

Дупчење и минирање
Drilling and Blasting

IV Симпозиум од областа на рударството
со меѓународно учество
IV Symposium in the field of Mining
with international participation

ОРГАНИЗАТОР:
РУДАРСКО - ГЕОЛОШКИ ФАКУЛТЕТ - ШТИП
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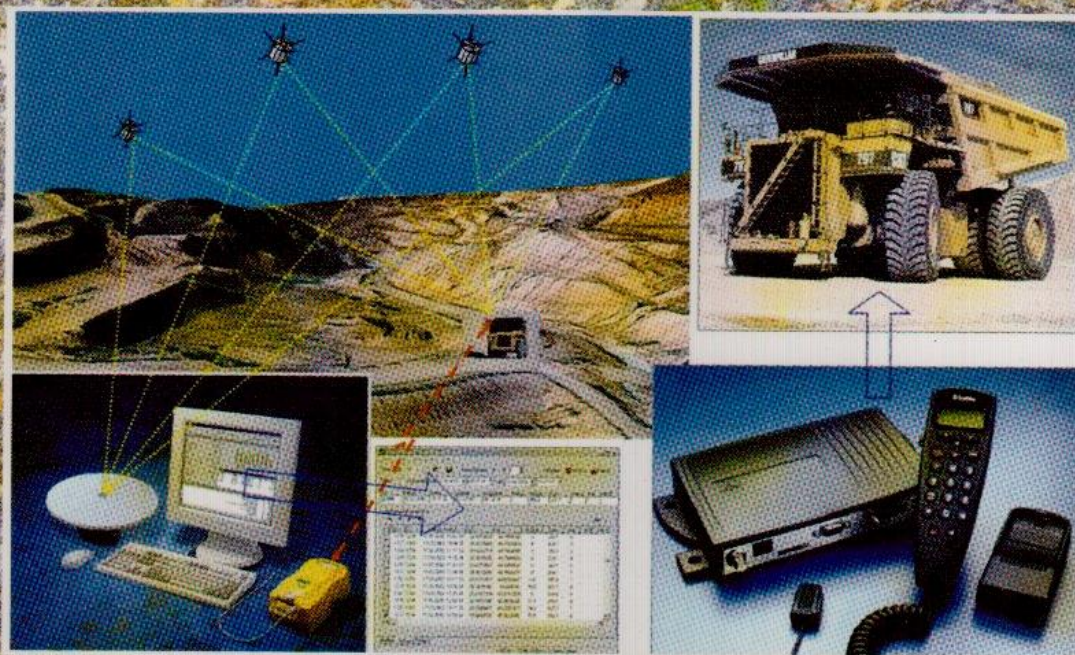


ЗБОРНИК НА ТРУДОВИ

СОВРЕМЕНИ ТЕХНИКИ И ТЕХНОЛОГИИ ВО РУДАРСТВОТО

PROCEEDINGS

MODERN TECHNIQUES AND TECHNOLOGIES IN MINING



30. 05 - 02.06.2006, Охрид, Реп. Македонија
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EXPLOSIVE DEVICES MAGAZINE - DIMENSIONING AND DESIGNING

Mitić Saša¹, Zoran Despodov²

ABSTRACT

This paper presents principles of the explosive devices magazines (EDM) and solutions for dimensioning and creating UEMD in the adit "Stitovo" in the Niksic bauxite mine. Information about daily needs of explosive and ignition devices in the open pit "Stitovo II", as well as regulations for this field, determined location and defined capacity, size and dimension of the UEMD rooms. There is also presentation of tunnelling technology and estimation of the work costs.

Key words: underground magazine, explosive devices, UEMD

INTRODUCTION

Intensive technology development of extracting and ore processing has changed comprehension of use of elementary explosive devices as only explosive materials in mining in order to obtain the best techno-economic effects, concerning both capacity and blasted material grading. Development of blasting hole drilling technique, as well as enlarging hole diameter, use of wide range of contemporary explosive and ignition devices is enabled. These devices automatically form blasting holes and blasting hole charges, and they are initiated in the underground or on open pits. Result of the development is enlarged explosive devices usage, and necessity of their storing according to very strict standards.

Based on the previously mentioned presumptions, calculated daily usage of the explosive devices and security reasons, it is decided to design an explosive devices magazine on OPM "Stitovo II" for bauxite ore excavation. Location of the magazine is chosen after consulting mining regulations about

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distribution, transport, storing, usage of explosive and ignition safety measures, and according to the project task. UEMD is a safe distance from the underground and surface objects, in the adit its left block, looking from the entrance into the adit, in the OPM (picture no. 1)

UEMD LOCATION

Entrance to UEMD is situated in the left block of the "Stitovo" 0+117m to 0+388,06m, and at the point zero the entrance to the "Stitovo" situated at OPM "Stitovo II", is on the level H – 1480 m.

Location in the adit "Stitovo" is chosen as the best for UEMD, because after its enlargement, explosive devices will be transported through this adit directly from the Main explosive devices magazine situated on the plan "Seoce".

Obeying regulations concerning this field, UEMD is designed as a symmetric mining room. This way of arrangement and room dimensions are appropriate for use of the previously designed drift from the adit "Stitovo" as an inclined ore drift – 2 (exit part), and the axis of the main drift UEMD is oriented to be parallel with the adit axis "Stitovo".

DEFINING SECURITY PARAMETERS

Conditions for UEMD are defined by regulations; therefore designing magazines that would be conceptually different and would satisfy regulations but be cheaper, is quite impossible. Elements for security parameters definition could be regulated only experimentally. Therefore, it is necessary to make certain changes in the designing order. When making the project, it is necessary to define whole magazine geometry (location, shape, size) and evaluate surrounding elements on the basis of given information about physical and mechanical characteristics of the rocks in which the magazine will be situated. Only after opening the pit for magazine location (in this case the adit "Stitovo") and performed experiments in this part, final parameters for calculation of magazine details are obtained. Technical project is designed based on these parameters.

It is known that explosion effect is manifested in the surrounding in several different ways; even surrounding objects react differently, depending on their construction, and showing different resistance. It is necessary to discuss object characteristics in the project. It is also important to notice the way the explosion effects people in the surrounding objects which are not damaged.

Storing larger quantity of explosives in the chambers has several disadvantages and the most important are:

- Storing up to 5000 kg ammonium-nitrate explosive gives theoretical possibilities of ignition and explosion of large amount of;
- To diminish destruction and save human lives in case of explosion in one chamber, it is necessary to perform wide works in the pit and great length of the rooms which would smother stroke air wave
- Magazine dimensions are large because of necessary distances among the chambers and nearby rooms.
- Mentioned reasons brought to new solutions which start with the following presumptions::
- Storing should be safe to prevent explosion of all stored explosives;
- Magazine should be constructed so that construction price is not enlarged if security is improved (comparing with classical construction).

In this case, UEMD is most often situated in long drifts and on their ends are explosive devices chambers. Part of the drift for explosion keeping is divided into boxes separated by concrete wall. Each box contains 500 kg of explosive. Separating concrete walls are calculated to keep potential explosion in only one box, without spreading to nearby boxes. Turning off of the stroke air wave is performed by combining rejection niche and knee-joint with security door on the access drifts. Haulage track and concrete floor, depending on the haulage way, passes by all the boxes so that explosive unloading and its turning very simple.

Accidental ignition of the explosive material in UEMD will start the explosion; its effects are very similar to the effects of the chamber blasting charge of the same explosive quantity. It is very similar, and not totally similar, because absence of stemming and incomplete chamber fulfillment makes different intensity of some effects. For example, air blast impact will be stronger when there is explosion in the magazine, but failure impact will be greater in the chamber charge.

Security of the workers in the pit or on the surface is endangered, either directly or indirectly, by the following effects in the magazine:

a) Air blast impact; the following three ways are used in UEMD construction for smothering air blast impact :

- Drift snapping at the angle of 90^0 ,
- Drift snapping at the angle of 90^0 with rejection,
- Rapid spreading and narrowing of the drift.

b) Failure impact – the solution is a protective pillar between the chambers (thickness is calculated at 8 m) ;

c) Seismic impact to other underground rooms (thickness is calculated at 50m) ;

- d) Creation of gas and poisonous or suffocating explosions prevented with better ventilating ;
- e) Heat impact.

UEMD TECHNICAL DESCRIPTION

UEMD in the adit „Stitovo“ is projected as a horizontal underground room which consists of several rooms of different diameters and is adjusted to the standard B.ZO-203 for low ceiling, and it depends on purpose for each room. This UEMD is designed to hold 5000 kg explosives each chamber, as well as appropriate number of the mining capsules (20 pieces) i.e. electrical detonators in the chamber for ignition devices.

Picture no. 1 shows UEMD base with room marks

Total designed length of underground rooms is about 400m, and total volume of the drift is, depending on the support type, from 4200 m³ (with rock support or rock bolt with the net) to 5300m³ (concrete 30cm thick).

UEMD will be designed using the classical drilling and mining work with haulage and diesel-powered LHD machine transport, combined with the self-powered hauling machine on compressed air. Ventilation will be performed in several steps, using booster fans and flexible tubes.

UEMD designing in the adit “Stitovo”, according to the known working space conditions (solid limestones), does not involve support with the concrete support, but only guniting. But, in case of change in the rock mass (cracking, faultness, surface nearness, etc.), the following supports are suggested:

- For the rocks of the strength $f=1+2$, including clays, decomposed shale, cracked sandstone, antracite coal, marl, soft shale, very soft limestone, etc. support is made with reinforced concrete MB-20 type, and the thickness of the concrete support is $d=30\text{cm}$.
- For the rocks of the strength $f=3+4$, including different weaker strata: compact marl (cracked quartzite), strong clay shale, weak sandstone and limestone, soft conglomerate, etc., support is made with reinforced concrete MB-20 type, and the thickness of the concrete support is $d=25\text{cm}$.
- For the rocks of the strength $f=4+6$, including cracked limestone, cracked quartzite, sand and clay shale, etc., support is made with rock bolt with the net or guniting or combined.

Depending on the type and quality of the working environment (limestone), one kind of the support will be used to support chambers, chambers and exit drifts. Final decision on the support type is brought in UEMD designing.

WORK ESTIMATION

Chart no. 2 gives estimation for UEMD works in the case UEM completely supported with guniting and rock bolts with steel net.

Chart no.1 UEMD works in guniting support

No.	Type	Measure	Quantity
1.	Excavation	m ³	4.365.0
2.	Guniting	m ³	452.0
3.	Rock bolts	pie	1.670.0
4.	Net	kg	3.500.0
5.	Floor concrete MB 10	m ³	54.78
6.	Canal concrete MB 10	m ³	23.0
7.	Narrowing concrete MB 20	m ³	18.0
8.	Floor concrete MB 30	m ³	136.28
9.	Locksmith works	kg	590.0
10.	Carpenter works	pie.	805.0
11.	Rubber belt	m	45.0

Total estimated cost of the UEMD works in the adit "Stitovo" is amount 130000 €.

CONCLUSION

Making project documents for designing underground explosive magazine, as well as performing works based on these documents, must strictly obeying prescribed regulations and standards for this field. When determining UEMD location and dimensioning underground rooms within part of it, it is necessary to determine capacity of the magazine, type of explosive devices which will be used, and shape and size of the package of explosive materials. Location of the magazine is determined according to the safety criteria, and possibility of exploiting in the pit. It is essential to take care of the quantity of explosive and ignition devices in the chambers, when determining shape and size of the rooms which are parts of UEMD. Quantity of explosive determines number and dimensions of side rooms which are safety rooms for protection from direct impact on people and other underground rooms, in the case of potential explosion.

Besides, when designing UEMD, parameters given in the project (dimensions of underground rooms, side objects and equipment e.g. fans, etc.) must strictly be obeyed. This paper is a short presentation of the project of dimensioning and UEMD designing in the adit "Stitovo" in the Banja Luka mine Niksic, with emphasis on safety criteria.

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