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SELECTION OF DRILLING AND BLASTING OPERATIONS AT THE OPEN PIT "POTRLICA" PLJEVLJA

Abstract

Considering that in obtaining the mineral resources about 70% of mining operations belongs to drilling and blasting, where there are the highest costs, this paper is aimed to description and proof the modern way of mining that imply maximum effects both in technological and in terms of safety.
Keywords: *technology, mining, maximum effects, safety*

1 INTRODUCTION

The Coal Basin Pljevlja, according to its economic importance, is right behind the Maoče Basin. Geomorphologically viewed, it almost entirely covers the Pljevlja valley, located in the middle course of the river Ćehotina in a place where the left tributary Vezišnica flows into it.

The area of Pljevlja Basin with the neogene sediments under the lake is 18 km^2 , while the Pljevlje Basin in a narrow sense covers an area of about 12 km^2 and is bounded by the points whose coordinates are [1]:

X from 4 798 100 to 4 801 530

Y from 6 607 000 to 6 612 400

2 DRILLING AND BLASTING OPERATIONS

Drilling and blasting operations are defined for exploitation of overburden in the amount of 4,000,000 m^{3}čm of the waste and 1,500,000 tons of coal.

Considering the applied discontinuous system of exploitation, the requirements of satisfactory coal granulation for consumer goods, the blasting is carried on agitation, it is rowed and millisecond.

Drilling and blasting of coal and overburden, defined according to the bench heights, is carried out at 10 and 15 meters. Powdered and water plastic explosives are used for blasting

2.1 Drilling of boreholes

At the open pit "Potrlica", drilling of boreholes of diameter 115 mm is performed. The boreholes are angled with the slope angle to the horizontal of $\alpha = 75^0$ on coal and overburden. The boreholes are drilled parallel to the bench slope. Length of boreholes varies, depending on height of benches that is thickness of overburden and coal seam thickness.

Taking into account all listed properties of working environment at the open pit "Potrlica", the rotary drilling system was applied.

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For this purpose, the hydraulic rotary drills are used. These are [2]:

BÖHLERR TCD-222	1 pcs.
SANDVIK Di 310	1 pcs.
ATLAS COPCO ROC L_6-25	1 pcs.

Figure 1 *ATLAS COPCO ROC L6-25*

2.2 Drilling and blasting operations on overburden

Blasting parameters on overburden using the explosive, type AMONEX

Calculation of explosive specific consumption

Calculation will be made for explosive AMONEX-3.

Calculation of specific consumption of explosive was made using the Lares formula and it is:

$$q = \frac{q_1 xsxvxexd}{\Delta} =$$

$$= \frac{0,.091x1x1x1,3x1}{1.05} = 0.11\, kg / m^3$$

Calculation of drilling length and borehole pitting

For H = 10m

$$L = \frac{H}{\sin \alpha} + l_{pr} = \frac{10}{\sin 75^0} + 1 = 11.35\, m$$

Network of boreholes and rapprochement coefficient of boreholes

Drilling of boreholes should be done in a triangular arrangement in two or three rows. The coefficient of bringing together should be equal to m = 1; m = a/W.

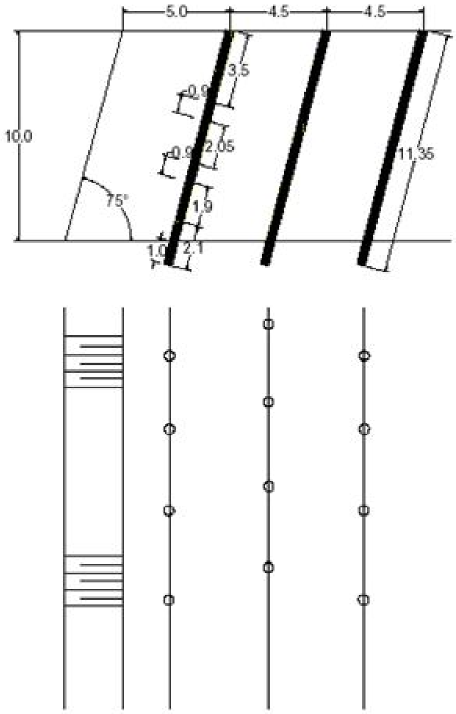

Figure 2 *Construction of blast filling of borehole on overburden for H = 10 m - schematic view*

Calculation the least resistance line

Will be carried out according to the model of S. Davidov

$$W = 53xk_t xdx\sqrt{\frac{\Delta}{\gamma_s}} =$$

$$= 53x1{,}1x0.115x\sqrt{\frac{1{,}03}{1{,}9}} = 4.93 \approx 5m$$

2.3 Calculation of distance between boreholes

For H = 10,

a = m x W = 1 x 5 = 5 m,

adopted as 5 m.

2.4 Calculation of distance between the rows of boreholes

For H = 10,

b = 0.87 x W =0.87 x 5 = 4.35 ≈ 4.5m,

adopted as 4.5 m.

2.5 Calculation the length of stemming

For bench height H = 10 m

L_s = (0.75 ÷ 1.0) x W = 3.75 ÷ 5 m

L_s = (20 ÷ 40) x d = 2.3 ÷ 4.6 m

The adopted length of STEMMING is l_s = 3.5 m.

2.6 Calculation the explosive quantity in one borehole

For calculation of filling in borehole, it is started from the basic form [3]

Q = q x V (kg)

3 CONCLUSION

It is necessary for exploitation to comply fully with parameters (amount of explosives, deceleration intervals, minefield schemes) as given in the design solution. Also, if for any reason there is a change of explosives or other blasting parameters, they should be thoroughly checked and subsequently analyzed.

During exploitation, it is necessary to carry out a continuous monitoring of blasting results (quality of fragmentation, the impact of mining on surrounding objects, etc.) for feedback analysis and possible correction of parameters that were unknown or did not take into account in design.

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IZBOR BUŠAČKO-MINERSKIH RADOVA NA POVRŠINSKOM KOPU „POTRLICA“ PLJEVLJA

Izvod

Obzirom da se pri dobijanju mineralnih sirovina od rudarskih operacija oko 70 % pripada bušenju i miniranju gde su i najveći troškovi, ovim radom želimo da opišemo i dokažemo savremeni način miniranja koji podrazumevaju maksimalne efekte kako u tehnološkom tako i u sigurnosnom smislu.

Ključne reči: *tehnologija, miniranje, maksimalni efekti, sigurnost*

1. UVOD

Pljevaljski ugljonosni basen po svom ekonomskom značaju, nalazi se odmah iza maočkog basena. Geomorfološki posmatrano on skoro u potpunosti obuhvata pljevaljsku kotlinu, koja se nalazi u središnjem toku reke Ćehotine, na mestu gde se u nju uliva leva pritoka Vezišnica.

Površina pljevaljske kotline pod jezerskim neogenim sedimentima iznosi 18 km^2 dok pljevaljski basen u užem smislu obuhvata površinu od oko 12 km^2, a omeđena je tačkama čije su coordinate [1]:

X od 4 798 100 do 4 801 530

Y od 6 607 000 do 6 612 400

2. BUŠAČKO MINERSKI RADOVI

Izvođenje bušačko-minerskih radova definisani su za eksploataciju otkrivke u količini od 4.000.000 m^3čm otkrivke i 1.500.000 t uglja.

Obzirom na primenjeni diskontinualni sistem eksploatacije, potrebe zadovoljavajuće granulacije uglja za široku potrošnju, miniranje se izvodi na rastresanje, višeredno je i milisekundno.

Bušenje i miniranje na uglju i otkrivci, saglasno definisanim visinama etaža, vrši se na 10 i 15 m. Za miniranje koriste se praškasti i vodoplastični eksplozivi.

2.1. Bušenje minskih bušotina

Na P. K. „Potrlica" vrši se bušenje minskih bušotina prečnika 115 mm. Bušotine su kose sa uglom nagiba prema horizontali od $\alpha = 75^0$ na uglju i otkrivci. Bušotine se buše paralelno kosini etaže. Dužina bušotina je različita, a u zavisnosti od visine etaže, odnosno moćnosti otkrivke i debljine ugljenog sloja.

Uzimajući u obzir sva nabrojana svojstva radne sredine na P. K. ,,Potrlica", primjenjen je rotacioni sistem bušenja.

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Za ovu svrhu koriste se hidraulične rotacione bušilice [2]. To su:

BÖHLERR TCD-222 1 kom.
SANDVIK Di 310 1 kom.
ATLAS COPCO ROC L_6-25 1 kom.

Sl. 1. *Bušilica ATLAS COPCO ROC L6-25*

2.2. Bušačko minerski radovi na otkrivci

Parametri miniranja na otkrivci primenom eksploziva tipa Amonex

Proračun specifične potrošnje eksploziva

Proračun će biti izvršen za eksplozivom Amonex-3.

Proračun specifične potrošnje eksploziva izvršen je primenom Laresove formule i iznosi:

$$q = \frac{q_1 \cdot s \cdot v \cdot e \cdot d}{\Delta} = \frac{0{,}091 \cdot 1 \cdot 1 \cdot 1{,}3 \cdot 1}{1{,}05} =$$
$$= 0{,}11 kg / m^3$$

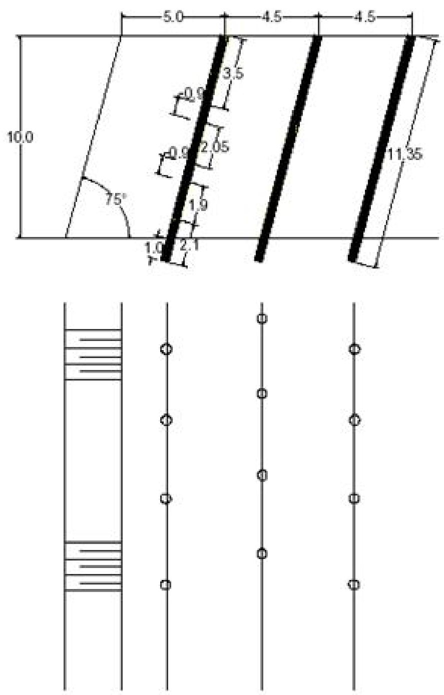
Proračun dužine bušenje i probušenja bušotina

Za H = 10m

$$L = \frac{H}{\sin \alpha} + l_{pr} = \frac{10}{\sin 75^0} + 1 =$$
$$= 11{,}35 m$$

Mreža minskih bušotina i koeficijent zbliženja bušotina

Bušenje minskih bušotina treba vršiti u trougaonom rasporedu i to u dva ili tri reda. Koeficijent zbliženja treba da iznosi m = 1; m = a/W.



Sl. 2. *Konstrukcija minskog punjenja bušotine na otkrivci za H = 10 m – šematski prikaz*

Proračun linije najmanjeg otpora

Izvršiće se prema obrascu S. Davidova

$$W = 53 \cdot k_t \cdot d \cdot \sqrt{\frac{\Delta}{\gamma_s}} =$$

$$= 53 \cdot 1{,}1 \cdot 0{,}115 \cdot \sqrt{\frac{1{,}03}{1{,}9}} = 4{,}93 \approx 5m$$

2.3. Proračun rastojanja između bušotina

Za H = 10 m,

a = m x *W = 1* x *5 = 5 m,*

usvaja se 5 m.

2.4. Proračun rastojanja između redova bušotina

Za H = 10 m,

b = 0,87 x W = 0,87 x 5 = 4,35 ≈ 4,5m,

usvaja se 4,5 m.

2.5. Proračun dužine minskog čepa

Za visinu etaže H = 10 m

$l_č = (0{,}75 \div 1{,}0)$ x $W = 3{,}75 \div 5$ *m*

$l_č = (20 \div 40)$ x $d = 2{,}3 \div 4{,}6$ *m*

Usvojena dužina minskog čepa iznosi $l_č$ = 3,5 m.

2.6. Proračun količine eksploziva u jednoj bušotni

Za proračun punjenja u minskoj bušotini polazi se od osnovnog obrasca [3]

Q = q x *V (kg)*

3. ZAKLJUČAK

Neophodno je da se pri eksploataciji u potpunosti ispoštuju parametri (količine eksploziva, intervali usporenja, šeme minskog polja) koji su dati u projektnom rešenju. Takođe, ukoliko iz bilo kojih razloga dođe do promene eksploziva ili nekog drugog parametra miniranja, iste treba detaljno proveriti i naknadno analizirati.

Pri eksploataciji je neophodno vršiti stalno praćenje rezultata miniranja (kvalitet usitnjavanja, uticaj miniranja na okolne objekte i dr.) radi povratne analize i eventualne korekcije parametara koji nisu bili poznati ili uzeti u obzir prilikom projektovanja.

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