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Post Blasting Environment in Underground Mine

Yammanuru Mabu Subahan[*1], Mr. Vinay Kumar Patel[*2]
1, Post Graduate Student, Department of Mining, Bhagwant University, Ajmer, Rajasthan, India.
2, Assistant Professor, Department of Nano Technology, Bhagwant University, Ajmer, Rajasthan, India.

ABSTRACT
Drilling and blasting are the major unit operations in opencast mining. Inspite of the best efforts to introduce mechanization in the opencast mines, blasting continue to dominate the production. Therefore to cut down the cost of production optimal fragmentation from properly designed blasting pattern has to be achieved. Proper adoption of drilling and blasting can contribute significantly towards profitability and therefore optimization of these parameters is essential.

Introduction
Mining industry is the backbone for the development of any nation. In mining the basic aim is to achieve maximum extraction of minerals keeping in view the environmental, economic and lease constraints. With the advancement of civilization, the requirement of different minerals has increased manifold to meet this demand. There is an upsurge in interest and action in opencast mining because of the improved productivity, recovery and safety of mining operation. Improvement in production has been achieved with the help of large capacity opencast machineries, continuous mining system with improved design, development of modern generation, explosives and accessories, process innovations and application of information technologies and increased adoption of computerized mine planning and control. Drilling and blasting are the major unit operations in opencast mining. Inspite of the best efforts to introduce mechanization in the opencast mines, blasting continue to dominate the production. Explosives contribute currently about 5% of the direct cost of production and if the aggregate cost of drilling and blasting is taken together, this may go as high as 30% of direct cost of production. Therefore to cut down the cost of production optimal fragmentation from properly designed blasting pattern has to be achieved. Fragmentation of rock represents one of the key problems in maximizing economic efficiency for exploitation of mineral deposits. Large fragments adversely affect the loading and hauling equipments and increase the frequency of sorting of oversize boulders and secondary blasting, thereby increasing the cost of mining. Fines are also undesirable as indicates excessive explosive consumption. It is therefore desirable to have a uniform fragment distribution, avoiding both fines and oversized fragments to overall cost of mining to optimum level.

Rock breaking by drilling and blasting is the first phase of the production cycle in most of the mining operations. Optimization of this operation is very important as the fragmentation obtained thereby affects the cost of the entire gamut of interrelated mining activities, such as drilling, blasting, loading, hauling, crushing and to some extent grinding. Optimization of rock breaking by drilling and blasting is sometimes understood to mean minimum cost in the implementation of these two individual operations. However, a minimum cost for breaking rock may not be in the best interest of the overall mining system. A little more money spent in the rock-breaking operation can be recovered later from the system and the aim of the coordinator of the mining work should be to achieve a minimum combined cost of drilling, blasting, loading, hauling, crushing and grinding. Only a "balance sheet" of total cost of the full gamut of mining operations vis-à-vis production achieved can establish whether the very first phase- rock breaking- was "optimum" financially; leaving aside factors of human safety. An optimum blast is also associated with the most efficient utilization of blasting energy in the rock-breaking process, reducing blasting cost through less explosive consumption and less wastage of explosive energy in blasting, less throw of materials, and reduction of blast vibration resulting in greater degrees of safety and stability to the nearby structures.

Development of a Blast Optimization

Model Selection of proper explosive in any blasting round is an important aspect of optimum blast design. Basic parameters include VOD of explosive (m/s), Density (g/cc), Characteristic impedance, Energy output (cal/gm), and Explosive type (ANFO, Slurry, Emulsion etc.). However, all these parameters can not be taken for optimizing the blasting method successfully. Some of the parameters are taken for minimizing the blasting cost. These cost reduction and optimum blast design parameter will give an economical result. The parameters are i. Drill hole diameter, ii. Powder factor (desired), iii. Cost of explosive, iv. Numbers of holes required to blast.

Methodology

The study of the various parameters of blasting suggests that the powder factor should be constant as per the requirement. The number of holes desired as per the explosive, the drill i hole diameter as available and the cost of explosive are kept as input. The spacing, bench height, burden, charge per hole as depending on the previous parameters can be calculated. From the different input and calculated parameters the total cost of the method is calculated and the least expensive method is selected as the optimized model.

LITERATURE REVIEW

Verma (1993) advocated that performance rating of explosives has become a primary need because of the growing requirement and competition. In experiments, the usually accessed parameters are the strength though there is no such parameter still to compare the performance index of the explosives. At present, the only way out is to compare the lab results and the company or manufacturers claimed results about the explosive properties. The ratio must be 1 but due to factors it must be close to it, if not equal. By the ratio the explosives can be classified into different categories.

Biran (1994) observed that many empirical formulas have been used over 200 years for selection of proper charge size and other parameters for good fragmentation. But for blasting efficiency and uniform fragmentation, there should be uniform distribution of explosives in holes. The blasted material heap should have more throw for loaders and hydraulic shovels and more heave for rope shovels and loaders. For good economic blasting the holes should not be deviated from the plan. It requires meticulous planning on the use of site mixed slurry explosives, stemming of holes with mechanical means and blasting after pilot blasting of holes to access various details.

Adhikari and Venkatesh (1995) suggested that drilling and blasting cost in any project can be as high as 25% of the total production cost. So the design and implementation of a blast must be given some priority. By the blast design parameters optimization the profitability would increase. For this the study of the existing practice was done followed by pre-blast, in-blast, and post-blast survey. Then the data were analyzed and a model was interpreted. All the parameters were then compared and worked on for the best suiting result. They observed that to achieve a certain degree of refinement in blast design, scientific and systematic approach is needed. With instruments like VOD probes, laser profiling system, etc the monitoring becomes easier, efficient and cost effective.

DRILLING

There are two forms of rock breakage viz., rock penetration and rock fragmentation. The former includes drilling, cutting, boring etc., while the latter includes blasting etc. The term rock penetration is preferred for all methods of forming a directional hole in the rock. There are many types of rock penetration depending on the form of energy application, viz. mechanical, thermal, fluid, sonic, chemical etc. The mechanical energy, of course, encompasses the majority (about 98%) of rock penetration applications today. The application of mechanical energy to rock can be performed basically in only one of the two ways: by percussive or rotary action. Combining the two results in hybrid methods termed roller-bit rotary and rotary-percussion drilling. In surface mining, roller bit rotaries and large percussion drills are the machines in widest current use, with rotary drills being heavily favoured. Drilling is performed in order to blast the overburden, ore deposit, coal seams etc., so that the power requirement for excavators to extract the materials becomes less. This also reduces the wear and tear of the excavators, increases their life, reduces clearing time of materials, and decreases operation cost. Drilling holes are usually made in a zig-zag pattern .The spacing between the rows and column is of equal length. Certain empirical rules are followed for this spacing and the depth of holes as indicated below (Dey, 1995).

DISCUSSION

The mining industry is heading towards a technology driven optimization process. It has been realized that the unit operations such as drilling, blasting, excavation, loading, hauling and crushing are interrelated variables in the total cost equation. The development, advancement and utilization of the innovative technologies are very important for the mining industry to be cost effective. The last decade has seen dramatic progress in the advancement of blasting technology and the quality of performance of products. Monitoring instruments, measurement technologies and computing tools now have the capabilities to provide a bank of useful information that has previously been the subject of broad assumption. The performance and reliability of explosives and initiation systems are now at a level that allows the distribution and sequencing of explosives energy to be carefully controlled. The major developments in blasting technologies can be grouped according to the blast optimization pyramid (Fig. 6.1). Three main stages of this pyramid are planning, execution and output of a blast.

CONCLUSION

Efficiency of drilling and blasting operations can be defined in many ways, but the “bottom line’ is that they must contribute to the best overall economic result for the total mining operation. Thus decisions on drilling and blasting operations need to be considered in the overall context, and should not generally be based on short term economic factors. Drilling and blasting costs are always a significant part of the overall operating costs for surface coal mines. The cost of explosives may vary from 4.0% to 12% of the total operating costs and out of this about 20% of the costs are controlled by mine site management, and thus there should be a strong emphasis on reducing the explosive consumption without sacrificing performance. In the present work a blast optimization model has been developed with simple methodologies which can be adopted by the mining industry to compare the explosive costs and achieve better blasting results and. The model takes into account the common explosives

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being utilized by large opencast mine at the moment which in turn is decided by the rock characteristics, density and other related parameters. The model developed is a user friendly one, since by keeping the powder factor and number of choices of explosives available as constant and by varying the parameters like drill hole diameter, number of holes and cost of explosives one can compare the explosive performance and accordingly take a decision to select the proper type of explosives for blasting. It may be noted here that the model has been developed based on case studies of three different mines of MCL, and it can be modified with collection of information from a large number of mines. The model will definitely give some relief to the mine operators and blasting engineers to achieve a better output with a low cost of mining. By reducing the cost of explosives a considerable amount of expenditure can be saved, since modern mines require very large quantities of explosives throughout the life of the mine

REFERENCES

1. Adhikari, G.R. and Venkatesh, H.S. (1995), “An approach for optimizing a blast design for surface mines”, The Indian Mining & Engineering Journal, February, pp.25-28. Bhandari,
2. (2004), “Indian mining industry: need for adoption of technology for better future”, The Indian Mining & Engineering Journal, December, pp.40-49. Biran, K.K. (1994), “Advancements in drilling and blasting technology”,
3. The Indian Mining & Engineering Journal, July, pp.20-29. Dey, A. (1995), “Drilling machine”, Latest development of heavy earth moving machinery, Annapurna Publishers, pp.120-228. Dutta,
4. P.K., Barman, B.K and Moitra, B.C. (1973), ”Some problems of opencast drilling and blasting“, Seminar on Limestone and Dolomite Industry in India, Roukema, pp.150. Jack Freymuller(2001), “What’s new in drilling and blasting”, a special report, July, quarrytour.rockproducts.com/ar/rock_whats_new_drilling/index.htm.
5. Karyampudi, P. and Reddy, A.A.K. (1999), “Toe formation on blasted benches and its elimination: a practical approach”, Mining Engineers’ Journal, November, pp.21-27. Konari, R., Babu, K.N., Kumar, K.S. and Rai, P. (2004), “Important techno-economic considerations for overburden casting”, The Indian Mining & Engineering Journal, January, pp.24-30.
6. Kumar, S., Ranjan, R., Sharma, A. and Murthy, V.M.S.R. (2004), “Performance analysis of bulk explosives in different geo-mining conditions”, The Indian Mining & Engineering Journal, December, pp.24-31.