driven by a gear motor. At the lower end of the frame there is a tension drum, the axis of which rests on a tensioning station, the threaded studs of which can move when the nuts rotate thereby adjusting the tension of the tape. However, the following parameters to employ the conveyor system need to be set:

the choice of the conveyor drive;
the tape width and material it is made of;
protection of the tape from gusts and ingress of ore under the tape;
constant maintenance of the tape tension, preventing it from slipping.

The belt conveyors must be equipped with lateral belt descent sensors that disable the conveyor drive when the belt descends more than 10% of its width; means of dust suppression in places of overload; devices for cleaning belts and drums; tools used to catch the cargo branch of the belt when it breaks; protective equipment for ensuring that the conveyor is turned off when the belt speed decreases to 75% of the nominal; a device for disabling the conveyor drive from any point along its length; braking devices; automatic and manual fire extinguishing means [1].

It is worth considering the innovation on the example of a joint stock company «Zhairem GOK», located in Kazakhstan, urban village Zhairem and is concerned with zinc-barite ore deposit working out. Field reserves held 15 years at a capacity of 5 million tons per year, but with the use of dump trucks the productivity was from 1 to 1.5 million tons per year. To prove the efficacy of the method under study, it is necessary to calculate the performance improvement and consider these data in numbers [1].

The productivity when using conveyors is 5 million tons per year, therefore, the conveyor transports: $\frac{5000000}{350} = 14285,7 » 14286$ tons/day (350 days were taken into account for the reason that approximately 15 days a year are related to holidays and repair work). Thus, to achieve the productivity target range using dump trucks with a volume of 60 tons, it is necessary to make: $\frac{14286}{60} = 238$ routes. Assuming that 1 hour is required for loading, driving, unloading and return road. Moreover, an 11-hour work shift per day results in 2 shifts which equals to 22 hours of work output. Consequently, $\frac{238}{22} = 10,8$, i.e. 11 dump trucks must continuously move from the quarry to the factory. The calculations presented above confirm that capital costs include:

eleven dump trucks;
fuel and maintenance costs;
rubber kit purchases at least 2 times a year;
eleven dump truck drivers per shift, the full-time number of which is 28 people (10 * coefficient 2.5). The coefficient of 2.5 involves 2 shifts together with those who substitute during the period of weekends, vacations, etc.

To infer, it is worth stating that the conveyor system implementation requires only 2 operators per shift and 5 people enlisted (2*2.5) together with costs for electricity to drive the conveyor. In the course of comparison of costs spent on operating and electricity it might be concluded that this system is quite cost-effective and more profitable than the one which involves diesel fuel. Therefore, setting the belt conveyor system into operation leads to the following outcomes: reduced cycle of operation, the process of ore supply is more stable and continuous, the service is less expensive and more energy-efficient.

References

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