UDC 681.3

SIMULATION AND VISUALIZATION OF THE ENTRANCE TRENCH'S CONSTRUCTION

Shumski S., Malcheva R.V.
Donetsk National Technical University

Introduction

To improve the technology of an entrance trench construction on open mines it is offered to apply an ejection explosive. At first, a safety screen on trench's sides is created by the use of contour charge explosive, and then – packing of rock aboard trenches by the use of ejection explosive is provided. Because the open mine is situated not far from the Dokuchaevsk town the weight of charges are simultaneously explosively ejected should not exceed 28,8 t. Depth of an entrance trench changes from 0 to 27,9 m, therefore a quantity of contour charges and a number of charges for ejection explosive have to change.

1 Mathematical model

To support the offered technology the charges' parameters should be calculated with the use of multi-factor mathematical expressions with changing parameters. Besides it is necessary to control the weight of simultaneously explosively ejected charges. Therefore the special software is developed. It includes a database from which it is possible to choose necessary factors and coefficients, and functions for calculation of charges' parameters for various technologies. The function to calculate charges' parameters for without transport scheme of an entrance trench construction works as follows. The external cycle (while) allows to control the total weight of the calculated charges. The distance between the charged contour blastholes at preliminary crack foundation is defined under the formula: $a = K \cdot d \cdot \left(1 + 2^{\frac{1}{n}}\right) \cdot \left\{2 \cdot \nu \cdot P_{\partial} \cdot \left(\frac{\nu_з}{\nu_c}\right)^{\chi} / \left[\sigma_p \cdot (1-\nu) \cdot (1+C)\right]\right\}^{\frac{1}{m}}$.

Calculation of charges for ejection explosive begins with a definition of an indicator of an explosive's action $n = \frac{r_в}{W}$, where $r_в$ – radius of an explosive crater, m; W - a line of the least resistance (LLR), m [1]. A value of $r_в$ should not exceed the value equal to half of distance between numbers of boreholes' rows. LLR will be a variable since a depth of a trench, H, is changed from 0 m (on entrance) to 27,9 m (in a final point) – fig.1.

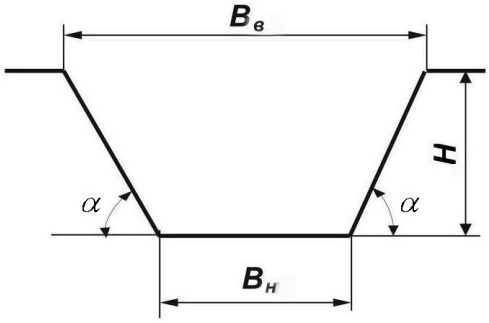

Figure 1 – Trench cross-section

Charges for ejection explosive have on such distance one from another that at joint action they formed a crater with an equal sole. The basic calculations are carried out in a loop

in parallel for 5 rows of blastholes. For the 1st row W=2,5 m, for the others – 5 m. Also initial value *n*=1,1 and for each following row of blastholes it increases on 0,04.

The distance between charges is calculated under the formula $a = 0{,}5 \cdot W \cdot (n+1)$. A charge's weight for a trench depth less then 25 m is calculated under Boreskov's formula $Q = q_н \cdot W^3 \cdot (0{,}4 + 0{,}6 \cdot n^3)$, and for a depth greater then 25 m under the formula $Q = q_н \cdot W^3 \cdot (0{,}4 + 0{,}6 \cdot n^3) \cdot \sqrt{\frac{W}{25}}$ [1].

Then a charge's length is calculated and a plug's length is determined. If obtained value is positive, the results of calculation are stored to file, the corresponding data are changes and "deepening on a trench" is carried out. Otherwise the program outputs the message on impossibility to charge a blasthole and suggests to apply more powerful explosive and to enter value of its working capacity. In the absence of approaching explosive program interrupts (a compulsory exit – Ctrl-Break). After the end of loop the results of calculations are transferred to the technologist.

Software testing has been executed for conditions of an entrance trench for an open-cast mine "Central" of the Dokuchaevsky flux - dolomite industrial complex. The entrance trench's parameters are: depth - from 0 to 27,9 m; width on ground – 25 m; width on top – 28,5 m; length – 678 m (as shown on fig.2).

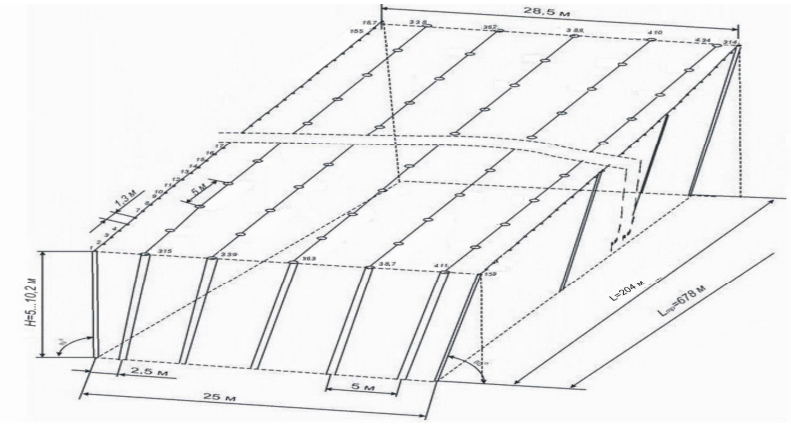

Figure 2 – Trench model with blastholes' marking

As the result the 16 explosive blocks are obtained. For the 1st block the weight of contour charge is ranged from 13,57 kg (for 5 m blasthole length) up to 75,67 kg (for 10,26 m blasthole length). The weight of charge for ejective explosive is ranged from 22,3 kg up to 391,1 kg for the same diapason of blasthole lengths. The calculated values of the width and height of a disintegration of broken rock are equal 21,3 m and 11,9 m, respectively.

Summaries

Thus the modeling has shown impossibility of application of technology on an initial part of a trench (depth from 0 to 5 m), and also expediency of level-by-level removal of excavation rock using blocks of 10-12 m depth.

Literature

[1] P. Taranov. Puurimis-ja Lõhketööd. – Tallinn: Eesti Riiklik Kirjastus, 1961. – 423 ll.