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New Trends in Economical and Safe Rock Blasting

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Blasting is the one of the most efficient and economical method of rock breakage for various social and industrial use. Mineral base industry use this techniques from vary beginning for exploitation of economical minerals and safely dispatch to mill.

It indicates that blasting is associated with various walks of life. Power, steel, cement are basic sectors which forms the backbone of growth of country economy and these basic raw material are coming from mine rock blasting. Therefore, in order to economy improvement of country, it is imperative to improve the blasting efficiency.

Blasting is an essential part of the mining cycle. In virtually all forms of mining, rock is broken by drilling and blasting. Blasting technology is the process of fracturing material by the use of a calculated amount of explosive so that a predetermined volume of material is broken. From the earliest days of blasting with black powder, there have been steady developments in explosives, detonating and delaying techniques and in the understanding of the mechanics of rock breakage by explosives. Good blast design and execution are essential for successful mining operations. Improper or poor practices in blasting can have a severely ill impact on the economics of a mine. Mine to Mill concept is to concentrate at the total cost of production rather than the cost of individual mining operation.

Blasting is used in both open pit and underground mining operations. While traditional blasting utilized black powder and dynamite, there are many different types of explosives used today. Common explosives used in industry now are ANFO (ammonium nitrate/fuel oil), slurries, and emulsions. Many factors are taken into account when determining what type of blast design or explosive will be used. Rock type, density, and strength are all important factors, as well as fracture condition of the rock, and water conditions.

Blasting is one of the more hazardous aspects of mining due to problems of vibrations, noises, fly rocks and scattering of stones. Blasting is prohibited of use near sensitive structure and residential areas. The alternatives to this method are rock breakage by such

crushing machines as large breakers and by chemical substances. RockFrac and Dexpan produce expansion chemicals which are used to break rocks. Most of these are used in limestone and sandstone quarrying. Expansion chemicals require huge amount of drilling. NonexTM and Magnum BusterTM are another two types of non-explosives which uses non-detonating chemicals to break rocks. There are also hydraulic rock splitters that can be used where blasting is not permitted, or where it is not suitable.

Plasma Blasting technique is also used for rock breakage and in this method pulsed electrical discharge by inserting a blasting probe in a water-filled cavity drilled in a rock, which produces shocks or pressure waves in the water. These pulses then propagate into the rock, leading to fracture. However, such breakage methods are high in cost and the problems of decrease in breaking performance were observed. These are mostly used in construction industry for breaking oversize rocks and concrete blocks. Plasma Blasting Technology (PBT) is costly and restricted in use.

The recent advancement of numerical simulation prior to actual blast of the rock mass can be appropriately model to see its impact and extended damage zone. Finite element modeling tools i.e., Abaqus/explicit, Auto Dyana and Ansys are used for prediction of behavior of rock mass under dynamic condition. The intelligent models are equally important to modify the blast based on the previous data. Soft computing tools like Artificial Neural Network (ANN), Fuzzy Logic (FL), Genetic Algorithm (GA) and Hybrid system like Neuro-Fuzzy, Neuro-Genetic models are commonly versatile tool used for prediction of blast performance and evaluation for improvement in fragmentation as well as reduction in blast ill effects either in surface and underground excavation.

In spite of all available tools and techniques still there is scope for improvement in blast efficiency for demolition blasting, rock friendly blasting for green and clean exploitation of rock mass for sustainable development.

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