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Theoretical studies of the influence of deep pit parameters on the choice of technological schemes for transporting rock mass

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Abstract: The article deals with the actual problem of selecting transport equipment for deep pits. Studies of the relationship between the performance indicators of technological transport and the mining conditions of deep pits are presented. When justifying the choice of dump trucks, the need to take into account adaptation to the main influencing factors is established. The influence of the width of the transport berm on the parameters of a deep quarry is determined.

Keywords: open pit, transport equipment, indicators of technological transport, deep pits, dump trucks, transporting rock mass

Introduction. The open-pit mining method is accompanied by an increase in production concentration, an increase in the depth and size of quarries, the distance and complexity of transporting rock mass. At the same time, constantly deteriorating mining-geological and mining-technical conditions for the development of deep deposits are the determining factors in the development of quarry transport. At significant depths, the operation of intra-barrier transport acquires its own specifics: the distances of transporting rock mass to the surface are significantly increased; from the total length of transport communications, the component of lifting the mountain mass increases sharply; the limited front of work makes it difficult to maneuver in the production of transport operations; there is a more frequent movement of transport communications, transshipment points inside the quarry, etc.

The greatest influence on changes in technical and economic indicators of transport is the distance of transportation, the volume of transportation, and the depth of mining operations. Many types of transport deteriorate their performance when used in deep quarries; they reduce the speed of movement, make it difficult to exchange vehicles, deteriorate the convenience of placing transport communications, increase the time of delivery of goods to the surface and the cost of transporting rocks.

Modern technology and world experience in open-pit mining is represented by an extensive set of machines and mechanisms. Thus technical support of open development is directed to the use of high-performance machinery with a maximum working parameters of the equipment of natural and mining conditions of the fields and their rational combination

when paired work in the deeper horizons, increase in unit capacity and operational reliability [1-5].

The variability of mining and geological characteristics of rock deposits significantly affects the efficiency of mining, significantly complicating the choice of technological parameters of transport and other mining processes.

As a rule, when developing a structurally complex Deposit, technological and technical difficulties inevitably arise related to the organization of work, the choice and management of parameters of technological processes, including those that are no less important when choosing a rational scheme for transporting rock mass.

The main mining factors determining the transition to a particular type of transport in deep pits are: increasing the productivity of the quarry capacity; increasing the depth of the quarry; changing the distance of transportation, etc.

Over half a century of operation of the Muruntau quarry, more than 1.3 billion.m^3 were extracted of rock mass. Since the beginning of operation, the total volume of rock mass issued from the pit bowl through the conveyor lines of the CPT complex is more than 400 million m^3, of which more than 168.5 million tons of ore. As the practical results of the work show, if at the beginning the specific weight of the mass issued through the conveyor lines was only 30 thousand.m^3 or 12.6%, the maximum annual productivity of 22.5 million.m^3 was achieved in 1998, which is 60% of the total volume of extracted rock mass from the quarry [6].

The quarry is worked out in queues. Mining operations are currently being carried out within the boundaries of the fourth stage of development to a depth of 650 m, where the Muruntau quarry is combined with the Mutenbai quarry (design depth of 300 m) and becomes a single quarry.

As the depth of the Muruntau quarry increases, the disadvantages of technological transport begin to be revealed. These include reduced operating efficiency due to increased transport distances, as well as increased fuel consumption and a polluted quarry atmosphere. The analysis of the increase in the distance of transportation shows that, since 1993, there has been an increase in the distance of transporting rock mass in the quarry [7].

Findings. Mining technical conditions of technological transport at the Muruntau quarry presented in the table show that in the first years of operation, it was possible to significantly increase the rate of deepening and reduce the distance of transporting rock mass by road by 2.5 km and the height of the rise by 80-100 m.

Table: Mining and technical conditions of technological transportation

Indicator	**Year**									
	1970	**1975**	**1980**	**1985**	**1990**	**1995**	**2000**	**2005**	**2010**	**2015**
Pit depth, m	50	80	140	180	250	305	360	420	555	580
Distance of transportation by road, km										
- dump it	2,5	2,7	2,8	4	4,9	5,3	6,5	7,7	2,76	3,36
-up to the CRP (CFT) (without a CIC-270)	-	-	-	1,6	2,2	2,6	2,8	3	2,57	2,48
average by quarry	2,5	2,7	2,8	3,5	3,4	3,9	4,5	5,7	3,33	3,44
Height of mountain mass lifting by motor transport, m										
to the dump	15	54	65	127	145	195	240	280	120, 3	146, 3

-up to the CRP (CFT) (without a CIC-270)	-	-	-	29	34	67	70	95	37,6	74,9
average by quarry	15	54	65	110	107	119	130	165	141, 6	153, 3

An important feature of mining factors is that they, unlike natural ones, are controlled in a certain range of changes. Technological factors are closely interrelated and have common changes with the depth of development in different quarries.

The intensive increase in the depth of open-pit mining operations required the study of the impact of mining conditions of quarries on the performance of technological vehicles. The indicator of the depth of quarries in this case is decisive. The given actual indicators of mining conditions of the Muruntau quarry (see table) allowed us to obtain a graphical interpretation of the indicators of technological transport with the depth of the quarry (Fig. 1).

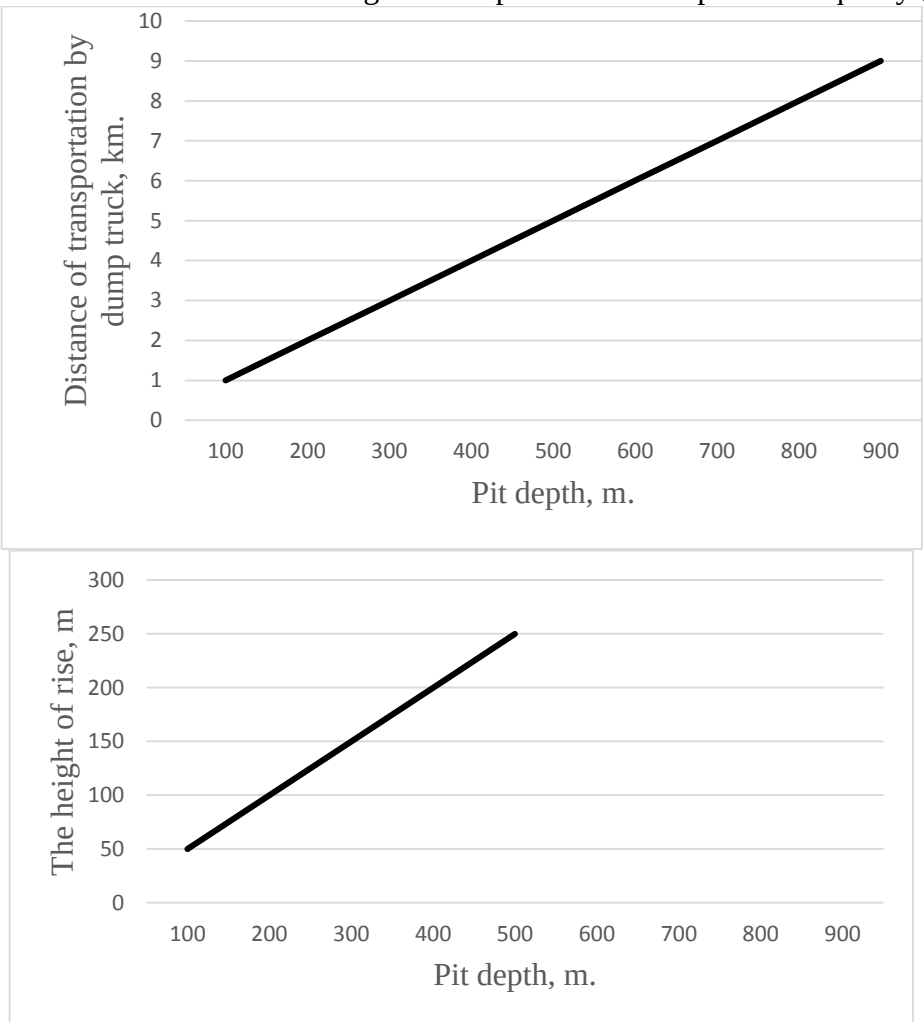

Fig. 1. Relationship of transport distance and lifting height with the depth of the quarry.

The presented dependencies and the listed parameters at the Muruntau quarry indicate a constant deterioration in the mining conditions of operation of technological transport.

Control actions, including the introduction of high-performance mining equipment, improving the parameters of the development system, opening schemes and transport systems of quarries, can compensate for the negative impact of the depth of development and

maintain the productivity of quarries for long periods at a given level [8].

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During the years of operation of the Muruntau quarry, almost complete and deep technical re-equipment of mining machines was carried out, which allowed to increase the volume of ore production by 2 times. Since the beginning of operation of the quarry, various types of dump trucks have been operating, while analyzing the effectiveness of each type, and further updating the fleet [9.10].

In this regard, the study of the impact of the volume of rock mass extracted from the quarry on the choice of mining transport equipment is also part of the selection of technological schemes for transporting deep pits. Volumes of ore and rock transportation for the period from 2020 to 2051 calculated by zones and horizons of development in stages in 4 years. For this purpose, the optimized final form of the quarry was divided into technological zones and the distribution of the volume of rock mass and ore was obtained depending on the location of the sides of the quarry.

Results. Analysis of practical and theoretical choice of one or another type of trucks for work in deep pits shows that the choice must take into account the adaptation of the main influencing factors: an intense increase in the depth of the quarry; an increase in the slope angle of the working and non-working boards; reducing the online workspace; slow performance career in the rock mass; the mode of mining operations (increasing the ratio of ore component). Adaptation to the influencing factors can be carried out by implementing:

- dump trucks first large (140-190t), and then small (25-40t) load capacity and size. In this case, the main criterion is to adapt to the reduction of the workspace resource.

- dump trucks that can move on tracks with a slope of 20-25% - adaptation to changes in the slope angles of working and non-working sides;

- temporary loading and storage warehouses, combined with dredging blocks and sliding bulk ramps-adaptation to reduce the resource of the working space.

Research has found [11] that such a factor as the overall size of a dump truck is poorly taken into account, and it determines the width of the transport berm, which, in turn, affects the design of the side of a deep quarry and, accordingly, the volume of extracted rock mass.

According to the results of the research, the standard width of the transport berm was established for the conditions of the deep Muruntau quarry, and its change leads to a change in the design and its parameters.

Conclusions.

Thus, the analysis of the actual performance of dump trucks on the lower horizons allows us to establish their relationship with the mining conditions of quarries, which is a reliable basis for planning and designing mining operations. In turn, the choice of transport scheme for deep pits should be carried out taking into account the mining and technical conditions, which will help to stabilize the specific costs of transporting rock mass. This will require the development of methods for determining the moment of transition from one type of transport to another.

Reference:

[1] O. N. Malgin et al. Improvement of cyclical-flow technology of mining operations in deep pits. Ed. "FAN", Tashkent. 2012, - p. 144.

[2] Kuznetsov D. V., Odaev D. G., Linkov Y. E.. Features of the choice of technological vehicles for the development of deep quarries in the North // Mining information and analytical Bulletin. 2017. No.5. Pp. 54-65.
[3] Fang N., Ji C., Crusoe G. E. Stability analysis of the sliding process of the west slope in Buzhaoba Open-Pit Mine // International Journal of Mining Science and Technology. 2016. Vol. 26. Iss. 5. P. 869–875.
[4] Raupova O., Kamahara H., Goto N. Assessment of physical economy through economywide material flw analysis in developing Uzbekistan // Resources, Conservation and Recycling. 2014. Vol. 89. P. 76–85.
[5] Braun T., Hennig A., Lottermoser B. G. The need for sustainable technology diffsion in mining: Achieving the use of belt conveyor systems in the German hard-rock quarrying industry // Journal of Sustainable Mining. 2017. Vol. 16. Iss. 1. P. 24–30.
[6] Kolomnikov S. S., Klevenko S. A. Stages of development and experience of operation of cyclical-flow technology in the deep Muruntau quarry. // Mountain Bulletin of Uzbekistan. 2012. № 1(48). pp. 29–33
[7] Yuldoshev U. U. Development of the deep Muruntau quarry in the new borders of the queue / / Mountain Bulletin of Uzbekistan. 2016. No. 1(64). pp. 22-25.
[8] Lel Yu. I., Sandrigailo I. N., Terekhin E. Yu. Mining-geological and mining-technical conditions for the development of deep pits. // News of the Ural state mining and geological Academy. Issue 11, 2000. Pp.77-85.
[9] [9] Ravshanov A. F., A. A. Silkin, A. V. Seleznev. Justification of the Park of mining and transport equipment in the transition period of the development of the "Muruntau-Mutenbai" quarry from the IV to the V stage / / Mining journal, 2018, No.9 Pp. 90-96.
[10] [10] Yuldoshev U.U. V turn of development of the "Muruntau" quarry of Navoi MMC // Mining and metallurgical complex: achievements, problems and modern trends of development: VIII Inter. scientific-technical conf. - Navoi, 2015, Pp. 87-88.
[11] [11] Burmistrov K. V. et al. Influence of the width of the transport berm on the technical and economic indicators of the quarry. // Modern problems of the transport complex of Russia, 2014, No. 5. Pp. 42-45