

DETERMINATION AND RESEARCH OF NORMS OF THE FERROUS QUARTZITES PREPARED TO BOOTY

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Abstract

Investigational provision of every extractive power-shovel the industrially-balance supplies prepared to the booty with the different degree of preparedness to the booty and quarry on the whole depends on a time domain between loosening of array of ferrous quartzite's and than anymore this time domain, the greater material well-being of every power-shovel removed, indignant and by other industrially-balance supplies prepared to the booty. At the same time domain between loosening of array of ferrous quartzites in coalfaces a time domain between the mass loosening can be anything. It is well-proven that effective work of quarry in the case when time domains between the mass loosening of array of balance-industrial supplies and loosening of array of ferrous quartzite's in coalfaces gather. Reasonably, that an optimal time domain between the mass loosening of array of balance-industrial supplies in iron-ore careers is in limits from two to three weeks and average of transitional removed from the array of ready to the booty of balance-industrial supplies is necessary to be increased on the coefficient of transporting.

The offered methodology of setting of norms of the balance-industrial supplies prepared to the booty is approved on the careers of Kryvyi Rih, and the methodology of setting of norms of preparedness of the balance-industrial supplies prepared to the booty, worked out for operating ore-mining enterprises modernized and adjusted to the use on the stage of planning. By an experience way the set values to the coefficient of reserve of extractive units, time domain between loosening of array of ferrous quartzite's in an extractive coalface accordingly in months and in changes and at presence of in the career of the motor-car and railway transporting of iron-ore mass from coalfaces for different time domains the got dependences for the calculations of norms ready to the booty of balance-industrial supplies.

Considered hypothesis about connection between middle for inside and for inters laughter dispersions of content of quality indexes of the iron related to magnetite, the sizes of that from different parties characterize changeability of content of quality indexes of minerals in the bowels of the earth and in iron ore mass, tested in the presence of correlation between these indexes. The brought dependences over between the sizes of time

domain between the mass loosening and productivity of extractive units are lines, use that for time domains between the mass loosening of array of ferrous quartzite's that equal according to one, two, three and to four weeks, as a function of the productivity of quarry on mountain mass (in default of breeds rocky opening).

Introduction. For trouble-free and productive work of every extractive unit at the booty of ferrous quartzites by an open method, it is necessary, that certain accordance stuck to between the different project technological types of mountain works. Planning of development of mountain works in the process of exploitation of balance-industrial supplies of deposit, bed, ore body or areas of array of hard minerals is the important stage in the decision of questions of technology of mountain production that provides plenitude of mastering of balance supplies of bowels of the earth [1].

At the annual planning of development of mountain works go into detail and specify perspective plans, and also decide concrete technological questions: establishment of volumes of the ore preparation, threaded and works taking into account norms on the degree of preparedness of the prepared and ready to the booty balance-industrial supplies exposed,, and also task on the volume of commodity products; set research constructed, research and other works, what booties of balance-industrial supplies sent to the improvement from the bowels of the earth; determine the rational amount of simultaneously working extractive units with the aim of providing of necessary amount and quality of commodity products; their redemption. Optimal loading set and fold the calendar graphic arts of booty of balance-industrial supplies of ferrous quartzite's on every extractive unit and determine terms.

A provision of every extractive power-shovel the industrially-balance supplies prepared to the booty is with the different degree of preparedness to the booty, and thus and on the whole depends a quarry on a time domain between loosening of array of ferrous quartzite's. Than anymore this time domain, the anymore there must be material well-being of every power-shovel removed, indignant and by other industrially-balance supplies prepared to the booty. At the same time domain between loosening of array of ferrous quartzite's in coalfaces a time domain between the mass loosening is different. Effective work

of quarry in that case, when time domains between the mass loosening of array of balance-industrial supplies and loosening of array of ferrous quartzite's in coalfaces gather, id est then, when time of mass explosion coincides in all extractive coalfaces. An optimal time domain between the mass loosening of array of balance-industrial supplies in iron-ore careers is in limits from two to three weeks. Size of «transitional» removed from the array of the balance-industrial supplies of ferrous quartzite's prepared to the booty use in content of quality indexes of reserve that compensates the unevenness of the productivity of extractive units.

An aim of work is development of methodology of setting of norms of the balance-industrial supplies prepared to the booty taking into account the complex mastering of bowels of the earth.

For the achievement of the put aim such **tasks** are untied:

- it is an analysis of present methods of setting of norms of the balance-industrial supplies prepared to the booty;

- it is an improvement of existent methodologies of setting of norms of the balance-industrial supplies prepared to the booty taking into account the complex mastering of bowels of the earth;

- it is establishment of norms of the balance-industrial supplies prepared to the booty.

An idea of work is an analysis and determination of methods of calculation of the optimal balance-industrial supplies prepared to the booty for development of economy of ore-mining enterprises and indexes of plenitude of the use of resources of bowels of the earth at present labour and material resources.

A research object is the balance-industrial supply of ferrous quartzite's prepared to the booty.

The subject of research is methodology of setting of norms of the balance-industrial supplies prepared to the booty.

Analysis of methods of setting of norms of the balance-industrial supplies prepared to the booty. From the bowels of the earth work is preceded the direct booty of balance-industrial supplies of ferrous quartzite's: on providing of norms of balance-industrial supplies of ferrous quartzite's on the degree of preparedness to the booty; to registration and claim of norms of acceptance in exploitation of extractive units, the amount of that provides the booty of different

on content quality indexes of balance-industrial supplies of ferrous quartzite's in correlations necessary for the receipt of iron-ore mass of the set content of quality indexes; determination of norms of losses of balance-industrial supplies and impoverishment of content of quality indexes of minerals at the booty of balance-industrial supplies of ferrous quartzite's on every extractive unit and quarry on the whole; a choice of parameters of works is taking into account a minimum of losses of balance-industrial supplies at the booty of balance-industrial supplies of ferrous quartzite's from the bowels of the earth [2,3].

Balance-industrial supplies of ferrous quartzite's of quarry, that is ready to the booty is optimal (and they can be accepted at content of quality indexes of norm), if optimal will be indexes of $Q_c=H_z$, $N=N_0$, $d=d_0$ and etc. [4,5]. The balance-industrial supplies prepared to the booty are removed from an array must provide the planning productivity of every extractive unit in every interval between loosening of array of ferrous quartzite's. The productivity of extractive unit on a career hesitates in wide limits in relation to her mean value that is why set the normative size of removed from the array of the balance-industrial supplies prepared to the booty with reserve. The brought totality over of means that in every interval between loosening of array of ferrous quartzite's in the coalface of i -a of extractive unit to the moment of completion of shipping of the removed iron-ore mass the prepared to the booty balance-industrial supplies corresponding to the productivity of extractive unit and to the moment of completion are indignant boring works to be cleaned out and prepared to the boring drilling of blast holes, corresponding to the volume of the iron-ore mass removed for an explosion.

The chart of changeability of the removed balance-industrial supplies of ferrous quartzites in the coalface of extractive unit is brought on the figure 1a.

Changeability of the removed balance-industrial supplies in the coalfaces of separate extractive units and in a career it takes place on the whole salutatory with a period, that equals an interval between the contiguous loosening of array of ferrous quartzite's and with amplitude that equals the volume of the removed iron-ore mass q_{ij} .. The amount of the removed balance-industrial supplies of iron-ore mass of i -a of extractive unit on the fixed moment of time determines by such method

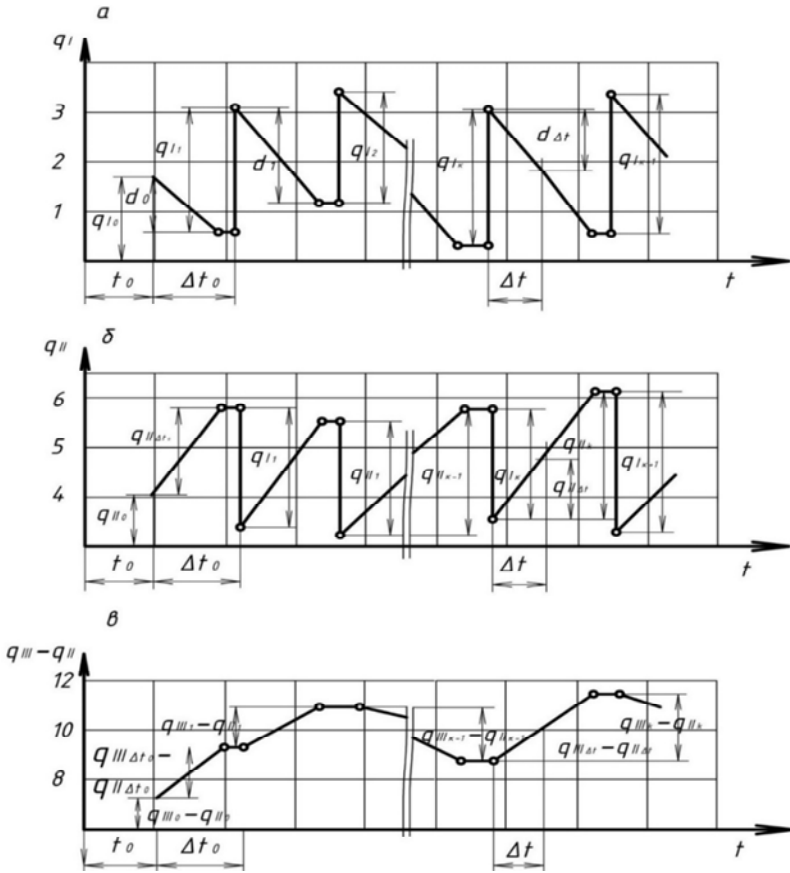


Fig. 1. Chart of changeability of balance-industrial supplies of extractive unit:
a - removed; *b* – indignant and *c* – preparation to the boring drilling blast holes

$$Q_{ii} = q_{Ii0} + \sum_1^{k_i} q_{Iij} - \sum_1^{k_i} d_{ij} - d_{i\Delta t} = q_{Ii0} + k_i q_{Ii} - (k_i - 1) d_{i} - d_{i\Delta t} \quad (1)$$

where: q_{Ii0} is an amount of the removed balance-industrial supplies of array of ferrous quartzite's in the coalface of *i*-a of extractive unit in initial moment of the considered period of time of t_0 ; d_{i0} is an amount of iron-ore mass, that ship *i*-a extractive unit in times of Δt_0 ; q_{Iij} is an amount of balance-industrial supplies of array of ferrous quartzite's of *i*-a of extractive unit, that beat back in *j*-m and

explosion; d_{lij} is the productivity of i -a of extractive unit in an interval between loosening of array of ferrous quartzite's; $d_{i\Delta t}$ is an amount of iron-ore mass that is shipped i -a by extractive unit in times of Δt ; q_{li} is the AV amount of the removed balance-industrial supplies of array of ferrous quartzite's of i -a of extractive unit in an interval between loosening of array of ferrous quartzite's; d_i is the middle productivity of i -a of extractive unit in an interval between loosening of array of balance-industrial supplies.

Changeability of balance-industrial supplies of ferrous quartzite's of extractive unit of indignant by blast holes, equal as and balance-industrial supplies removed, carries salutatory character with a period that equals a time domain between the contiguous loosening of array of ferrous quartzite's. The amount of balance-industrial supplies of ferrous quartzites of i -a of extractive unit, indignant at blast holes on the fixed moment of time, determines from expression

$$Q_{li} = q_{li0} + q_{li\Delta t_0} + \sum_1^{k_i-1} q_{lij} - \sum_1^{k_i-1} q_{lij} + \quad (2)$$

$$+ q_{li0} + q_{li\Delta t_0} + (k_1 - 1)q_{li} - k_i q_{li} + q_{li\Delta t}$$

where: q_{li0} are balance-industrial supplies of ferrous quartzite's of i -a of extractive unit, prepared to the boring drilling blast holes, present in the moment of time of t_0 ; q_{lij} are balance-industrial supplies of ferrous quartzite's of i -a of extractive unit, prepared to the boring drilling blast holes in a i -a interval between loosening of array of ferrous quartzite's; q_{li} it is an average of balance-industrial supplies of ferrous quartzite's of i -a of extractive unit, prepared to the boring drilling blast holes in an interval between loosening of array of ferrous quartzite's; $q_{li\Delta t}$ are balance-industrial supplies of ferrous quartzite's of i -a of extractive unit, prepared to the boring drilling blast holes for time Δt .

The chart of changeability of balance-industrial supplies of ferrous quartzites of extractive unit, indignant at blast holes, is brought around on chart. 16. Like on the fixed moment of time the amount of balance-industrial supplies of ferrous quartzites of i -a of extractive unit of the blast holes prepared to the boring drilling will present

$$Q_{III} = q_{III_0} - q_{I_{t_0}} + q_{III\Delta_0} + \sum_1^{k_1-1} q_{IIIj} - \sum_1^{k_1-1} q_{IIIj} + q_{IIIj} - q_{III\Delta} = \quad (3)$$

$$q_{III_0} - q_{I_{t_0}} + q_{III\Delta_0} + (k_1 - 1)q_{III} - (k_1 - 1)q_{I_{t_0}} + q_{III\Delta} - q_{I_{t_0}\Delta}$$

where: q_{III_0} are balance-industrial supplies of ferrous quartzite's of i -a of extractive unit, prepared to the boring drilling of blast holes, present in the moment of time of t_0 ; q_{IIIj} are balance-industrial supplies of ferrous quartzite's of i -a of extractive unit, prepared to the boring drilling of blast holes in j -a and interval between loosening of array of ferrous quartzite's; q_{III} it is an average of balance-industrial supplies of ferrous quartzite's of i -a of extractive unit, prepared to the boring drilling of blast holes in an interval between loosening of array of ferrous quartzite's; $q_{III\Delta}$ are balance-industrial supplies of ferrous quartzite's of i -a of extractive unit, prepared to the boring drilling of blast holes for time Δt .

The chart of changeability of balance-industrial supplies of ferrous quartzite's of extractive unit, blast holes prepared to the boring drilling, is brought around on chart 16. Balance-industrial supplies are ready to mining of i -a of extractive unit in fixed moment of time present a size that equals a sum

$$Q_{I_i} = Q_{I_t} + Q_{I_{t_0}} + Q_{III} = (k_1 - 1)q_{III} - (k_1 - 1)d_i + \quad (4)$$

$$+ q_{III\Delta_0} + q_{III_0} + q_{III\Delta} + q_{I_{t_0}} - d_{i_0} - d_{i\Delta}$$

If oscillation of the productivity of i -a of extractive unit in intervals between loosening of array of ferrous quartzite's to characterize a size middling quadratic rejection [6] then

$$q_{I_{t_0}} = d_{i_0} + t\sigma_{di}, \quad (5)$$

where t is a coefficient of probability.

Normative average of the removed balance-industrial supplies of array of ferrous quartzite's prepared to the booty

$$q_{I_{t_0}} = d_{i_0} + t\bar{\sigma}_{di}, \quad (6)$$

where $\bar{\sigma}_{di}$ – determine as AV

$$\bar{\sigma}_{di} = \frac{1}{N} \sum_1^N \sigma_{di} . \quad (7)$$

Use the size of «transitional» removed from the array of the balance-industrial supplies of ferrous quartzites prepared to the booty in content of quality indexes of reserve that compensates the unevenness of the productivity of extractive units. Accept $q'_{i_0} = t\sigma_{di}$, and determine the size of coefficient of probability from actual data of work of quarry [4] in obedience to formulas

$$t_i = (d_{\max_i} - d_i) / \sigma_{di} , \quad (8)$$

$$t = \frac{1}{N} \sum_1^N t_i , \quad (9)$$

where d_{\max_i} is a burst performance of i -a of extractive unit.

From expression of oscillation of number of explosions in the $H_r = N_0[(k + 0,5)q_{III_0} - (k - 0,5)d_0 + \sigma_k(r_{kd_{III}} \sigma_{d_{III}} - r_{kd_0} \sigma_{d_0}) + q'_{III_0} + q'_{I_0}]$ [4], considered time domain characterize that a quadratic average, influences on the norm of the balance-industrial supplies prepared to the booty. At the calculations of norms of the balance-industrial supplies of ferrous quartzite's prepared to the booty a quadratic average it is possible to ignore, because explosive works in a career must be conducted rhythmically with identical time domains between loosening of array of ferrous quartzite's. Therefore expression will accept the following

$$H_r = N_0[(k + 0,5)q_{III_0} - (k - 0,5)d_0 + q'_{III_0} + t\sigma_{d_0}] . \quad (10)$$

Raising of task. At the open method of booty of ferrous quartzite's it is necessary for trouble-free and rational work of every extractive unit, that certain accordance stuck to between the different types of mountain works. Mathematically this accordance can be expressed by next correlations:

$$\begin{aligned} q_{Iij} / t_{Iij} &= q_{IIij} / t_{IIij} = q_{IIIij} / t_{IIIij} = \\ &= (Q_{wif} - Q_{rif}) / t_{wif} = (Q_{eif\phi} - Q_{II\phi}) / t_{eif\phi} , \end{aligned} \quad (11)$$

where t_{Iij} , t_{IIij} , t_{IIIij} accordingly time on shipping, boring drilling of blast holes and preparation to indignation of the balance-industrial

supplies q_{1ij} , q_{2ij} , q_{3ij} of i -a of extractive unit prepared to the booty in j -a interval between loosening of array of ferrous quartzite's; and t_{1ij} , t_{2ij} is time of implementation of works on creation of the exposed ($Q_{if} - Q_{i\phi}$), and ready to the booty balance-industrial supplies of i -a of extractive unit prepared ($Q_{2i\phi} - Q_{3i\phi}$).

The brought totality over of equalities means that in every interval between loosening of array of ferrous quartzite's in the coalface of i -a of extractive unit to the moment of completion of shipping of the removed iron-ore mass the prepared to the booty balance-industrial supplies corresponding to the productivity of extractive unit must be indignant; to the moment completions of boring works must be cleaned out and prepared to the boring drilling of blast holes, corresponding to the volume of the iron-ore mass removed for an explosion, and, including works on preparation and opening of balance-industrial supplies [4]. A transition from the productivity of extractive unit to the balance-industrial supplies prepared to the booty carry out taking into account the losses of the ferrous quartzite's and content of quality indexes of minerals prepared to the booty at booty. Sizes t_{1ij} , t_{2ij} , t_{3ij} in general case do not equal duration of time domain between loosening of array of ferrous quartzite's and not even inter se. Unequal are sizes q_{1ij} , q_{2ij} , q_{3ij} . These indexes will be identical in idealizing case: at even time domains between loosening of array of ferrous quartzite's, to even work of all machines and equipment [4].

Exposition of material and results. Relations driven to expression (11), there are products of number of pieces of equipment on his middle productivity [4]. Yes, the first relation is the productivity on shipping of the balance-industrial supplies of ferrous quartzite's of i -a of extractive unit removed from an array in j -m interval between loosening; the second relation is a product of number of boring machine-tools of i -a of extractive unit on their middle productivity in j -m interval between loosening of array of ferrous quartzite's

$$d_{ij} = n_{c1ij} d_{c1ij} = n_{3ij} d_{3ij} = n_{2ij} d_{2ij} = n_{1ij} d_{1ij}, \quad (12)$$

Where d_{ij} is the productivity of extractive unit, in j -m interval between loosening of array of ferrous quartzite's n_{cmij} , n_{zij} , n_{nij} , n_{eij} it is a number of pieces of equipment accordingly on the boring drilling of blast holes, to preparation of the balance-industrial supplies prepared to the booty to indignation, on works on preparation and opening of the ferrous quartzite's of i -a of extractive unit prepared to the booty in an interval between loosening of array; d_{cmij} , d_{zij} , - and it is the middle productivity of piece of equipment on the boring drilling of blast holes on preparation of the balance-industrial supplies of ledge prepared to the booty to the boring drilling and in a j -m interval between loosening of array of ferrous quartzite's of j -m to obtaining

$$n_{cr} = \bar{n}_{cr} + t\sigma_{n_{cr}} . \quad (13)$$

For the calculations of indexes will use expression (12) examine that as a between's by casual sizes? Determining the expected values and dispersions of right and left parts of equality (12), will get

$$d_i = n_{cr}d_{cr} + K_{n_{cr}d_{cr}} , \quad (14)$$

$$\sigma_{di}^2 = \sigma_{n_{cr}}^2 \sigma_{d_{cr}}^2 + \bar{n}_{cr}^2 \sigma_{d_{cr}}^2 + \bar{d}_{cr}^2 \sigma_{n_{cr}}^2 + K_{n_{cr}d_{cr}}^2 + 2\bar{n}_{cr} \bar{d}_{cr} + 2\bar{n}_{cr} K_{n_{cr}d_{cr}} , \quad (15)$$

where $\bar{n}_{cr}, \bar{d}_{cr}$ are mean values, $\sigma_{n_{cr}}^2, \sigma_{d_{cr}}^2$ are dispersions, $K_{n_{cr}d_{cr}}$ is a cross-correlation moment of sizes of n_{cr}, d_{cr} .

Decide equalization (14) and (15) and get expression for the calculations of indexes. Determine the normative number of pieces of equipment an analogical method in all stages of realization of mountain works [5,6]. From correlations (11) and (12) on condition of $t_{lij}=t_{llj}=t_{llij}$, where t_{lij} is a time domain between loosening of array of ferrous quartzite's, swims out, that must be executed to equality of $q_0=q_{10}=q_{ll0}$, and also $\sigma_{d0}=\sigma_{d10}=\sigma_{dll0}=\sigma_{dlll0}$, id est on the average on each there must be one ton of the iron-ore mass removed from an array, indignant, cleaned out, prepared and exposed, tone of the shipped iron-ore mass [5,6]. Therefore expression for the calculations of norm of the balance-industrial supplies prepared to the booty yet more will simplify and taking into account reserve ΔH_{r2} , he will accept the following

$$H_r = N_0(d_0 + t\bar{\sigma}_{d_0} + q'_{III_0}) + \Pi - B + \Delta H_{r_2}, \quad (16)$$

where: Π , B accordingly losses of the balance-industrial supplies prepared to the booty and amount of breeds of, that participate in a booty, in this period, equals a time domain between loosening of array of ferrous quartzite's in extractive coalfaces, τ ; ΔH_{r_2} it is reserve of the balance-industrial supplies prepared to the booty, that compensates the error of their determination, τ .

A transition from the productivity of extractive unit to the balance-industrial supplies prepared to the booty carry out taking into account the losses of the ferrous quartzite's and content of quality indexes of minerals prepared to the booty at booty. This circumstance is taken into account by a formula (16). For providing of front of boring works and considerable simplification of calculations accept the size of the balance-industrial supplies prepared to the booty such that equals the size of the productivity of extractive unit.

$$H_r = N_0(2d_0 + t\bar{\sigma}_{d_0}) + \Pi - B + \Delta H_{r_2}. \quad (17)$$

Assuming $\Delta H_{r_2} = t\bar{\delta}_{r_2}$ [5], where t a coefficient of probability, $\bar{\delta}_{r_2}$ is a middle quadratic error of determination of normative size of the balance-industrial supplies prepared to the booty. Indexes of d_0 , σ_{d_0} and t in a formula (17) at the use of large statistical material establishment practically without errors. Therefore the error of calculations of norm of the balance-industrial supplies prepared to the booty on a formula (17) depends only on the error of determination of number of extractive units

$$\delta_{r_2} = \delta_{N_0}(2d_0 + t\bar{\sigma}_{d_0})$$

where δ_{N_0} is an error of determination of number of extractive units.

Execute the calculations of number of extractive units in obedience to formulas $N'_0 = \kappa_1 \bar{M}_{II} / n_{\kappa} \bar{\kappa d}_{3M}$; $\Delta = t\sigma$ [5,6]. Indexes that are included in these formulas set a plan, or determine on the basis of the statistical processing of actual data practically without errors. Therefore by the error of determination of number of extractive units, and thus, and at the calculations of norm of the

balance-industrial supplies prepared to the booty it is possible the error of determination of reserve of the balance-industrial supplies prepared to the booty to scorn.

In obedience to a formula (17) the average of the transitional removed balance-industrial supplies prepared to the booty equals on a career $N_0 t \bar{\sigma}_{d_0}$. The conducted analysis showed that this size in the conditions of iron-ore quarries of Kryvyi Rih can be accepted by such that equals 0,3 the average monthly productivity of ore-mining enterprise. Such size is sufficient for indemnification of vibrations of the productivity of extractive power-shovels at the motor-car transporting of iron-ore mass from extractive coalfaces. However at the railway transporting of iron-ore mass such reserve of the transitional removed balance-industrial supplies prepared to the booty can appear insufficient. It is therefore expedient in a formula (17) to enter a coefficient that takes into account the increase of the balance-industrial supplies prepared to the booty at the railway transporting. Then a norm of the balance-industrial supplies prepared to the booty will be

$$H_r = N_{01} d_{01} (2 + tV_{d_1}) + N_{02} d_{02} (2 + k'_1 tV_{d_1}) + \Pi - B, \quad (18)$$

where N_{01} , N_{02} is a number of extractive power-shovels that work accordingly on a motor and railway transport, with the observance of condition of $N_0 = N_{01} + N_{02}$.

In general case for the m types of transport

$$H_r = \sum_1^m N_{0j} d_{0j} (2 + k'_m tV_{d_j}) + \Pi - B. \quad (19)$$

The expounded methodology of setting of norms of the balance-industrial supplies prepared to the booty, based on the use of dependence (17), is widely approved on the careers of Kryvyi Rih. The methodology of setting of norms of preparedness of the balance-industrial supplies prepared to the booty, worked out for operating ore-mining enterprises, is not quite comfortable however, because the row of indexes determines from data of work of operating ore-mining enterprise. In connection with it methodology of setting of norms of preparedness of the balance-industrial supplies prepared to the booty is modernized and adjusted to the use on the stage of

planning. Indexes and coefficients, that is included in a formula (17), characterize correlation of separate constituents of the balance-industrial supplies (indignant and prepared to the boring drilling blast holes removed) prepared to the booty, type of transporting of iron-ore mass and unevenness of extractive works. Coefficient «2» in this formula is set subject to condition, in accordance with that, to the moment of loosening of array in ferrous quartzites in extractive coalfaces. Such assumption it is possible and not to do, but the size of the «transitional» balance-industrial supplies blast holes prepared to the boring drilling prepared to the booty, to estimate by means of coefficient of material well-being that takes into account presence in composition the balance-industrial supplies prepared to the booty cleaned out blast holes prepared to the boring drilling. In this case expression for the calculations of norm of the balance-industrial supplies prepared to the booty will assume a next view

$$H_{\Gamma} = N_0 d (1 + tV_d) k_{\tau} k_3 + \Pi - B, \quad (20)$$

where k_{τ} is a coefficient that takes into account the increase of the balance-industrial supplies prepared to the booty at the railway transporting of mountain mass from coalfaces in comparing to motor-car.

The coefficient of material well-being shows, at the balance-industrial supplies how many times prepared to the booty more sum of removed and indignant. The values of indexes, that is included in a formula (20), depend on the applied technique and technology of open method of booty of balance-industrial supplies from a deposit, bed, ore body or areas. Will lead

$$k_p = N_0'' / N_0' \dots \tau_m = \tau_{3M} / n_k \dots d = \tau_{3M} k_H d_{3M},$$

where k_p is a coefficient of reserve of extractive units; τ_m , τ_{3M} is a time domain between loosening of array of ferrous quartzite's in an extractive coalface accordingly in months and in changes.

Using these dependences will get a formula for the calculations of norm of the balance-industrial supplies prepared to the booty in time (in months) units:

$$H'_{\Gamma} = 1,05(1 + tV_d) k_3 k_{\tau} k_p \tau_m + \frac{\Pi - B}{\mathcal{D}_M}. \quad (21)$$

For determination of mean values of indexes of t and V_d data of daily variably-allowance charts of work of iron-ore quarries of Kryvyi Rih are used, and in a formula (21) at the calculations of norms of the balance-industrial supplies prepared to the booty it is possible the last addition to scorn (table. 1).

Table 1

For determination of mean values of indexes of t and V_d data of daily variably-allowance charts of work of iron-ore quarries of Kryvyi Rih are used

Ore-mining enterprises	Value of indexes of V_d (in a numerator) and t (in a denominator) depending on a time (in weeks) domain between loosening of array of ferrous quartzite's in extractive coalfaces			
	1	2	3	4
Inguletz CRG	0,57/2,11	0,48/1,41	0,44/1,54	0,41/1,47
South CRG	0,51/1,98	0,35/1,79	0,35/1,65	0,34/1,42
Novo-Krivorizkiy CRG «ArselorMittal»	0,52/1,77	0,37/1,76	0,33/1,63	0,36/1,46
Central CRG	0,53/1,62	0,44/1,68	0,38/1,45	0,42/1,56
North CRG	0,53/1,76	0,48/1,87	0,32/1,68	0,28/1,41
AV	0,53/1,85	0,42/1,71	0,37/1,59	0,36/1,46

During work on a railway transport in a loosening block that provides the a week's productivity of power-shovel, when approximately 30 from the array of balance-industrial supplies is in the distance from the axis of railway way that exceeds a 25 m, mountain mass is shipped with overcastting with mountain mass of next block that increases the removed balance-industrial supplies ready to mining in 1,3 times (figure. 2).

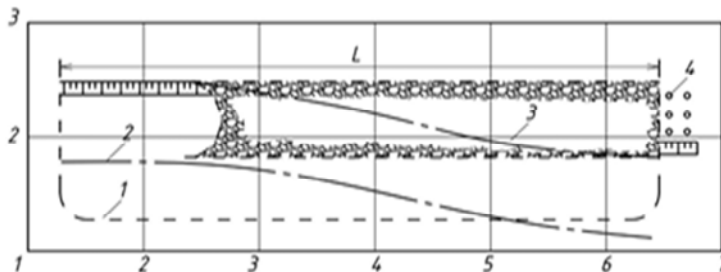


Fig. 2.. Chart to the calculations of the transitional removed balance-industrial supplies during work on a railway transport: L is length of loosening array of block; 1 is a contour of loosening array of block; 2 is an axis of railway way; 3 is a contour of the transitional removed balance-industrial supplies; 4 are blast holes

At the calculations of norm of balance-industrial supplies of the minerals prepared to the booty in this case it follows to accept $k_T=1,3$. With the increase of volume of block, that loosen the value of coefficient of k_T will diminish. For blocks that provide two-week work of power-shovel, at the calculations of norm of balance-industrial supplies of the minerals prepared to the booty it follows to accept $k_T=1,15$, of four weeks – $k_T=1,08$. For the estimation of size of coefficient of k_3 , the executed analysis of correlations of the balance-industrial supplies prepared to the booty removed, indignant and prepared to the boring drilling blast holes. An analysis is conducted in the conditions of iron-ore quarries of Kryvyi Rih. By a feedstock for an analysis became given to the account of the indignant and cleaned out prepared to the booty balance-industrial supplies removed, on extractive ledges that present in a sum the balance-industrial supplies prepared to the booty. The got results on the careers of Kryvyi Rih CRG drawn on for the estimation of middle between's between the indignant and cleaned out industrial prepared to the booty supplies of ferrous quartzite removed, driven to the table. 2.

Table 2

An estimation of middle between's by the indignant and cleaned out prepared to the booty balance-industrial supplies removed

Ore-mining enterprises	Balance-industrial supplies of ferrous quartzite's prepared to the booty		
	removed	indignant	cleaned out
Inguletz CRG	39,8	37,1	23,1
South CRG	52,8	28,5	18,7
Novo-Krivorizkiy CRG «ArselorMittal»	41,6	29,6	28,8
Central CRG	41,4	32,7	25,9
North CRG	51,2	29,6	19,2
Mean value	45,4	31,5	23,1

Thus, by an experience way from data of work of iron-ore quarries of Krivbass the set values to the coefficient of reserve of extractive units, time domain between loosening of array of ferrous quartzite's in an extractive coalface accordingly in months and in changes.

Using the set values of indexes and coefficients, at presence of in the career of the motor-car and railway transporting of iron-ore mass from coalfaces for different time domains dependences are got for the calculations of norms of the balance-industrial supplies prepared to the booty that is driven to the table. 3.

Table 3

Dependences are for the calculations of norms of the balance-industrial supplies of ferrous quartzite's prepared to the booty

A type of transporting of iron-ore mass is from coalfaces	Expression is for the calculation of norms of the balance-industrial supplies of ferrous quartzite's prepared to the booty in different time τ_m , miss domains			
	0,23	0,47	0,69	0,93
Motor-car	$H'_r=0,61k_p$	$H'_r=1,18k_p$	$H'_r=1,58k_p$	$H'_r=1,91k_p$
Railway	$H'_r=0,83k_p$	$H'_r=1,33k_p$	$H'_r=1,67k_p$	$H'_r=1,98k_p$
Combined	$H'_r=(0,61p_1+0,83p_2)k_p$	$H'_r=(1,18p_1+1,33p_2)k_p$	$H'_r=(1,58p_1+1,67p_2)k_p$	$H'_r=(1,91p_1+1,98p_2)k_p$

In the table of size of p_1 and p_2 mark accordingly the motor-car and railway transporting of iron-ore mass from coalfaces in a career. At the calculations of norms of balance-industrial supplies of the minerals prepared to the booty on the stage of planning most difficulties are caused by determination of middle for inwardly slaughter dispersion of content of quality indexes of useful component mean that.

Taking into account numerous requirements to inside quarry average of content of quality indexes of minerals in iron-ore mass at setting of norms of preparedness of balance-industrial supplies, from one side, difficult, and from other - beside the purpose, because these requirements not always are reasonable, often duplicate each other and not controlled fully. It is Therefore expedient to conduct the analysis of requirements on inside-mining blending of quality indexes of minerals in iron-ore mass with an aim them substantial simplification and clarification. If blending of content of quality indexes of minerals in iron-ore mass in a career carry out for to a few

useful components, then it follows to reduce the presence of dependences between them. The presence of reliable dependences between content of useful components that averages in iron-ore mass that comes from a quarry on an ore mining and processing factory allows asserting about the presence of dependences between descriptions of changeability of content of these useful components. In that case, when between standard deviations of content of useful components that average, there is substantial correlation, then blending of content of quality indexes of minerals in iron-ore mass can be conducted on one of useful components, determination of that is simpler and cheap. In general to limit oscillation of two interdependent useful components beside the purpose. It is enough to limit oscillation of content of one useful component. Its position is known and confirmed experimentally [7-9].

Before blending of content of quality indexes of minerals in iron-ore mass obtain that different requirements operate on careers:

- it is limitation of oscillation of content of useful and harmful components in the different volumes of the obtained iron-ore mass (mostly in variables and day);

- on iron-ore careers content of quality indexes of minerals in iron-ore mass, that supply with on an ore mining and processing factory, limit oscillation of content of quality indexes of iron general, or content of quality indexes of the iron related to magnetite, sculptures and silica in variables and daily allowance volumes of balance-industrial supplies of minerals.

For simplification of calculations there was the tested hypothesis about the presence of connection between middle for quadratic and middle for quadratic inters laughter dispersions of content of quality indexes of the iron related to magnetite. Size middle for quadratic and middle for quadratic inters laughter dispersions of content of quality indexes of iron related to magnetite, from different parties characterize changeability of quality indexes of minerals in the bowels of the earth and in iron-ore mass obtain that. In the same time they are descriptions of the same part of array of ferrous quartzites, general totality that allows assuming the presence of correlation between these indexes. For an analysis data that is set on the ore-mining enterprises of Krivbass are used [4].

	$\bar{\sigma}^2$	$\bar{\delta}^2$
Inguletz CRG	20,6	7,8
South CRG	10,6	6,2
Novo- Krivorizkiy CRG «ArselorMittal»	10,2	3,6
Central CRG	24,4	12,2
North CRG	12,3	7,5

The conducted cross-correlation analysis shows that between the considered sizes there is dependence as a line, that to pass from beginning of coordinates

$$\bar{\sigma}^2 = 2,2\bar{\delta}^2. \quad (22)$$

$$N_0'' = \frac{\delta^2(2,2 + 3,2V_d^2)}{\sigma_0^2 k_y^2} - V_d^2. \quad (23)$$

Numerous determinations of coefficient of variation of variable-stroke of extractive power-shovels showed that $V_d=0,4 \div 0,5$, not taking into account the last addition in a formula (19), will get

$$N_0'' = \frac{3\delta^2}{\sigma_0^2 k_y^2}. \quad (24)$$

From expression (24) comes out, that

$$k_p = 3\delta^2 / \sigma_0^2 k_y^2 N_0. \quad (25)$$

Generalization of data of work of iron-ore quarries of Krivbass testifies that the size of coefficient of blending of content of quality indexes of minerals in iron-ore mass changes in limits from 1 to 1,5, and his value depends on the capacity of composition of blending of content of quality indexes of minerals in iron-ore mass and warehousing technology stated below.

Compositions of blending of content of quality indexes of minerals in iron-ore mass and compositions of blending of content of quality indexes of minerals in iron-ore mass on shifting grounds are absent 1

Compositions of blending of content of quality indexes of minerals in iron-ore mass by a capacity to 50 thousand t..... 1,1

Compositions of blending of content of quality indexes of minerals in iron-ore mass by a capacity 100-200 thousand t, including shifting compositions of blending of content of quality indexes of minerals in iron-ore mass 1,2-1,3

Compositions of blending of content of quality indexes of minerals are in iron-ore mass by a capacity over 300 thousand t with the layer conclusion of iron-ore mass and shipping of the reaching..... 1,4-1,5

Thus, determine the coefficient of reserve of number of extractive units depending on changeability of content of quality indexes of minerals in an array, requirements to inside quarry blending of content of quality indexes of minerals in iron-ore mass and efficiency of the system of blending of content of quality indexes of minerals in iron-ore mass on a ore-mining enterprise. Indexes that are included in expression (25) will set on the stage of planning of ore-mining enterprise. Dependences that is driven to the table. 3, allow to expect the norms of the balance-industrial supplies prepared to the booty depending on the coefficient of reserve, time domain between loosening of array of ferrous quartzite's and type of transporting of iron-ore mass from coalfaces. The calculations of norms are executed for the iron-ore quarries of Krivbass. Results are driven to the table. 4.

Table 4

Dependences for the calculation of norms of the balance-industrial supplies of ferrous quartzite's prepared to the booty depending on the coefficient of reserve of time domain between loosening of array of ferrous quartzite's and type of transporting of iron-ore mass from coalfaces for the terms of quarries of Krivbass

Interval between loosening of array of ferrous quartzite's, τ months	Coefficient of reserve, k_p	Norms of the balance-industrial supplies of ferrous quartzite prepared to the booty are depending on part of the motor-car (p_1) and railway (p_2) transporting from extractive coalfaces					
		$p_1=1$ $p_2=0$	$p_1=0,8$ $p_2=0,2$	$p_1=0,6$ $p_2=0,4$	$p_1=0,4$ $p_2=0,6$	$p_1=0,2$ $p_2=0,8$	$p_1=0$ $p_2=1$
0,23	1,0	0,7	0,7	0,7	0,7	0,7	0,8
	1,5	0,9	1,0	1,1	1,1	1,1	1,2
0,47	1,0	1,2	1,2	1,2	1,3	1,3	1,4
	1,5	1,8	1,8	1,9	1,9	2,0	2,0
0,69	1,0	1,6	1,6	1,6	1,6	1,7	1,7
	1,5	2,4	2,4	2,4	2,5	2,5	2,6
0,93	1,0	1,9	1,9	2,0	2,0	2,0	2,0
	1,5	2,9	2,9	2,9	3,0	3,0	3,0

Thus maximally use the balance-industrial supplies prepared to the booty, diminish the number of mass explosions and outages of quarry during explosive works. Results of researches showed that an optimal time domain between the mass loosening of array of balance-industrial supplies in iron-ore careers was in limits from two to three weeks. On a formula (21) and table determine 4 norms of the balance-industrial supplies prepared to the booty depending on the size of time domain between loosening of array of ferrous quartzite's, but on the stage of planning of the use of such index for the calculations of norms of the balance-industrial supplies prepared to the booty presents certain difficulties.

As a rule, at planning technology of exploding works is not gone into detail and a time domain between loosening of array of balance-industrial supplies of ferrous quartzite's in extractive coalfaces is not determined. Therefore expediently to replace this index other, more user-friendly at planning. With a time domain between loosening of array of ferrous quartzite's in coalfaces constrained time domain between the mass loosening of array of balance-industrial supplies and productivity of quarry on rocky mass. This dependence is conditioned by limitation numbers of blocks that loosen simultaneously, during a mass explosion. If maximal number of blocks that loosen during the mass explosion of N_{max} , number of extractive units of N , that provide the production capacity of quarry \bar{D}_{TMO} of on rocky mass, less than or equals the maximal number of blocks, then between loosening does not depend a time domain on the production capacity of quarry, thus at $N=N_{max}$, $\bar{D}_{TM}=\bar{D}_{TMO}$ and $\tau_M=\tau_{MO}$. In area of $N>N_{max}$ takes place increase of the productivity for on iron-ore mass of $\bar{D}_{TM}>\bar{D}_{TMO}$ and increase of time domain between loosening of array of balance-industrial supplies of ferrous quartzite's $\tau_M>\tau_{MO}$ figure 3.

For the calculation of norms of the balance-industrial supplies prepared to the booty it is necessary to set dependence of size of time domain between loosening of array of ferrous quartzite's in rocky coalfaces from the production capacity of quarry on rocky mountain mass. Thus it follows to take into account a between's by the volumes of booty of balance-industrial supplies of ferrous quartzite's and rocky mass. If correlation such remains permanent, then changeability of size of time domain between loosening of array of

ferrous quartzite's in rocky coalfaces will be analogical to changeability of size of time domain between loosening of array of ferrous quartzite's, that represented on figure 3.

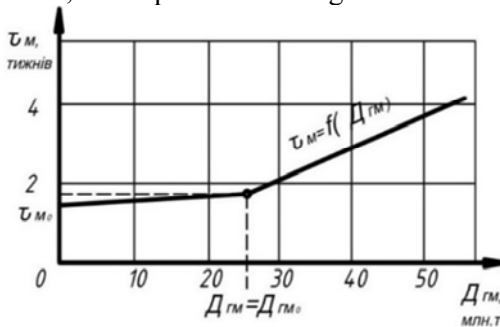


Fig. 3. Dependence of time domains between loosening of array of ferrous quartzite's in extractive coalfaces from the productivity of quarry on rocky mountain mass

However in general case (for the same time domain) of relation of time domain between loosening of array of ferrous quartzite's in rocky coalfaces will be anything. Thus dependence $\tau_{MF} = f_r(D_{TM}, \mu)$ is system of lines, each of that answers the defined value of index of time domain between loosening of array of ferrous quartzite's in rocky coalfaces. Schematically this dependence is shown on figure. 4.

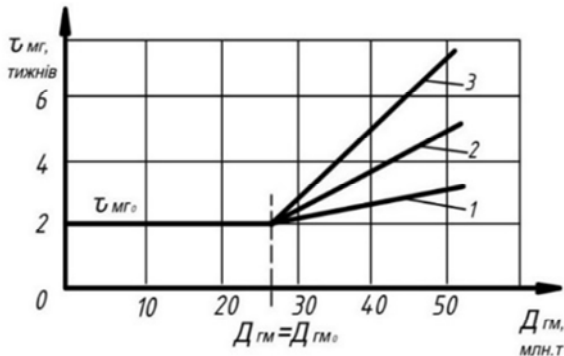


Fig. 4. Dependence of time τ_{M2} domain between loosening of array of ferrous quartzite's in rocky coalfaces from the productivity of quarry on rocky mountain mass at different between's by the volumes of booty of useful fossil and rocky mountain mass: 1 - $\mu=1$; 2 - $\mu=1,2$; 3 - $\mu=1,4$

Variant $\mu=1,0$ answers absence in the career of the rocky opening and on chart. 4 this variant is shown by the line located in the underbody of bunch of lines. The angular coefficient of lines in a bunch grows with the increase of index of time domain between loosening of array of ferrous quartzite's in rocky.

At an unchanging technique and technology of mountain works and permanent time domain between the mass loosening of array of ferrous quartzite's dependence $\tau_M=f(I_{TM})$ in area of $N>N_{max}$ has the appearance of line. As the conducted analysis of work of iron-ore quarries of CRG Kryvyi Rih number of ore blocks that simultaneously mass loosen does not exceed six, showed. It is related to the technique and technology of drilling-and-blasting works, geological and mine technical terms, requirements of rules of accident prevention. If to assume, that all rocky mass on a career is presented by minerals then under right technological planning of ore-mining enterprise of ferrous metallurgy for six extractive power-shovels a quarry must answer with the productive productivity 30 million t. on a year [10]. For quarries with the higher productivity in connection with the increase of number of extractive power-shovels time domain between loosening of array of ferrous quartzite's in coalfaces (at the same time domain between the mass loosening of array. For such terms of between's by time domains and productive productivity of quarry driven to the table. 5.

Table 5

There is a between's by time domains and productive productivity of quarry

Production capacity of quarry on rocky mass of I_{TM} , mln. t	Time domain between loosening of array of balance-industrial supplies of ferrous quartzite's, week(month)							
	Mass loosening	Loosening is in extractive coalfaces	Mass loosening	Loosening is in extractive coalfaces	Mass loosening	Loosening is in extractive coalfaces	Mass loosening	Loosening is in extractive coalfaces
20	1(0,23)	1,0(0,23)	2(0,47)	2(0,47)	3(0,69)	3,0(0,71)	4(0,93)	4(0,93)
25	1(0,23)	1,5(0,35)	2(0,47)	3(0,69)	3(0,69)	4,5(1,05)	4(0,93)	6(1,41)
30	1(0,23)	2,0(0,47)	2(0,47)	4(0,93)	3(0,69)	6,0(1,41)	4(0,93)	8(1,86)
35	1(0,23)	2,5(0,58)	2(0,47)	5(1,16)	3(0,69)	7,5(1,75)	4(0,93)	10(2,33)

Dependences are between the sizes of time domain between loosening to the array and have the appearance of lines $\tau_{M1}=t_{he}$ productive productivity of quarry $\tau_{M1}=0,0077\Delta_{\Gamma M}$; $\tau_{M2}=0,0157\Delta_{\Gamma M}$; $\tau_{M3}=0,0233\Delta_{\Gamma M}$; $\tau_{M4}=0,0310\Delta_{\Gamma M}$, that can be used for time domains between the mass loosening of array of ferrous quartzite's that equal weeks accordingly. If the brought dependences over to put in a formula (21), then determine the normative size of the balance-industrial supplies prepared to the booty as a function of the productivity of quarry on mountain mass (in default of breeds of the rocky opening). Dependences for the calculations of norms of the balance-industrial supplies prepared to the booty are driven to the table 6.

Table 6

Dependences are for the calculations of norms of the balance-industrial supplies of ferrous quartzite's prepared to the booty

A time τ_m domain is between the mass loosening of array of ferrous quartzite's in a career, week	Dependences are for the calculations of norms of the balance-industrial supplies prepared to the booty at the use of transport		
	motor-car	Railway	combined
1	$H'_r=0,0210 k_p\Delta$	$H'_r=0,0273 k_p\Delta$	$H'_r=(0,0210p_1+0,0273p_2) k_p\Delta$
2	$H'_r=0,0389 k_p\Delta$	$H'_r=0,0447 k_p\Delta$	$H'_r=(0,0389p_1+0,0447p_2) k_p\Delta$
3	$H'_r=0,0521 k_p\Delta$	$H'_r=0,0563 k_p\Delta$	$H'_r=(0,0521p_1+0,0563p_2) k_p\Delta$
4	$H'_r=0,0639 k_p\Delta$	$H'_r=0,0665 k_p\Delta$	$H'_r=(0,0639p_1+0,0665p_2) k_p\Delta$

As an example the norms of balance-industrial supplies of the ferrous quartzite's prepared to the booty are expected for a time domain between the mass loosening of array $\tau_M=0,47$ months (table. 7).

Table 7

Norms of the balance-industrial supplies of ferrous quartzites prepared to the booty are for a time domain between the mass loosening of array

D , mln.t	k_p	Norms of the balance-industrial supplies of ferrous quartzite's prepared to the booty at motor-car p_1 and railway p_2 transporting of mountain mass from extractive coalfaces					
		$p_1=1,0$ $p_2=0,0$	$p_1=0,8$ $p_2=0,2$	$p_1=0,6$ $p_2=0,4$	$p_1=0,4$ $p_2=0,6$	$p_1=0,2$ $p_2=0,8$	$p_1=0,0$ $p_2=1,0$
20	1,1	1,3	1,3	1,4	1,4	1,4	1,5
25	1,2	1,5	1,5	1,5	1,6	1,6	1,7
30	1,3	1,6	1,6	1,6	1,7	1,7	1,8
35	1,4	2,1	2,1	2,1	2,2	2,3	2,3
40	1,5	2,4	2,4	2,5	2,5	2,6	2,7

In connection with the tendency of increase of the productivity of obtaining units on the booty of balance-industrial supplies and opening breeds the size of the productive productivity of quarry on rocky mountain mass in a prospect must increase. In addition, in connection with the improvement of technique and technology of explosive works increase the number of blocks, that simultaneously use during a mass explosion that conduces to the increase the sizes of the productive productivity of quarry on rocky mountain mass, and thus, to the increase of range of changeability of the productive productivity of quarry in that the size of time domain does not depend on the productive productivity.

Thus, by an experience way from data of work of iron-ore quarries of Kryvyi Rih the set values to the coefficient of reserve of extractive units, time domain between loosening of array of ferrous quartzite's in an extractive coalface accordingly in months and in changes. Using the set values of indexes and coefficients, at presence of in the career of the motor-car and railway transporting of iron-ore

mass from coalfaces for different time domains dependences are got for the calculations of norms ready to the booty of balance-industrial.

Conclusions

1. The brought totality over of means that in every interval between loosening of array of ferrous quartzite's in the coalface of *i*-a of extractive unit to the moment of completion of shipping of the removed iron-ore mass the prepared to the booty balance-industrial supplies corresponding to the productivity of extractive unit must be indignant; to the moment completions of boring works must be cleaned out and prepared to the boring drilling of blast holes, corresponding to the volume of the iron-ore mass removed for an explosion.

2. A transition from the productivity of extractive unit to the balance-industrial supplies prepared to the booty carry out taking into account the losses of the ferrous quartzite's and reduction content of quality indexes of minerals prepared to the booty at a booty. On the basis of analysis of middle correlations of the balance-industrial supplies prepared to the booty removed, indignant and prepared to the boring drilling blast holes the executed estimation of coefficient of material well-being.

3. The average of the transitional removed balance-industrial supplies prepared to the booty in the conditions of iron-ore quarries of Kryvyi Rih equals 0,3 the average monthly productivity of ore-mining enterprise and is sufficient for indemnification of vibrations of the productivity of extractive power-shovels at the motor-car transporting of iron-ore mass from extractive coalfaces.

4. Methodology of setting of norms of preparedness of the balance-industrial supplies prepared to the booty is modernized and adjusted to the use on the stage of planning. Indexes and coefficients characterize correlation of separate constituents of the balance-industrial supplies (indignant and prepared to the boring drilling blast holes removed) prepared to the booty, type of transporting of iron-ore mass and unevenness of extractive works.

5. By an experience way from data of work of iron-ore quarries of Kryvyi Rih the set values to the coefficient of reserve of extractive units, time domain between loosening of array of ferrous quartzite's in

an extractive coalface accordingly in months and in changes, at presence of in the career of the motor-car and railway transporting of iron-ore mass from coalfaces for different time domains dependences are got for the calculations of norms of the balance-industrial supplies prepared to the booty.

6. At the calculations of norms of balance-industrial supplies of the minerals prepared to the booty on the stage of planning most difficulties are caused by determination of middle for inwardly-slaughter dispersion of content of quality indexes of useful component blend that.

7. Determine the coefficient of reserve of number of extractive units depending on changeability of content of quality indexes of minerals in an array, requirements to of content of quality indexes of minerals in iron-ore mass and efficiency of the system of content of quality indexes of minerals in iron-ore mass on ore - mining enterprise.

8. A time domain between loosening of array of ferrous quartzite's in extractive coalfaces is one of basic indexes, use that for determination of normative size of the balance-industrial supplies prepared to the booty, that conducted by an explosive method.

9. Dependences between the sizes of time domain between loosening of array and productive productivity of quarry have the appearance of lines, use that for time domains between the mass loosening of array of ferrous quartzite's that equal according to one, two, three and to four weeks and determine the norm of the balance-industrial supplies prepared to the booty as a function of the productivity of quarry on mountain mass.

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