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JUSTIFICATION OF RATIONAL PARAMETERS OF TRANSSHIPMENT POINTS FROM AUTOMOBILE CONVEYOR TO RAILWAY TRANSPORT

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Abstract:
Justification of rational parameters of loading points from automobile and conveyor to railway transport is presented. Also, the paper will determine the main technological parameters of the rock mass transfer unit from the conveyor to the railway transport and justify the relationship between the parameters of the transshipment and transport complex of machines with the parameters of the rock mass dump in the scheme of cyclic-flow mining technology.

Keywords: Deposit, quarry, ore, mineral, conveyor, dump truck, railway transport, face, loading, ledge, volume, dumpcar, dumper.

When developing deposits with steeply falling ore bodies, for example, the Muruntau quarry in its development consistently goes from shallow to medium in depth, deep, and sometimes to super-deep. A space-time hierarchically organized system is formed, which determines the continuity of decisions and the ability to predict mining, technological and economic situations. To ensure uniformity of approaches in determining the category of quarry, a classification of quarries by depth has been developed, which differs from the known classifications in that it uses the scheme of natural ventilation of the developed space as a classification feature.

The height of the ledges of the Muruntau quarry varies from 10 to 15 m, but below the mountains. +315 m is assumed to be only 15 m. The degree of saturation of the massif with St. ore bodies requires a different approach to the organization of drilling and blasting, excavation, loading and transport operations. In the quarry, depending on this, the following are distinguished: an ore zone represented by powerful simple and uncomplicated ore deposits and sections (C=0.7); an ore-rock zone represented by complex and very complex ore deposits and sections (C= 0.25), and a rock zone that does not contain ore bodies. The parameters of the natural and technological zones of the quarry are shown in the table.

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Parameters of natural and technological zones of the Muruntau quarry
Table

Zone	Zone parameters			
	coefficient of complexity of the structure of ore bodies	percentage of rock mass in the pit contour, %	recoverable volume, million m^3/year	Percentage (%) of rocks with different compressive strength $\sigma_{сж}$, Мпа
Ore	0,08	25	10-12	$\sigma_{сж}$=90÷120(35) $\sigma_{сж}$=120÷140(55) $\sigma_{сж}$>140(10)
Ore and host rock	0,22	35	14-16	$\sigma_{сж}$=80÷90(20) $\sigma_{сж}$=90÷120(60) $\sigma_{сж}$=120÷140(15) $\sigma_{сж}$>140(5)
rock	0	40	10-15	$\sigma_{сж}$=80÷90(80) $\sigma_{сж}$=900÷120(20)

In 1990-1995, the productivity of the quarry by rock mass was 28-30 million m^3/year, and then began to increase and in 1997 exceeded 37 million m^3/year.m^3. during the year, work is carried out on 18-20 horizons. At the same time, the rate of decline in mining operations is on average 10.5 m/year. However, over the past 10 years, it has increased by 20-30 %, and this trend continues. Mining IV stage career is characterized by a capacity increase of rock mass to 45 million m^3 per year (i.e., 1.4—1.5 times), which should be kept for 7-8 years. In this regard, the adaptation of mining equipment to the growth of the volume of developed rock mass, the growing rate of reduction and intensity of mining operations in combined and heterogeneous cargo flows was ensured by increasing the average bucket capacity of the mining equipment fleet and parallel technical re-equipment with hydraulic excavators.

Currently, the extraction and loading equipment is represented by rope (EKG-8I, EKG-12.5, EKG-15) and hydraulic (CAT-5230 from caterpillar, RH-170 from O&K EX-3500 from Hitachi) excavators and front loaders: SAT-992S with a bucket capacity of 10.7 m^3 and SAT-994 with a bucket capacity of 20 m^3.

In addition, four EKG-10 excavators load commercial ore into railway dumpcars with a load capacity of 105 tons at the quarry's transshipment points (illustration 1,2).

Illustration 1. Loading of EKG-10 commercial ore into railway dumpcars

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Illustration 2. Ore dumping with the OSS 4000/125 cantilever dumper and loading of EKG-10 commercial ore into railway dumpcars

Analysis of the data shows that the excavators are comparable in their geometric and power parameters. The main technical features of hydraulic mechanical shovels in comparison with electric ones should be considered autonomy in operation and the articulation of the bucket handle with an arrow. The first feature allows you to effectively adapt the excavation equipment to the high variability of the consumer properties of the Muruntau quarry, the second-limits the height of the face of the excavator to almost the height of the excavator's scooping.

The main technological solution for improving the development of the Muruntau field was the transition from cyclical to CPT mining operations in a deep pit with rocks. The Muruntau quarry is an example of a successful implementation of TTC. The total volume of rock mass delivered from the pit bowl through the conveyor lines of the CPT complex over the 30-year operation is more than 800 million tons, including about 200 million tons of ore. The mining and loading equipment of the quarry is represented by rope and hydraulic excavators with a bucket capacity of 8.0-26.0 m^3. The introduction of the TPP complex, designed according to the project for transportation of overburden rocks, was a logical continuation of the evolution of technological transport in the Muruntau quarry

The production line of this complex consists of two conveyor lines (belt width 2.0 m), each of which includes two inclined, one transfer, main and dump conveyor, as well as a cantilever dumper. Inclined conveyors are located in one trench.The total length of conveyor line No. 1 is 3375 m, and line No. 2 is 5385 m. The design capacity of each line is 12.8 million m^3/year, and the complex as a whole is 25.6 million m^3/year (rock density is 2.6 t/m^3).

The connection of the cyclic and in-line links of the CPT complex is carried out through semi-stationary crushing reloading points (DPP) equipped with KVKD-1200/200 crushers. Each DP can work on any of the two conveyor lines.

The essence of this solution is that if there are not enough excavators in the faces (less than 50 % of the required capacity of the cyclic link), the conveyor line stops, and the rock mass accumulates in an intermediate storage warehouse. In the future, when the situation in the faces changes or the warehouse is full, the conveyor line starts, and the rock mass from the faces is directly sent to the transshipment points. At the same time, an intensive shipment of rock mass from the intermediate warehouse begins. This ensures a more complete loading of the conveyor line and increases the performance of the CPU complex. Intermediate storage warehouses are also used for unloading dump trucks during emergency or planned stops of conveyors, which generally reduces the distance of transportation and the height of lifting the rock mass from the quarry by road. For this purpose, two such warehouses are organized in the quarry: one for off-balance ore and rock. Their location is selected depending on the specific mining situation in the quarry, and as it changes, the warehouses are moved to another location.On average, 3.0-3.5 million m3 of rock mass per year is surrounded through intermediate storage and pre-loading warehouses. They use EKG-8I excavators or Cat-992 front-end loaders as loading equipment. As a result of experiments, it was found that the intensification of the cyclic link of the CPT complex during the development of a complex-structural

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Deposit is possible if the quality of crushing the massif by explosion is correlated with the specific resistance of the destroyed rock mass to digging and the productivity of equipment.

To solve this problem, energy consumption in technological processes was used as a generalizing evaluation criterion, which made it possible to reasonably choose the loading and transport equipment that best corresponds to the physical and technical characteristics of a complex-structural field and the mining conditions of the quarry. Processing the results of pilot experiments under various conditions allowed us to establish the dependence of the productivity of the EKG-10 excavator for 1.0 h of net operating time on the average size of a piece of blasted rock mass (D_{av}) and obtain the following analytical expression:

$$Q_{ekg}10 = 700 - 1900d_{cp}^2 + 36d_{cp},$$

Analysis of the obtained dependence shows that as the average size of a piece of blasted rock mass increases, the productivity of the EKG-10 excavator increases and at D_{av}=600 mm, its operation becomes practically possible.

For more than 50 years, the Muruntau quarry has been effectively operating a transshipment and transport complex in the scheme of mining operations as part of three crushing transshipment points and a system of parallel main inclined belt conveyors along the height of the Central section of the southern side of the quarry. The complex is designed for simultaneous transportation of containing overburden and special rocks to the external dump and mineral resources to the place of its transshipment to railway transport facilities. The link between the conveyor railway transport is a warehouse of rock mass, which is filled out with the help of an energy-intensive spreader OSS 4000/125. Its use as auxiliary technological equipment leads to significant operating costs.

The technological scheme for loading rock mass is as follows.

The dumper, moving along a horizontal conveyor, pours the rock mass to the warehouse. EKG - 10 excavators are used for the shipment of minerals to railway vehicles (dumpcars 2VS-10). Improvement of the technological scheme for filling the rock mass warehouse along the length of the transshipment point provides for the replacement of the dumper with mobile equipment.

As such, an autostell equipped with a rotary unloading console with a length of 12-15m can serve. if necessary, its length can be increased to 15-20m.

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Thus, the basic technological parameters of node overload the rock mass from conveyor to rail transport and the interrelation of parameters of reloading-transport complex machines with parameters paved (shipped) for the location of the rock mass in the scheme of cyclical-and-continuous mining technology.

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