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RESEARCH REGARDING THE DESIGN AND DIG OF AN AUTOMATIC CIRCUIT IN VĂRATEC MINE, BĂIUȚ COMMUNE, MARAMUREȘ COUNTY

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Abstract

The detour circuits of modern mining pits represent a complex system of mining works connecting the pit with the main floor galleries. They are composed of straight sections (pit ramps) and curvilinear portions (detour galleries). The length of these detour circuits are designed based on the production realized on that horizon, the transport intensity on the pit and how well is the transport applied.

Key words: *automatic circuit, mine gallery, pit, ramp*

INTRODUCTION

Underground workings are done in the earth's crust, and consist generally of: galleries, shafts, inclined planes, underground rooms etc.

To give evidence or to operate a useful mineral deposits are digging some underground excavations, called mining works which have a well established technology and process that are placed under the technical projects must contain all the elements necessary to materialize their land surveying (Dima et al., 1996).

Operations by running mining works are called mining operations and the surface towards the mining work forward is called front work.

The part from where the mining work starts from surface or from another mining work is called the mouth work and depending on the mining type of work is called the mouth of the gallery, the pit mouth etc (Fodor, 1980).

In terms of mining destination can be:

- research or exploration, mainly aimed for research deposits;
- exploitation, mainly aimed for exploiting deposits.

Depth of pits varies with conditions and rock utility but generally can reach up to 1500 m. Pits cross section (profile) depends on the excavation, supporting way, utility depth, the nature of the terrain in which the engravings etc. and can usually be square (Figure 1 – a), rectangular (Figure 1 – b), circular (Figure 1 – c), ellipsoidal (Figure 1 – d), combined (Figure 1 – e) etc.

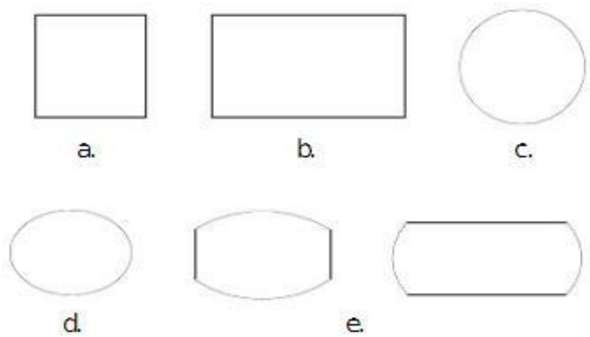

Figure 1. Types of profiles for vertical mining works

Based on the movement resistance coefficient of the wagons, the circuit is designed at an automatic ramp. In case of automatic ramps, the full and empty wagons move freely under an initial impulse on certain portions of the detour circuit (Popia et al., 2008; Ortelecan et al., 1999).

In underground, staking out the connecting curves consists in digging and supporting the galleries under a designed connection angle (Ionel, 2004; Bos et al., 2007). The correct dig and support of the galleries in curve is very important for the production process to run normally, with the compliance of work safety rules.

MATERIALS AND METHODS

The curve design of the galleries is done depending on the connection radius (R) and the angle (U) between the galleries. Thru design we determined the coordinates of the base points (curve starting point T_i, curve ending point, intersection point of the alignments (V) and the origin of the arc (O)) and the detail points (Figure 2).

To take account of path elements polygonal curves first resolve the connection strings using polygon method, as amended.

In order to have the calculus elements of the polygonal path, first it is solved the connection curves using the strings polygon method.

In this context, the connection curves are known by the radius curve, thus (N=8m):

- for the C_1 curve it is known the connection radius R_1=28 m;
- for the C_2 curve it is known the connection radius R_2=23 m;
- for the C_3 curve it is known the connection radius R_3=23 m;

Knowing the connection radius R_1, R_2, R_3 and the angles to the center α_1, α_2, α_3 of each curve, can be calculated:

- connection curve length (C);
- length of the provisional strings (S'), so that they are not tangent to the gallery wall;
- number of strings in which the curve is divided (n);
- angle to the center corresponding to each string (λ);
- length of the final strings (S);
- angles of entry and exit from the curve and the angles of the detail points

entry and exit of curve and angle of the points of detail (β_i).

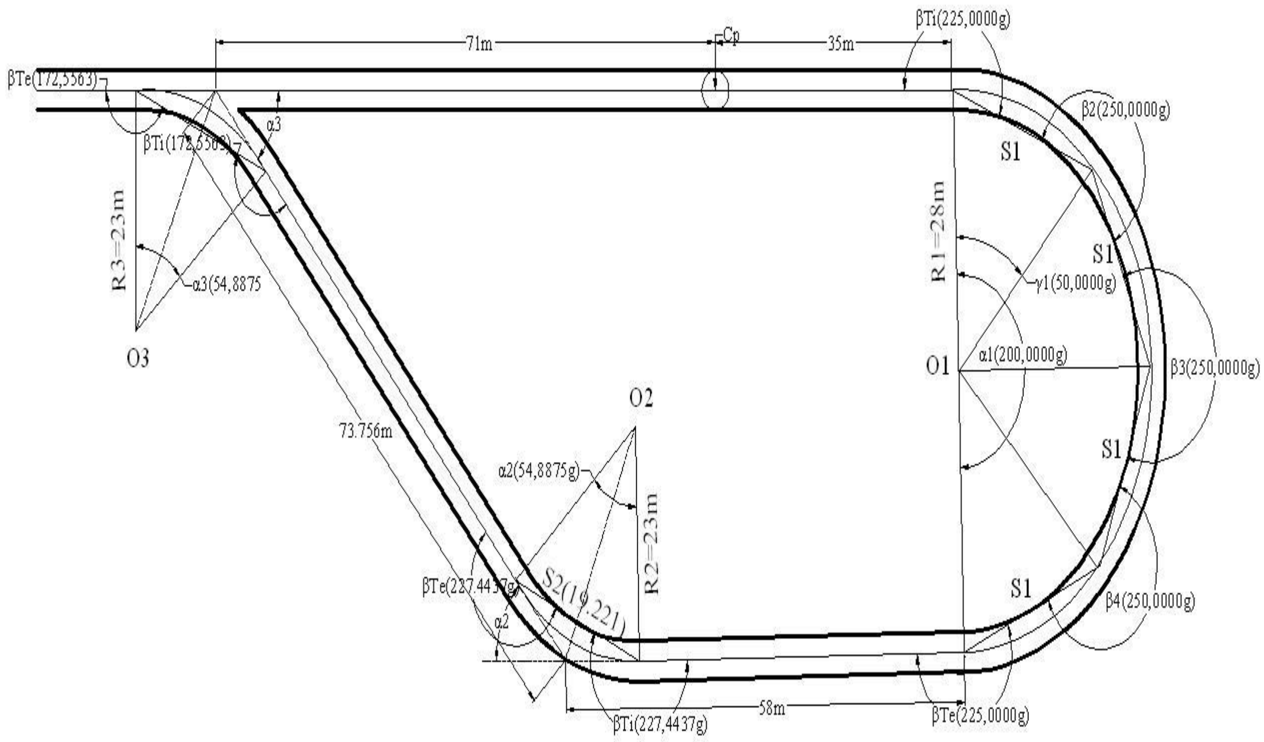

Figure 2. Design of the automatic circuit

RESULTS AND DISCUSSIONS

Solving the curve C_1 (R_1=28 m; α_1=200^g):

a) connection curve length (C_1):

$$C_1 = \frac{\pi \cdot R_1 \cdot \alpha_1}{200} = 87.965m$$

b) length of the provisional strings (S_1'), so that they are not tangent to the gallery wall:

$$S_1' = \sqrt{8 \cdot R_1 \cdot f} = 20.357m$$

where: f - the mid rope arrow, which is equal to half the width of the gallery

c) number of strings in which the curve is divided (n_1):

$$n_1' = \frac{C_1}{S_1'} = 4.321$$

Since n_1' is a decimal number, it shall be rounded to a whole, resulting the number of strings in which is divided the curve (n_1=4 strings).

d) angle to the center corresponding to each string (λ_1):

$$\lambda_1 = \frac{\alpha_1}{n_1} = 50.00.00$$

e) length of the final strings (S_1):

$$S_1 = 2 \cdot R_1 \cdot \sin\frac{\lambda_1}{2} = 21.430m$$

f) angles of entry and exit from the curve:

$$\beta_{Ti} = \beta_{Te} = 200 \pm \frac{\lambda_1}{2} = 225.00.00$$

Waypoints angles are:

$$\beta_i = 200 \pm \lambda_1 = 250.00.00$$

i=2,3,4

The curves C_2 and C_3 are solved in the same way.

By solving the 3 curves reach a closed circuit polygonal path with its computing elements: Cp (2657,123; 1747,232) and the orientation of the main axis of the shaft θ_{ax} = 18.20.50.

We noted all β angles from the first point of the polygonal route after the center of the shaft, from 1 to 9.

Calculation of the sides orientations which form the polygonal path, start from the main axis orientation:

$\theta_{Cp1} = \theta_{ax}$ = 18.20.50

$\theta_{12} = \theta_{ax} + \beta_1 - 200^g$ = 43.20.50

…………………………………

$\theta_{9Cp} = \theta_{89} + \beta_9 - 3 \times 200^g$ = 18.20.50

Because we worked with projected angles and distances, the unclosure on orientations must respect the geometric condition:

$$(\beta_1 + \beta_2 + \beta_3 + ... + \beta_9) - 200^g \cdot (9 \pm 2) = 0$$

2200-200 x 11= 0 (condition is respected)

Knowing the sides orientations of the polygonal path and distances between points forming the polygonal path, we determined the coordinates of points (Table 1), based on the coordinates of the center shaft Cp (2657,123; 1747,232).

Table 1. Final coordinates of the points

Nr. pct.	X	Y
1	2690.702	1757.105
2	2707.383	1770.558
3	2709.666	1791.866
4	2696.213	1808.547
5	2674.905	1810.830
6	2629.410	1797.453
7	2614.922	1784.822
8	2593.347	1736.852
9	2578.858	1724.221
Cp	2657.124	1747.233

CONCLUSIONS

Differences between the calculated coordinates of point Cp and the known coordinates of point Cp, which is 1 mm, is due to rounding of calculations.

For vans to move freely under the initial impetus from the floor galleries to the pit shaft and then from the pit shaft to the floor galleries, is to require automatic slopes. Slopes are calculated from the coefficient of resistance to movement of carts and guidance following values:

- for rectilinear galleries p‰ = 10 ‰;
- for curve galleries, branch with full vans p‰ = (12-14) ‰;
- for curve galleries, branch with empty vans p‰ = (14-16) ‰.

To compensate the level difference which occurs because the slopes in the branch of empty vans, it is placed a compensator level (elevator chain), whose slope angle must satisfy the inequality $9^o < \varphi < 14^o$.

REFERENCES

Dima Nicolae, Pădure I., Herbei O. Topografie miniera, Editura Corvin, 1996

Fodor D.,Exploatari miniere la zi, Editura Didactica si Pedagogica, 1980

Rodica Popia, Adrian Popia, Măsurători subterane. Îndrumător pentru lucrări de laborator, editura Tehnopress, 2008

Mircea Ortelecan, Palamariu Maricel, Jurca Traian, Trasarea lucrarilor miniere, Editura Infomin, 1999

AutoCAD 2004, Simion Ionel, Editura Polirom,2004

Boş, N., Iacobescu, O., 2007, Topografie modernă, Editura C. H. Beck, Braşov