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DETERMINATION OF BLASTHOLE PARAMETERS BASED ON FIELD RESULTS

MG. OSANLOO
Faculty of Mining And Metallurgy Engineering University of AmırKabır (Tehran Polytechnic), Tehran, IRAN

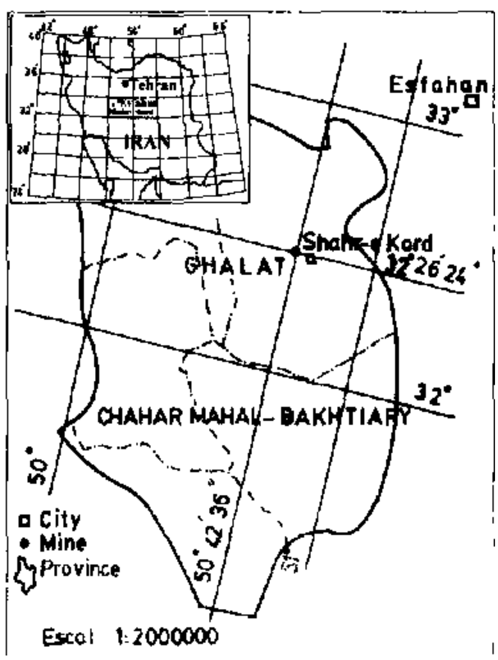
S.TABBE-EMAM
Mining Engineer, Mines and Metals Ministry of Iran

ABSTRACT' Correct selection of coefficients for blasthole parameters in Ghalat limestone mine in Shahr-e-kord of Iran was determined following designing and performing of 20 blasting operations After each blast, the amount of fragmented rock larger than one square meter, called oversize, was estimated and they were prepared for secondary blasting The next blast hole pattern were designed based on the previous blasting results. The results of these field operations studies showed that the optimum ratio between spacing(S) and burden(B) in Ghalat limestone mine was 1.25- The ratio of cutheight(H), subdrilhng(J) and length of stemming(T) to burden were: 4, 0 5 and 1 respectively (H/B=4 , J/B=0 5 , T/B=1) The field results under these conditions showed that more than 90 percentage of fragmented rocks would have sizes less than one square meter and the cost of production would be reduced by 18.9 percent

1. INTRODUCTION

Proper selection of coefficient for blasthole parameters such as spacing, burden, cutheight, subdnlling and length of stemming for each particular mine can reduce secondary blasting operations and reduce cost of production (Clark, 1985, Singh, 1990) Today there are several equations that show the relation between spacing, cutheight, subdrilling, length of stemming and burden (Konya, 1985, Ash, 1990, Jimeno, et al 1995). But non of these equations can be used as a general equation for ali type of rocks, because the rock is a highly complex material It varies in its characteristics across very short distance (Stewart and Kennedy 1971) therefore it is necessary to find specific equations that show the best relation between blasthole parameters of each particular mine. This paper discusses the correct selection of coefficients for blasthole parameters in Ghalat limestone mine located ai 8 km west of Sharh-e-kord in south west of Iran, between 32°,26',24" longitudinal and 50",42',36" latitudinal (Figure 1)

Annual production of this mine is 120000 tons and is mostly used by concrete manufacturer located 2 km from Ghalai limestone mine The manufacturer can not use the law material direclly and it is required to i educe a limestone to sand and gravel size For this purpose, a crusher with a feed opening of one square meter area is used Therefoic, all mine fragmented rocks should be less than one squaie melei m sı?c



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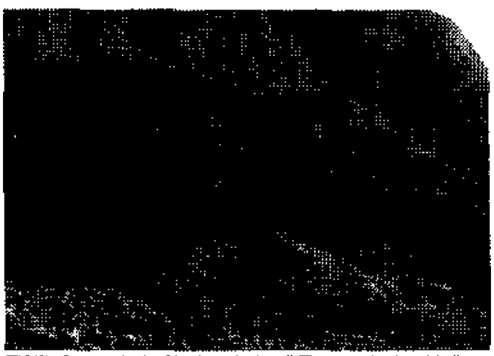
Otherwise lliev icqune semmlaiy hidMing opeuiiuins In the prist (i!i,tl,H limestone w,ı:. nimeti lıv dulling unci b!a.slnif-' without using the pailiuiUn ıelation KM dcsiiyiiu» hlitsi link' parametria l'iobleins like lly rock .iivl i'Mui'u \ili!;ilmii.s weie observed Menimportant problem was that, more than 25% of blasted rocks had greater than one square meter in size This problem required secondary blasting operations, increased production cost and sometimes stopped crushing processes In this study, several blastings were earned out under predetermined conditions in order to define the optimum parametric ratios for S, H, T, J, and B by evaluating the measured and estimated quantities of fragmented rocks that are larger than 1m in size

2 FIELD OPERATIONS

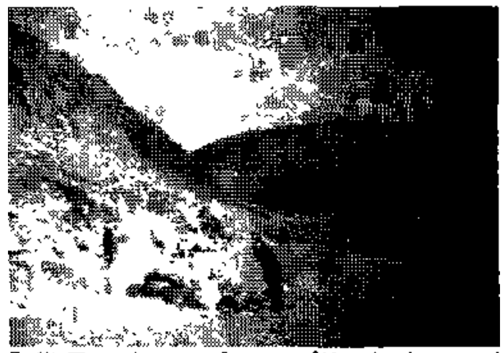
In Ghalat limestone mine, the average specific gravity of limestone is 2 6 and its hardness estimated to be 3 The formation do not have major joints, therefore, the effect of joints on blasting of rocks were minor Wagon drill with 3" dtameter is used for dnlitng operations To explode the rock, ANFO with specific gravitg of 0 8 was used as the main charge, dynamite was used as the primer and booster In each explosion, the condition of explosion such as number of holes, hole depth, total drilling length, tonnage of blasted rocks, spacing, burden, subdnlhng, length of stemming, amount of charge per hole and weathers conditions were recorded After each explosion, the percentage of oversize, were estimated If the amount of oversize were more than 10 percent of total blasted rocks, the explosion was classified as "bad explosion " In this case, the oversize materials were collected and prepared for secondary blasting operations (Fig 2-4)



Fi£(2) One typical of bad explosion " Too much o\ers!/c "

The design of the next blast was based on previous blasting results The parameters were rearranged in order to have good explosion This pun-ess repeated until more than W'n of blasted recks ueie less ih.in

Fig{3) The (oial aniouni of oversize collected for secondary blasting operations



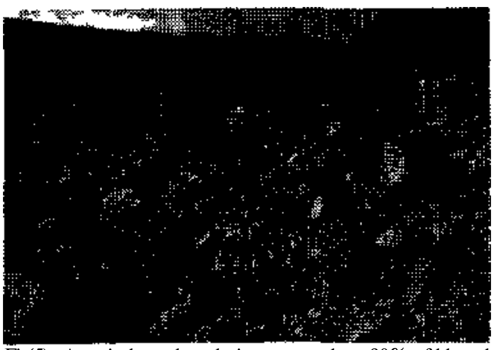
Fig(4)· The total amount of oversize of blasted rocks prepared for secondary blasting operation

Tabled) The overall conditions of typical bad blasting operation

No of Row	1	T	3
No of Holes	29	38	30
Hole depth H(m)	4	45	5 5
Dynamite (gr/hole)	62 5	125	187 5
ANFO (kg/hole)	3	65	85
S(m)	T 1	2 2	-> 2
B(m)	2	2	2
T(m)	1	1 1	1 2
J(m)	06	07	07

one square meter in size so (hat they could pass through the crusher This blast was classified as "good explosion " as shown in Figure 5

By choosing correct delay, the fly rocks and ground vibration kept under control After 14 explosions the oversizes and fly rocks were minor and the selected explosion conditions were recommended for the next blasting operations Table 2 shows the conditions of good explosion in Ghalat limestone mine



Fig(5) A typical good explosion more than 90% of blasted rocks were less lhan one square meter m size

Table(2) The conditions of one of good blasting operations

No of Row	1	2	3	4
No of Holes	6	8	12	15
Hole depth **H(m)**	75	7	6	5
Dynamite (gr/hole)	625	625	625	625
ANFO (kg/hole)	33	31	28	25
S(m)	2	2	2	2
B(m)	1 6	1 6	1 6	1 6
T(m)	1	i	1	1
J(m)	05	05	05	05

3 RESULTS

After 20 blasting operations in Ghalat limestone mine and analysing the results of operations, it was founded that the best conditions to obtain the optimum results are as following

I- The ratio between spacing and burden is

$$S / B = K_S \qquad (1)$$

Where K_s is spacing coefficient and the optimum value of K_s was I 25 Therefore,

$$S = 1\ 25\ B \qquad (2)$$

The optimum value of S was ranged between 1 7 to 2 and that of B was between 1 4 to ! 6 (Fig 6)

2- The ratio between cutheight and burden is

$$H / B = K_h \qquad (3)$$

Where K_h is cutheight coefficient and the optimum value of K_b was 4 Therefore,

$$H = 4\ B \qquad (4)$$

1- The ratio between subdnlhne and burden is

$$S / B = K_J \qquad (5)$$

Where K is coefficient of subdnlling and the optimum value of K was 0 5 Therefore,

$$J = 0\ 5\ B \qquad (6)$$

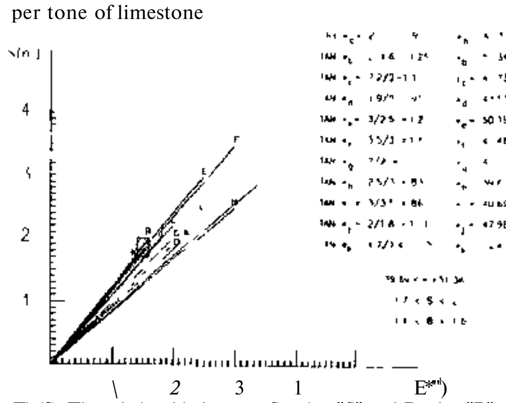
4-The ratio between length of stemming and burden is

$$T / B = K_t \qquad (7)$$

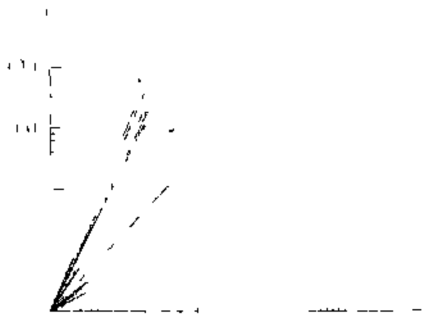
Where K, is coefficient of stemming and the optimum value of K. was 1 Therefore,

$$T = B \qquad (8)$$

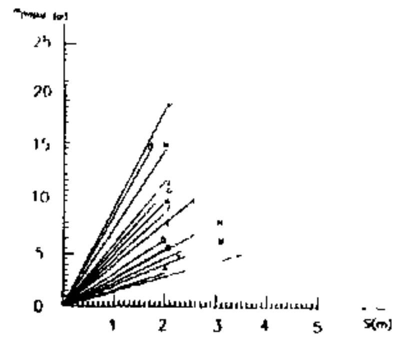
In Ghalat limestone mine, the optimum results were obtained when S-2m and B=l 6m Based on these conditions, the amouni of ANFO per ton was 160 grams and amount of dynamite per ton was 15 grams Fig 7 to 10 show the relation between "S" and "B" with amount of ANFO and dynamite required per tone of limestone



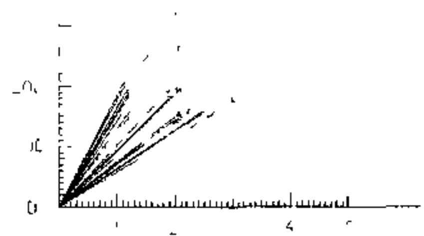
Fig(fi) The relationship between Spacing "S" and Burden "B" The optimum results were obtained ,i! "S" ranging between 1 7 lo 2 and "B" ranging between I 4 to 1 (>



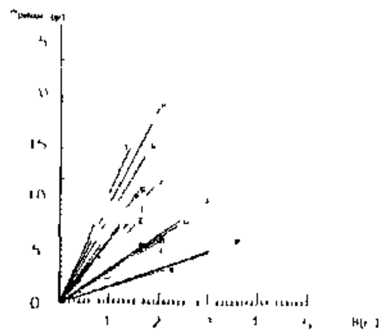
Fıg(7) The relationship between "B" and the amounl of ANFO required per tonne of limestone The optimum result was obtained at B=l 6 meter and 260 grame of ANFO per tonne of limestone



FigflO) The relationship between "S" and the amount of dynamite required per tonne of limestone The optimum result was obtained at S = 2m and I *Sg dynamite per tonne of limestone



Fig(8) The relationship between "S" and the amount of ANFO required per lonne of limestone The optimum result was obtained al S - 2m and 260 grams ANFO per tonne of limestone



Hg(9) The relationship between "B" and llic antouul «I dynamite required per lonne of hnicslonc Ilıt. opiummt result:, were obtained at 13 - 1 6m <ind I Sp dviumili. pu lonne «riiucsLoiK.

4 CONCLUSION

Based on field operations studies in Ghalat limestone mine in Shahr-e-kord, a new relationship between "B", "S", "H", "J" and "T" was found The results of blasting operations optimised using the new equations showed that more than 90% of blasted rocks would be less than one square meter in size and so that they could pass through the crusher With the optimised blasting conditions, fly rock and ground vibration were negligible It is understood that rocks are very complex material and have different character in different location Therefore the results obtained for Ghalt limestone mine may not exactly be the same for other limestone mines, but they may be suggested as good approximations for the start up operations

Nomenclature

S - Spacing (m)
B Burden (m)
II (ıılhcıyiıt (m)
1 Subdnlling (ni)
I Stemming (m)
K = coefficient

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