Thus, with an increase of the volume of technogenic deposits, the specific costs of its development are reduced, while the specific costs for the formation of technogenic deposits are increasing.

This is due to the increase in the distance of the transport of overburden in the period of formation, which depends on the number of tiers in the technogenic deposits.

Also, the cost of working out is influenced by the distance of transportation of dry mineral raw materials on the technogenic deposit surface, as the size of the deposit increases the range of transportation of the rock mass to the orepass, accordingly, the productivity of the loader decreases.

It has been shown that the technical and economic indicators of the enterprise is influenced not only by complexes of mechanization, but also the ratio of the main parameters of the technogenic deposit.

Therefore, the next step of the research will be to analyze the interdependence of the main parameters of the technogenic deposits.

UDC 622.271.324

V.K. SLOBODYANYUK, PhD (Engineering), Associate Professor, Kryvyi Rih National University, Ukraine
S.YU. PENKAL, student, Kryvyi Rih National University, Ukraine

DESIGN OPTIMIZATION OF THE SHOVEL RELOADING POINTS FOR THE ROAD AND RAIL TRANSPORT

The department of open pit mining operations at our University is continuously being carried out the researches aimed at improving the transport system of deep iron ore open pits [1-4]. Byzov V.F., Prof. Dr.-Ing., paid much attention to the issues of road and rail transport optimization. The location of reloading points directly in the working area of open pit mines using the road and rail transport leads to the complication of transport flow chart. Because of the need to bypass the rail dead-end tracks, the truck haulage distance significantly

increases. In order to solve this problem, a collapsible overpass was developed to allow eliminating an intersection of cargo flows by road and by rail and curtailing the truck haulage distance [1].

Since the depth of the open pit grows, the rail transport loses its efficiency mainly not because of the lesser gradient (30-40‰ vs. 80‰) in comparison with the road transport, but because of the need to freeze a section of the pit wall in order to locate the reloading points for shovels. By eliminating the afore-mentioned shortcoming, it is possible to improve significantly the efficiency of road and rail haulage in the open pit mine. The article [3-4] proposes a new method of arranging and operating a reloading point for shovels.

Drawbacks of reloading points equipped with the rope shovels are that during operation of the reloading point, the trucks and dump cars intersect that leads to a decrease in the tonnage capacity of trucks, and unloading the trucks at a level higher than the shovel is located makes it impossible to combine the handling operations in time and space. This causes a decrease in the shovel performance and an increase in the distance haulage of rock mass by trucks. In order to locate the reloading point, it is necessary to deactivate a section of the pit wall that resulted in a decrease in the rock mass output. The developed technology reduces the negative impact of reloading points on the dynamics of mining operations, increases the tonnage capacity of trucks due to eliminating the additional lift of rock mass by trucks and avoiding the intersection of roads and railways (Fig.1).

The mining operations using the developed technology are made as follows. A backhoe hydraulic shovel (1) excavates a receiving trench (2). This trench (2) is conditionally divided by width into two sections: the unloading wall (3) and the loading wall (4). The receiving trench (2) is filled with rock mass on the unloading wall (3) by trucks (5). In the general case, in order to prevent from intersecting the haul roads, the receiving trench wall (2) located closer to the lower pit benches is the unloading wall (3). The receiving trench wall located closer to the higher pit benches is the loading wall (4). The rail track is located (7) along the loading wall (4) of the receiving trench (2).

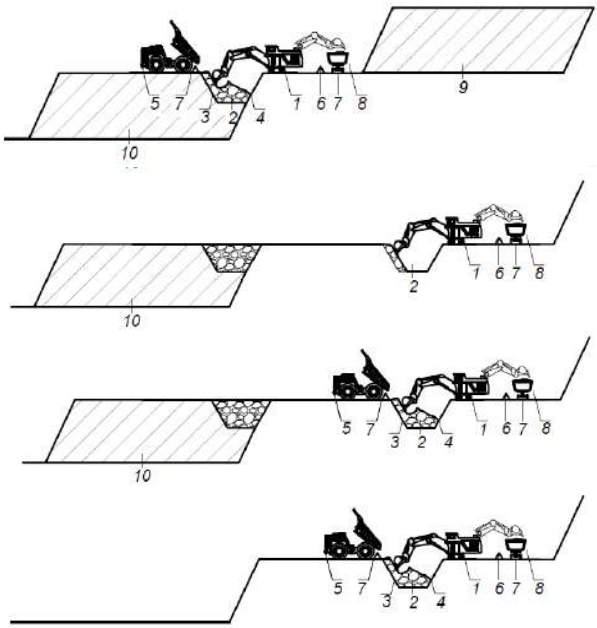

Fig. 1. Diagram of mining operations when shifting a reloading point

The rock mass from the receiving trench (2) is reloaded by a hydraulic shovel (1), located on the loading wall (4) of the receiving trench (2) onto dump cars (8) located at the level of the hydraulic shovel.

The reloading point in the given place operates until the higher benches (8) are mined out. After this, a backhoe hydraulic shovel (1) excavates a new receiving trench (2) on the extended site. After commissioning the relocated reloading point, the lower benches (9) are mined out. In order to increase the capacity of the reloading point, two or more backhoe hydraulic shovels are placed on the loading trench wall at a safe distance from each other. The use of the proposed reloading point design provides an increase in the capacity of mining equipment and reduces the negative impact of open pit transport on the dynamics of mining operations. The reloading point of the proposed design is easily relocated as the mining operations progresses and does not freeze the pit wall.

Minimum operation of the open pit transport, being the first link

of road and rail transport, will be provided if the truck haulage distance of maximum rock tonnage to the reloading point will be minimum. This imposes a number of requirements on the optimum mining technology, such as the use of more powerful shovels on the border of adjacent links of combined transport and the possibility of operating the second link of combined transport without freezing the working pit wall. The second requirement is fulfilled when using the developed design of the reloading point for shovels.

References

1. Влияние пересечений автомобильных и железнодорожных грузопотоков на работу автотранспорта карьеров / В.Ф. Бызов, Ю.Г. Вилкул, С.В. Литвинов, В.А. Завсегдашний // Разработка рудных месторождений : респ. межвед. науч.-техн. сборник / отв. ред. В. Ф. Бызов. – К., 1989. – Вып. 47. – С. 69-74.

2. Vilkul Y., Slobodyanyuk V., Maximov I. Optimization of capacity and the number of crushing and transfer stations at the deep open pits. Metallurgical and Mining Industry. 2016. No. 4. pp. 116–120.

3. Slobodyanyuk V., Turchin Yu. Rational use of hydraulic excavators in iron ore pits. JOURNAL OF MINING AND GEOLOGICAL SCIENCES. University of Mining and Geology "St. Ivan Rilski". 2017. No. 60. pp. 21–26

4. Slobodyanyuk V., Maksimov I., Slobodyanyuk R. Influence of mutual arrangement and performance of shovels on the position of an optimum point for run-of-mine stock location. JOURNAL OF MINING AND GEOLOGICAL SCIENCES; University of Mining and Geology “St. Ivan Rilski”. 2018. No.61. pp. 28–32.

UDC 622.271:622.17: 625.731.4: 624.131.537

K. TOMICZEK, PhD (Engineering), Assistant Professor, Silesian University of Technology, Poland

STABILITY SIMULATIONS OF THE MULTI-LEVELER DUMPS MADE OF MINING WASTE

The analysis aimed at designing an outline of a multilevel dumping ground/embankment built of post open-cast mining waste and post-mining waste.

No information on the strength properties of the material was delivered plus the contractor did not plan to conduct laboratory tests. Properties of mining waste were unknown and data on them