EFECTS OF USED DIFFERENT TIPE OF EXPLOSIVES

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ABSTRACT
Blasting is the basic operation in open pit mines in obtaining hard rock masses and has an important influence on the costs in the obtaining useful mineral raw material. The costs vary widely depending on the capacity of the open pit operation, the organisation, the machinery used as well as the professional support.
The major goal of every professional man deployed in the process of blasting is to bring costs down to a minimum or to set and define parameters. The paper offers analyses of several blasting series in terms of normative materials used and successful blasting.
Key words: *quarrying, blasting, costs, explosives, series, design, values*

1.0 Introduction

Drilling, particularly blasting, as production processes require a good choice of equipment and method of blasting including the means of crushing of rock mass. The equipment used in drilling and crushing must be brought into accord with the physical-mechanical
characteristics of the working environment.

The right determination of drilling-blasting parameters is of importance for the process of exploitation or the adequate granulation of the mined out material. It also has an effect on all other phases of exploitation. Achieving of the right granulation depends on the right choice of the above mentioned parameters.

The importance of the adequately selected drilling-blasting parameters can be seen from the fact that in some pits the technological process amounts to 40% of total costs, of which blasting costs alone amount to more than 80%. Blasting efficiency has a great influence on the productivity and the price of cost per unit product.

1.1 Conditions for drilling - blasting parameters

The calculation or dimensioning of parameters for drilling and blasting are the first step in setting the technique of drilling and blasting which later, in local conditions, can be modified and yield the best possible results.

Table 1. Physical - mechanical characteristics of the rock

Specific gravity	$\gamma_z = 2.2 - 2.65\left[t/m^3\right]$
Specific mass	$\gamma_s = 2.73\left[t/m^3\right]$
Embankment mass	$m_n = 1.6\left[t/m^3\right]$
Porosity	0,01
Angle of internal friction	Ø = 32 – 66 ^{o}
Koefficient of Strength	3
Resistance to pressure	$\sigma = 115 - 182\left[MPa\right]$

2. Drilling-blasting parameters

The basic drilling-blasting parameters that have a great effect on the blasting costs are given below. They may vary depending on the design of the blasting series, the type of explosive, the location of blasting series etc.

Table 2. Drilling-blasting parameters

Para-me-ters	Drilling diameter (mm)	Depth of bore-hole (m)	Burden, W (m)	Distance between boreholes(m)	Length of stemming (m)	Length of inter stemming, (m)	Drilling angle (^{0})	Amount of explosive (kg/boreh.)	Theoretical interval of delay, ms
Values	105	20 - 22	3,5 - 4,0	3,5 - 4,0	3,0 - 4,0	0,5 - 1,0	75 – 85	140-150	17

Tip of explosive which is in use is different and depends of blasting series.

The tip of explosives which used for this blasting are: Amonit, AN- FO and Elotol.

Initiating means which used in this series are: Deton. fuse C-12, Cap N^0 8, NONEL - system, Busters PP400. The amount of explosives per meter in hole is 6,5 - 8,5 kg/m^l , and per one hole is 140 - 150 kg depends of type of explosive.

3.0 Blasting costs

Normative materials are consumption material per unit product of mined out mass, which is an indicator of their direct influence on production costs, and the overall operation.

Since almost all normative materials for drilling and blasting are imported, it is necessary to possess larger finances for their purchase.

Blasting costs are higher than drilling costs. However, the amount of costs may vary and may be higher or lower. This can be done by the application of various types of explosives, means of initiation, the method of blasting, its schemes etc. The diameter of drilling is 105 mm with angle of drilling of 85^o.

3.1 Costs per blasting series [2]

- Blasting series n^o. 1, n^o.2

Blasting parameters	Type of explosive: AMONITE		
Parameters of blasting series	Measure unit	**Values**	
		Blast series no.1	Blast series no.2
Drilling geometry **(a x b)**	m	3,8 x 3,8	3,8 x 3,8
Burden (W)	m	3,8	3,8
Bench height	m	8	16 - 24
Number of boreholes	No	57	15
Mass obtained per borehole	t t	317,7	771
Total	t	18107	11566
Busters + Nonel (U500)	usa $	6,0	10,76
Explosive per borehole	usa $	46,8	77,67
Nonel per series (Sl 25, Sl 17)	usa $	342,6	161,4
Explosive per series	usa $	2670	1165
TOTAL	usa $	3012,6	1326
Specific consumption of explosive	kg/t	0,177	0,175
Costs per tonne mined out mass	usa $ / t	**0,167**	**0,115**

- Blasting series nº.3 and nº. 4

Blasting parameters	Type of explosive : Elotol, **AMONIT, AN-FO**		
Parameters of blasting series	Measure unit	**Values** Blast series 3	Blast series 4
Drilling geometry **(a x b)**	m	3,8 x 3,8	3,8 x 3,8
Burden (W)	m	3,8	3,8
Bench height	m	21	20
Number of boreholes	Nº	52	20
Mass obtained per borehole	t	803	710
Total	t	41786	14204
Buster + Nonel/borehole	usa $	11	10,7
Explosive/borehole	usa $	77,1	65,5
Nonel (total)	usa $	577	214,4
Explosive (total)	usa $	4008,9	1310
TOTAL	usa $	4586	1524
Specific consumption of explosive	kg/t	0,167	0,135
Costs per tonne mined out mass	usa $ / ton	**0,109**	**0,107**

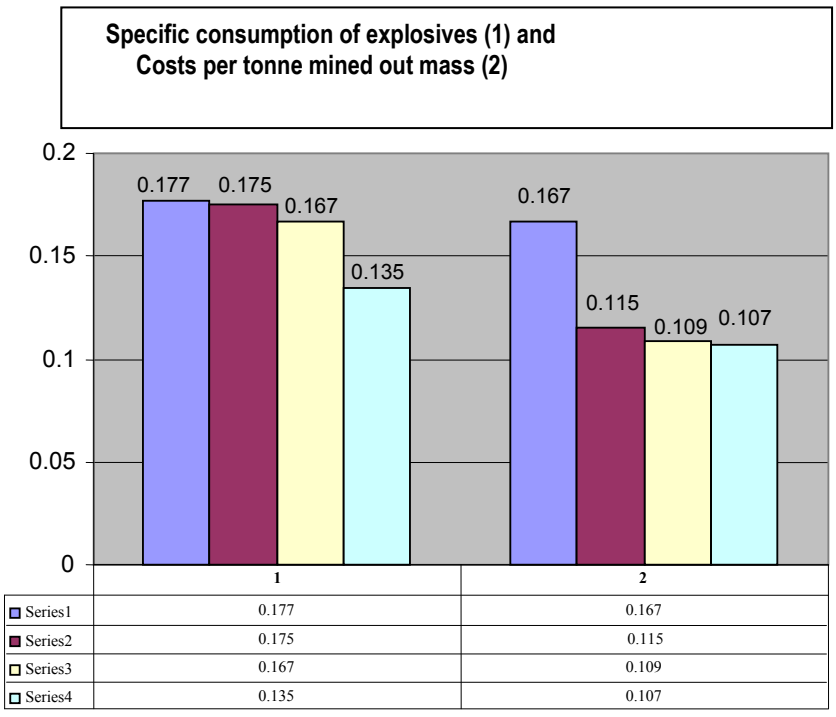
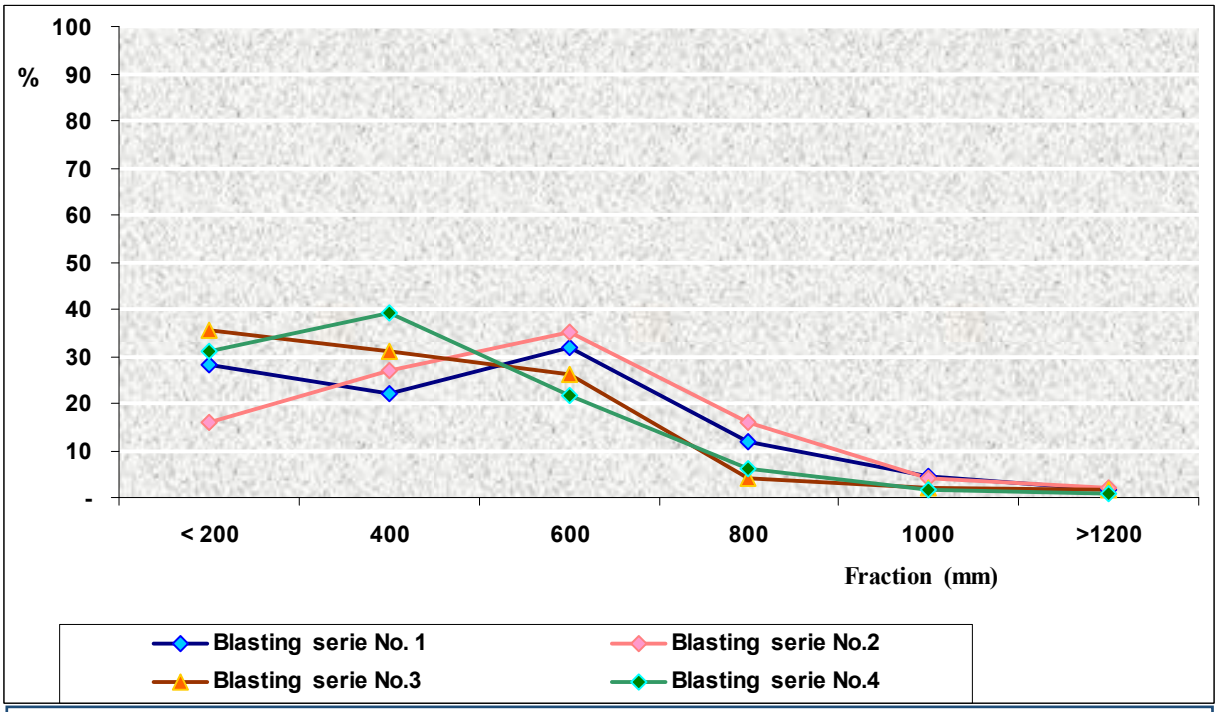


Fig. 1 Graphical presentation of 4 (four) blasting series for Specific consumption of explosives and Costs per tonne mined out mass

The influence of physical – mechanical characteristics can be seen in the strength characteristics of the environment and impedance of the environment. From main drilling - blasting parameters and the results from this series (effects) can be resume that for marbleized limestone in this quarry is possible to use explosives with lower acoustic impendence or lover density and detonating speed. On the other way this means that it is possible to purchase of less expensive explosive and reduction of total blasting costs [2, 3].

In the fig. 2 are presented distribution of granulation for this series reviews. From this effects from mining series can be see that the consumption is not always most important parameter obtained size distribution curves. In blasting series no. 4 are used two types of explosives An - FO and cartridge Ammonite. According to the consumption in this series and the characteristics of explosives were obtained good results for distribution of granulation (pieces with D<40mm are with >40%). On the other view, specific consumption of explosives per ton blast mass for the same series is the smallest compared to others. Also, the price per ton blasted mass for this series is the smallest.



Fraction (mm)	Blasting serie No. 1	Blasting serie No.2	Blasting serie No.3	Blasting serie No.4
< 200	28	16	35.5	31
400	22	27	31	39
600	32	35	26	21.5
800	12	16	4	6
1000	4.5	4	2	1.5
>1200	1.5	2	1.5	1
	Total 100	100	100	100

Fig. 2 Distribution of granulation for blasting series

According to these parameters can be concluded that regardless of the used lowest explosive (AN-FO) for the mining series, with a good combination of support - supplement with powerful cartridge Ammonite, can get good effects of mining results according of the granulation blast and the price per ton blast mass even the number of drill holes is smaller than another series. [5]

4.0 Conclusion

The analyses carried out on several blasting series in the Banjani open pit mine indicated that the combination of several types of explosives in the borehole may significantly lower costs of explosives. The use of NONEL system for initiation leads to security in blasting, lower costs and better seismic effects. In blasting series of a larger number of blasting holes blasting costs are lower, and with used the type of Amonit and AN- FO, in same blast hole, the cost are lowest, for this quarry, although the same types of explosives and manner of initiation are applied.

5. 0 References

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