УДК 622.4.28

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FUNCTIONAL – STRUCTURAL ANALYSIS OF THE ACTING NETWORK OF MINE WORKINGS «HIRSKA»

The analysis was made of the active network of mine workings «Hirska» using functional – structural analysis. As a result of recommendations designed to reduce the extent of mine workings at 4500 meters.

Keywords: *mine workings, functional – structural analysis.*

Introduction.

Due to lack of data on the mine Hirska, which allows to calculate the cost of the technological functions that are performed by mine workings, instead of cost-effectiveness analysis was performed functional-structural analysis, which is the basis of FCA. For this table has been drawn up. 1, which reflects the functions performed by the existing mine workings as of 01.10.2010.

The presentation of the material and its results.

For this purpose Table 1 was drawn up, it reflects the functions performed by the acting mine workings as of 01.10.2010.

Table 1 – Functions performed by a network of mine workings

Mine Workings	Functions							Water drainage	Electric power supply	$\sum l$, м	l, м	K_f	K_c
	Ventilation			Transport									
	Fresh	Outgoing	Fresher	Coal	Rock	People/safety escape	Materials						
1	2	3	4	5	6	7	8	9	10	11	12	13	14
Shaft № 1	+							+	+		700		
Skip shaft	+										700		
Drainage incline	0,38					/+					1100		0
Central cross-cut	0,75			+	+	+		⊕			1000		
Belt incline under skip shaft	0,14			+	+						300		
Northern rock drift of the horizon 700	0,22					/+		+			2970		

Table 1 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Southern rock drift of the horizon 700	0,26			0,62	+	+	+	+			1500		
Outrunning cross-cut of the horizon 700	0,09			0,20							320		
Southern rock belt incline	0,24			0,20				+	+		900		
Southern rock man incline	0,07	0,7				+		+	+		860		
Cross-cut under the southern rock man incline	0,54			0,91		+					250		
Alternative cross-cut of southern incline				+	+								
Ventilation cross-cut of the horizon 700		0,91				/+					550		
Southern shaft		+-				/+					700		
Southern under borehole	+												
Rock conveyer passage of the eighth and ninth southern longwalls		0,18				/+					400		
Diagonal travelling way on the horizon 800 m		0,66				/+					75		
Belt incline of the fifth southern longwall		0,34									200		
Belt incline of the 2-4 southern longwalls		0,56									550		
Northern rock incline of the horizon 900 m	0,15 0,38			0,91		+	+	+			2050		
Cross-cut of the southern longwall on the horizon 900 m	0,5			0,91		++		+			350		

Table 1 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Ventilation travelling way of the southern longwall on the horizon 900 m	0,08					/+					225		
Conveyer passage of the fifth southern longwall	0,68					+	+				175		
conveyor passage on the winze	0,10			0,24		+	+				220		
Travelling way on the winze	0,26										50		
rock conveyer passage of the sixth longwall of northern block	0,04					/+					100		
the conveyor passage of the seventh southern longwall on the horizon 900 m	0,4			0,16			+				850		
Precast conveyor passage of northern longwall	0,19					+	+				535		
Cross-cut on the seam k_8	0,10					+	+				200		
conveyor passage of the longwalls of northern block			0,35	0,24		+	+				525		
Ventilation travelling way of the tenth northern longwall	0,28					-/+	+	+			1040		
conveyor passage of the tenth northern longwall			0,44	0,24		/+	+	+			875		
the tenth longwall											300		
magazine chamber of the eleventh longwall											250		

Table 1 (continued)

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Ventilation incline k_8		0,45				/+	+	+			1500		
northern rock belt incline on the horizon 900-1000 m		0,08						+			200		
northern rock man incline	0,07							+			450		
Auxiliary incline 700-800-900		1,1				/+					910		
Incline on the northern dip entry	0,27					+	+				150		
Ventilation holing 900	0,22										100		
Northern point-of-attack on the horizon 800 m	0,13					/+							
Northern auxiliary shaft	+				+	+	+	+	+		900		
Northern ventilation shaft		+				/+					700		
Northern cross-cut 700		1,5				/+		+			775		
Northern rock drift 700		+				/+					100		

In this table, "+" sign shows the functions performed by each mine working. The numbers indicate the functional workload of a particular mine working by performance of the respective functions. In column 7 sign "+" below the line indicates that working is intended for the emergency exit.

Workload of workings is calculated only by functions of ventilation and transportation of coal and rock. The movement of people, materials, electricity and drainage are not estimated on the degree of workload due to lack of actual data.

Enumerated in Table 1, data showed that the mine has mine workings, that are very weakly functional loaded, such as a drainage incline, the north rock drift on the horizon 700 m, rock conveyer passage of eighth and ninth southern longwalls, diagonal travelling way on the horizon 800 m, belt incline of the fifth southern longwall and belt incline of the 2-4 southern longwalls on the horizon 900 m, air crossing of the southern longwall on the horizon 900 m, travelling way on the winze, rock conveyer passage of the sixth longwall of northern block on the horizon 900 m, magazine chamber, northern rock man incline on the horizon 900-1000 m, air connection on the horizon 900 m, air crossing on the warehouse of explosive materials, northern point-of-attack on the horizon 800 m, northern rock drift on the horizon 700 m.

Analysis of prospects for the use of indicated mine workings hereafter in the process of development of mining operations has shown, that after the extension of the conveyor passage of seventh southern longwall to the junction with the northern rock drift on the horizon 900 m there is no need to maintain and operate the conveyor passage on winze (*l*=220 m), travelling way on winze on the horizon 900 m (*l*=50 m), conveyor passage of the 5-7 south longwall $K_в$ on the horizon 900 m (*l*=175 m), air crossing of the southern longwall of the horizon 900 m (*l*=225m), belt incline of the fifth southern longwall and belt incline of the 2-4 southern longwall on the horizon 900 m, diagonal travelling way on the horizon 800 m (*l*=75 m), man incline on the horizon 800 m (*l*=110 m).

The total length of these workings, which can be redeemed will be 855 m. At the same time due to the redistribution of the fresh air stream movement is possible to supply its amount to the conveyor passage of the seventh southern longwall of the seam k_8 on the horizon 900 m necessary only for ventilation of this travelling way and refreshing outgoing air stream from the tenth northern longwall. In the future, during the mining of the underlying longwall is expedient to supply to this travelling way only stream for its ventilation. The basic amount of fresh air is supplied to the northern rock drift on the horizon 900 meters from the southern intake borehole and northern intake shaft. As a result, on the cross-cut on the horizon of 900 m air will be supplied through to 1,710 m^3 / min, which is quite acceptable for its current capacity.

To clarify the volumes of air distribution in workings after the liquidation of the above workings it is necessary to calculate the circuit of ventilation. Whereas it is necessary to foresee the ingress of the basic amount of fresh air through the southern rock man, incline rather than through the belt incline, as it happening now.

The rock conveyor passage will be needed to exhaust the tenth and subsequent northern longwalls. Through it, the outgoing air stream will be issued from these longwalls, which should be issued to the southern rock conveyor passage, rather than to the manway, and further to the south shaft through ventilation crosscut.

Displacement scheme of outgoing air stream from these longwalls to the southern shaft can be substantially simplified if the ventilation cross slit pass to the installation location of the wall stopping on the belt incline of 2-4 southern longwalls on the horizon 900 m, to the ventilation crosscut on the horizon 700 m. Earlier this working was prematurely extinguished.

If pumping station of shaft bottom on the horizon 400 m is dismantled, previously erecting a waterproof stoppings, electric locomotive garage build in the area of the upper receiving-landing platform of southern stone incline, it is possible to set the fixed dam on the diagonal incline on the horizon of 400-700 m and to eliminate the function of moving of air stream from ventilation of electric locomotive garage along the northern rock drifts of the horizon 700 m. If in this case water from the horizon 900m get out through northern ventilation shaft to the surface, but not to throw it in the northern rock drift of the horizon 700 m, this drift is completely loses its function. It can be destroyed (*l*=2970 m). As a result, a significant part of the fresh air that enters through the central shaft will be directed to ventilate the mine workings and longwall on the horizon of 1000 m.

The additional amount of air for them is 1900 m^3 / min.

Also the additional amount of air will be obtained, if a jumper between the workings of north point-of-attack on the horizon 800 m (488 m^3 / min) will be created, northern rock man incline and belt incline with a total length of 450 and 200 m will be destroyed (294 m^3 / min).

Considering the low loading level of active workings by ventilation function, a redistribution of air amount, which supplied to the mine workings, can be carried out without their timber replacement and violations of safety rules for air velocity. Definitively this opportunity can be assessed in the process of calculating the ventilation scheme.

The low loading level of acting conveyor chain of coal transportation (Table 1) also shows the available reserves of its current capacity. The exceptions are areas with electric haulage. Therefore for them it is necessary to calculate the required number of locomotives and trolleys.

Conclusions.

The implementation of the proposed technical solutions allow to reduce the length of supported workings a total of almost up to 4500 meters. In this case, the scheme of mine ventilation is considerably simplified and the reliability of performing of this function is increased. Moreover, it is possible to reuse the steel support of these workings, the rails, cables, pipes, etc.

For the calculation of economic effect from the implementation of the proposed solutions is necessary to know the residual value of destroyed workings, cost of recoverable steel roof support and other types of materials, and the cost of destroying of the workings.

Moreover it is necessary to compare the proposed options of mine layout, the method of protection and degasation scheme with basic (project), this will assess the cost-effectiveness of relevant proposals.

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Recommended for publication by prof. DonSTU Antoshchenko M. I., PhD (Engineering) Halchenko A. M.

The article was send to the edition 19.09.2016

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ФУНКЦІОНАЛЬНО – СТРУКТУРНИЙ АНАЛІЗ ДІЮЧОЇ МЕРЕЖІ ГІРНИЧИХ ВИРОБОК ШАХТИ «ГІРСЬКА».

Виконано аналіз діючої мережі гірничих виробок ш. «Гірська» із застосуванням функціонально – структурного аналізу. В результаті розроблені рекомендації по скороченню протяжності гірничих виробок на 4500 м.

***Ключові слова:** гірничі виробки, функціонально – структурний аналіз.*

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ФУНКЦИОНАЛЬНО – СТРУКТУРНЫЙ АНАЛИЗ ДЕЙСТВУЮЩЕЙ СЕТИ ГОРНЫХ ВЫРАБОТОК ШАХТЫ «ГОРСКАЯ».

Выполнен анализ действующей сети горных выработок ш. «Горская» с применением функционально – структурного анализа. В результате разработаны рекомендации по сокращению протяженности горных выработок на 4500 м.

***Ключевые слова:** горные выработки, функционально – структурный анализ.*