J. Int. Environmental Application & Science, Vol. 11(1): 87-91 (2016)

Drilling & Blasting Optimal Parameters and the Results in the Dismemberment of Limestone in Volljak

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Received January 19, 2015; Accepted March 21, 2016

Abstract: Considering discontents expressed by the companies who exploit limestone in some quarries in Volljak, aiming for better possible fragmentation of limestone, and having less output of large pieces and remain with as regular possible flooring. We have taken the intention to perform a test blasting in the said zone, with optimal parameters of drilling and blasting. We have included drilling & blasting parameters in the paperwork based on the calculation, based on experience and based on the results obtained in this area. After performing the massive blast, we obtained results that their demands can be achievable, because the outcome pieces from this blasting were minimal, not exceeding 3% of the blasted volume. After the loading and transportation of the blasting material, we can see that the remained floor has a very good flattened surface. In order to achieve these results, we have implemented connection of the field with detonating fuse, with millisecond deceleration between rows, and initiating the field with nonel connector and dynoline. With this initiating system we have obtained deceleration between rows with immediate initiation of one drilling row, thus we acquired a consumption of explosive material with optimal value for this area. This confirms that the mentioned demands are more of commercial nature, with intention of reducing the cost of drilling and blasting.

Key words: *Detonation, Initiation, Hole, Detonation Cord, Explosive, Nonel.*

Introduction

The limestone in Volljak represent a significant national amount and are among the most qualitative in the Balkan region. Based on the physic - mechanical and chemical holdings, they can be used in construction, as concrete aggregate, road infrastructure, swabs and asphalt, and they may be also used in foundry to reduce oxide-ores and regulation of PH. With the values possessed by this type of limestone some companies begun with its exploitation. In order to be able to use these rocks there should be a method of drilling and blasting used. Large number of blasts was performed in this area in the past, and the demands from companies were to always reach a larger breaking of the rock and obtain smaller pieces as possible. For this purpose, blasting was made in quarry "REA" and was performed by blasting company "Jaha Company". There are in total of eight companies operating in this area. The quality of limestone changes from one quarry to another, in small values. Definition of the drilling parameters is based on calculation, experience and based on results obtained from the earlier blasts. Intensive monitoring was made for the drilling process, charging and connection of the field. The blast field has eight drilled rows with the length that can be taken in minimal or zero. In our case we have speared the length of further drilling l_{tsh} = 0.0 m, because the atmospheric circumstances have influenced the first level of limestone, therefore these limestone formations are part of the rocks that are easily crushed.

Detonation field plan

The blasting field is in the form of a rectangle with following dimensions: length of the field is L = 54 m and the width L_t = 24 m. The said field has eight drilling rows, with seven of them each having 18 holes whilst the last row has 17 holes. The field in this exploitation place has in total 143 drillings with 12 m of depths. The line of least resistance was W = 3.0 m, distance between rows b=3.0 m, distance between drillings in row a = 3.0 m, β = 70^0 the angle of drilling, and drilling diameter d=89 mm. Figure 1.

Calculation of material needed for field detonation

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The calculation of the material needed for field detonation was made with MS Excel program which is provided in tabular form, where the required calculating equations were used in the **Table 1**.

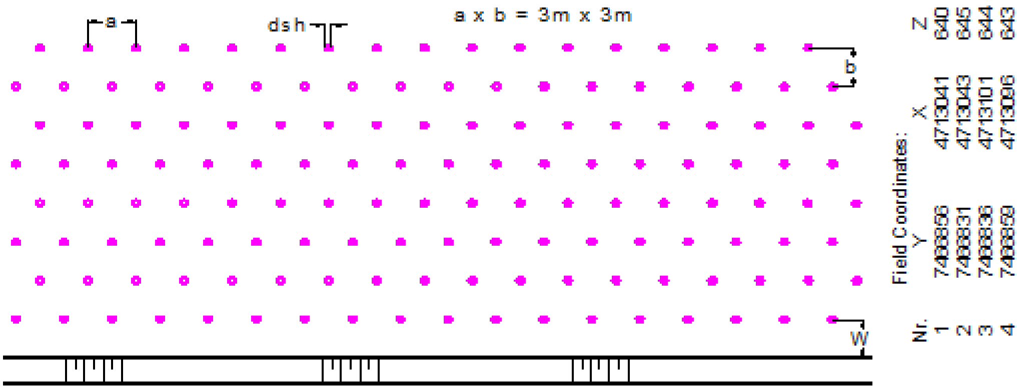

Figure 1. Detonation field plan

. Detonation specifications for exploitation place in Volljak .

Quarry			**"REA"**				
Region – Municipality			**Peja – Klina**				
Detonating company			**"Jaha Company"**				
Date of detonation			**17.07.2014**			Total	
		G.1	**G.2**	**G.3**	**G.4**		
Total drilling length	m	432	432	432	420	1716	m'
Number of holes	N_b	36	36	36	35	143	hole
Distance between holes	a	3	3	3	3		m'
Distance between rows	b	3	3	3	3		m'
Hole diameter	Ø	89	89	89	89		mm
Drilling angle	α	70	70	70	70		^{0}
Tapping		2.8	2.8	2.8	2.8		m'
Cartridge diameter	d	89	89	89	89		mm
Cartridge length	l=cm	33.00	33.00	33.00	33.00		cm
Compression	%	4%	4%	4%	4%		%
Explosive density	γ	0.85	0.85	0.85	0.85		g/cm^3
Effective diameter of compression	d^1	90.835	90.835	90.835	90.835		mm
Effective length of compression	l^1	31.68	31.68	31.68	31.68		cm
Drilling length	L_{sh}	12	12	12	12		m'
Volume of rock per hole	V	101.488	101.488	101.488	101.488		m^3
Average rock height	H_{sh}	11.276	11.276	11.276	11.276		m'
Cartridge mass	q_s	1.744	1.744	1.744	1.744		kg
Calculated number of cartridges in hole		29.04	29.04	29.04	29.04		pcs.
Estimated number of cartridges		29	29	29	29		pcs.
Filling length		9.20	9.20	9.20	9.20		m'
Hole filling in m'		5.51	5.51	5.51	5.51		kg/m
Filling of a hole	q_{sh}	50.65	50.65	50.65	50.65		kg
Specific consumption of EXP.	q_{sp}	0.50	0.50	0.50	0.50	0.50	kg/m^3
Total filling amount with EXP.	Q_A	1823.42	1823.424	1823.424	1772.773	7243.0	kg
Measure the volume of obtained	V_A	3653.55	3653.55	3653.55	3552.07	14512.7	m^3
Detonation cord	L_f	558	558	558	542.5	2216.5	m^1

Specification of expenses for field detonation is:

ANFOKOS	6350 kg	Milliseconds Delays	14 pcs.
Amonite (F = 65 mm)	900 kg	Nonel Connector	2 pcs.
Detonating Cord	2250 m.	Dynoline	300 m + (300 m reserve)

Charging of holes using detonating cord for initiation

For the charging of drilled holes, we selected Anfokos as explosive material, while Amonit was selected as the striking patron, and the detonating wick was used for initiation. The explosive material Amonit which is used as striking patron is not calculated in the table presented above in the calculation Table 1, but was used out of 4 (four) patron for each drilling. This quantity of explosive material was reduced from the total amount of calculated explosive material and then revealed the amount of explosive material Anfokos. In order to start with the charging of boreholes, first the detonation wick is tied to the strike patron and together are placed at the end of the drilled hole, and immediately afterwards we place the second patron knock, then continue charging with Anfokos to the determined level and thereafter place two other striking patrons and then charge with Anfokos to the corking level. With the completion of charging process, we perform the plugging of drilled holes. Usually the plugging is made from its dust derived from the drilling or by clay measures which are condensed with wooden rod, and afterwards continue with the process of the connections. Figure 2**.**

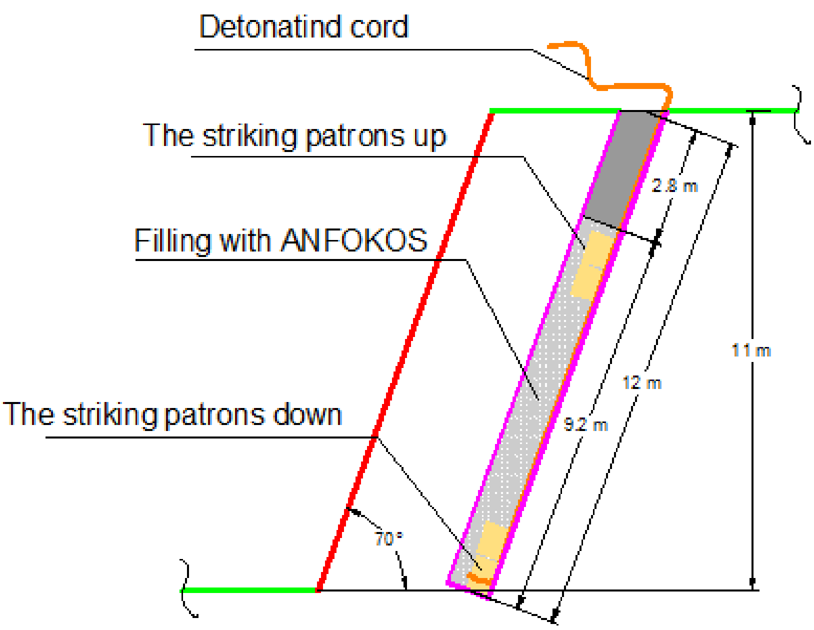

Figure 2. Schematic presentation of charging holes

Field connection with detonating cord

Connecting the field with detonating fuse is performed by connecting threads of detonating wick that are located in the drilling, with the general thread of the detonating wick at the surface of the field. Once all drilled holes are connected, we then place millisecond decelerations between rows. Afterwards we place the connector in the place considered for initiation and continue with the dynoline thread to move away from the field. After performing all these actions, we then consider that the field is connected as it appears in Figure 3.

Results

The blasting area that was elaborated above will be presented in the following Figure 4. The land is seen before the blast. In the photo it shows that the terrain is almost flat and the exploitation place is in its opening stage; therefore the blast is on the surface of the first degree. The selected parameters for carrying out this blast obtained very good results in the breaking of the rock and cutting of the scale, this can be seen in Figure 5. To achieve these results, additional caution is added to the drilling, charging, cork/plugging and connection. In the drilling, we strictly follow distances between holes in rows, the less resistant line, the depth of drilling and the angle. The charging is performed by placing four striking patrons of Amonit, with two of them placed at the bottom and two placed above in the upper part of the corking/plugging level, and for charging of explosive material we use Anfokos. The reason of placing two striking patrons down and up is to have increased working ability and speed of the detonation of the Anfokos.

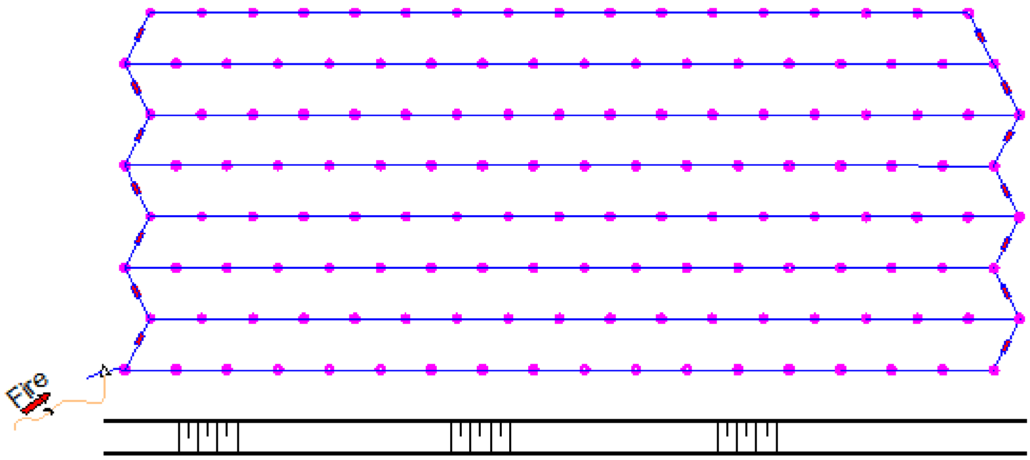

Figure 3. Schematic presentation of the connection of the field with detonating cord

Figure 4. Mining field prior to blasting

Figure 5. Mining field after blasting

This results in a greater use of energy burst. Furthermore the blasting with many drill rows and good corking/plugging enables a better energy burst. Regarding the leveling of floor, this is done by using explosives with greater detonation velocity at the end of drilled hole, which is affected by the angle of the drilling and drilling length. The surface of the floor after removal of the material can be seen in Figure 6.

Figure 6. Mining field after the removal of blast material

Conclusion

This paperwork addresses key parameters which affect the results of blasting, and the selection of explosives was adapted. After the blasting, we obtained excellent results in grinding the rocks, cutting and leveling of the floor level of the scale. Factors that affect the results of drilling and blasting are: drilling diameter, less resistant line, the distance between the drilling sequences, the distance between sequences, charging and plugging/corking length and use of millisecond decelerators. From all the elaborated above it shows that the distance between the drilling rows and the distance between the rows that were selected, fit very well with the rocky environment and give very good results in the breaking of rock, which we can say that these values should be used for other blasts as well. In order to have flat floor remained, a same angle of drilling should be kept in the whole field, with good monitoring of the drilling depth by adapting it to the terrain, and always place strike patron at the end of drilling, and this strike patron should be an explosive with detonation speed of 4200÷5500 ms. The use of detonating wick gives us very good results even though during blasting time it makes a lot of noise. However, this land enables us to do this based on the distance from the exploitation place to the nearest residence that is L = 900÷ 1000 m and can be used without disturbing the district. If it is spent more on drilling and blasting, the outcome would lead to reduction of transport and loading expenditures and vice versa. The cost of cubic meter of blasted material must be optimal and tried to move towards the minimum, to never disagree with obtained results, but use every blasting for additional tests. In our case, the specific consumption of explosive material is 0.50 kg/m^3, nevertheless this can be smaller or greater depending on the geometry of the drilling.

References

Dzodič R, (1985) Tehnologija bušenja i miniranja, Prishtinë. (Drilling and mining technology) Pristina

Brahimaj I, (2008) Determining technical-economic parameters towards the advancement of massive detonations in exploring bauxites in Kosovo. M.Sc. thesis. Mitrovica.

Brahimaj I, (2012) Contribution in the selection of optimal parameters of massive detonations in the limestone deposits of Gremnik. Ph.D. thesis. Mitrovica

Brahimaj F, (2013) Appliance of contour blasting within road infrastructure Morine-Merdare. Msc. Thesis. Mitrovica.

Brahimaj F, (2014) Elaborate for blasting, Prishtina, Kosovo.

Brahimaj Sh, (2013) Opening and preparation of trenches on the highway Morine-Merdare. M.Sc. Thesis. Mitrovica.

Kennedy BA, (1990) Surface Mining, USA.

Jimeno LC, Jimeno LE, Carcedo AJF, (2006) Drilling and blasting of rocks, New York.