International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 05 | May 2020 www.irjet.net p-ISSN: 2395-0072

CASE STUDY OF CONTROL BLASTING IN GRANITE MINES

P. Taviti Naidu[1], P. Kumar[2], V. Ravi[2], S. R. K. S. S. Ganesh pavan Kumar[2], D. Vamsi Krishna[2], B. Ravi kumar[2]

[1] *Assistant professor, Dept. of Mining engineering, Godavari Institute of Engineering & Technology(Autonomous) Rajahmundry, Andhrapradesh, India*

[2] *B. Tech final year students, Dept. Of Mining Engineering, Godavari Institute of Engineering & Technology (Autonomous), Rajahmundry, Andhra Pradesh, India*

Abstract - *Mining activity plays a major role for economic development of nation.drilling and blasting are two key operations in mining industry.Execution of these rows activities generates two main problems they are ground vibrations, and flyrocks and also some disturbances to the environment like noise pollution,air pollution soil pollution apart from that there also ground vibrations.Ground vibrations are very difficult to control.In blasting and drilling generally more noise pollution and vibrations will occur.These vibrations are very much dangerous to our intact structures.Even tough mining activity is done far from the resendial areas there are some structures at mine like mine office,workshop,material handeling plant and so on.From these vibrations there will a great threat. These vibrations from blasting may effect on the structures, to reduce these vibrations from blasting we implemented and used a techniques called control blasting techniques in mines. They are very much attentive and useful to control ground vibrations from blasting and fly rocks. Control blasting techniques are used both in opencast and underground mines also. Due to the severity and impact of ground vibrations the techniques are implemented. This techniques are very useful to control various hazards like noise pollution and ground vibrations and fly rocks.*

***Key Words*: Control blasting , ground vibrations , fly rock**

1.INTRODUCTION

Granite in a common type of igneous intrusive rock which in granular and phaneritic in texture. It can be Predominantly white, pink (or) gray in color depending on their mineralogy.

The word comes from Latin word granum, a grain in reference to coarse grained structure such as holocrystalline rock. It in a Igneous rock with 20%-60% quartz by volume and at least 35% of feldspar. Composition of Granite consists of potassium feldspar , quartz and biotite and amphibole the average density of granite is between 2.65 to 2.75 g/cm3.Its compressive strength lies above 200mpa meeting point is1215-1260c

Controlled blasting methods are used to control blast induced effects such as, over-break, fractures within remaining rock walls and ground vibrations etc. In both the mining and construction industries, blasting is the predominant method for fragmentation of consolidated mineral deposits. Adopting various techniques of controlled blasting such as line drilling, trim (cushion) blasting, smooth (contour or perimeter) blasting, pre-splitting etc,; selecting and employing various parameters of blast design; using modern technology such as precise timing delays, varied density of explosives product by using bulk explosives; muffle blasting ata very critical and congested areas are some of the points discussed in this paper for mitigation of adverse impact of blasting. By adopting these precautions not only the ground vibration is restricted to ease the public relation problem, but the mines'/constitution's techno-economics, preservation of host rock strength and safety standard are improved to a considerable level.

1.1Objectives

The main purpose of using control blasting techniques is to reduce ground vibrations and fly rocks while blasting and drilling. This techniques helps the miners to get better output with less risk and also for the reduction of risk from workers.

To maintain this technique the following objectives are to be followed

1. To study about control blasting in Granite mines and Granite case study.

2. To study Drilling pattern applicable in granite mines.
3. To Study about control blasting in granite mines.
4. To Study about processing of granite blocks after extraction.

1.2 Need for study

Granite usually occurs in large deposits many times referred to as slabs, Thought the world mining operations are different methods of cutting to extract the different deposits from ground in place called quarries.

The slabs are then polished, put on trucks and sent to fabricators. The fabricators will then cut the slabs into the appropriate sixes and lengths for commercial and home use.

Since granite needs to be extracted in large pieces, typical methods of large scale blasting and collection will not work instead large team of workers with a series of large, specialized equipment and products such as high capacity excavators, chemicals.

The broken slabs are pulled to large trucks capable of carrying heavy load. The granite slab can weight as much as 40 tons.

2. CONTROL BLASTING

Controlled blasting methods are used to control blast induced effects such as, over-break, fractures within remaining rock walls and ground vibrations etc. In both the mining and construction industries, blasting is the predominant method for fragmentation of consolidated mineral deposits. Adopting various techniques of controlled blasting such as line drilling, trim (cushion) blasting, smooth (contour or perimeter) blasting, pre-splitting etc,; selecting and employing various parameters of blast design; using modern technology such as precise timing delays, varied density of explosives product by using bulk explosives; muffle blasting ata very critical and congested areas are some of the points discussed in this paper for mitigation of adverse impact of blasting. By adopting these precautions not only the ground vibration is restricted to ease the public relation problem, but the mines'/constitution's techno-economics, preservation of host rock strength and safety standard are improved to a considerable level.

2.1 Granites

Granite is formed within the crust of the Earth when Felsic magma, that is magma that is rich in Silica, cools down without reaching the surface. Because it remains beneath the surface as it i s cooling it forms large crystals (ie, you can see the individual crystals without need of a microscope or hand-lens).It has a minimum of 20% Quartz with up to 65% of the rock being Feldspar Other minerals such as Mica or Amphibole are usually present and can make up to 25% of the total volume.

Fig-1 Granite block

Granites tend to form in Subduction zones, where water-rich crust gets assimilated into the Asthenosphere and undergoes partial melting. The melt rises, reaches the base of the crust, partially assimilates the base of the crust (increasing silica content), and continues to rise until it reaches a point where the majority of the melt stops moving. The melt stops moving when the internal pressure is equal to the surrounding pressure (if the melt has a greater internal pressure then the rocks surrounding it, then it will continue to rise all the way to the surface). But because gases (volatiles) can escape quicker than the molten rock, the melt loses volatiles as it rises and the internal pressure drops. Some of the melt may reach the surface as a Rhyolite, but the majority (some 95%) remains below ground and cools slowly to form a granite.

2.2 Chemical composition of Granites

A worldwide average of the chemical composition of granite, by weight percent, based on 2485 analysis. Granite is mainly composes of silicon, aluminum, potassium, sodium, calcium, iron, magnesium, manganese.

SI02	72.04%
AL203	14.42%
K20	4.12%
NAZO	3.69%
CAO	1.82%
FEO	1.8%
FE203	1.22%
M60	0.71%
Tio2	0.30%
P205	0.12%
MNO	0.05%

Table-1 composition of Granite

This material can have a dark black background, a dark black/green tinge or black with grey/white pinhead sized spotting.

All will have golden specks in them however there are two distinct types: small/medium flake and large flake.

There are many different quarries of Black Galaxy granite, the background colour and flecking can vary considerably. For large projects ensure that the blocks are all extracted from the same quarry face for matching purposes.

First Choice material will have no white lines or veins. Expect to pay a much higher price for large gang saw-sized slabs.

Lower cost Black Galaxy may have black or white lines or clouds however First Choice small blocks suitable for tiles and smaller-sized slab production are usually readily available.

Low cost Black Galaxy retail tiles are usually of Commercial Quality material, only when placing First Choice alongside Commercial Quality would the layman tell the difference

Technical Specification of Granite rock

1	Compressive Strength	2777 Kg/cm2
2	Comp. Strength after Gelidity	2696 Kg/cm2
3	Ultimate Tensile Strength	274 Kg/cm2
4	Coeff. Thermal expansion	0.0045mm/mc
5	Water Absorption	0.04%
6	Impact Test-Min Fall Height	68 cm
7	Specific Gravity	2.960 Kg/m3
8	Hardness (Moh's Scale)	6.5

Granite is the rock most often quarried as a "dimension stone" (a natural rock material that has been cut into blocks or slabs of specific length, width, and thickness). Granite is hard enough to resist abrasion, strong enough to bear significant weight, inert enough to resist weathering, and it accepts a brilliant polish. These characteristics make it a very desirable and useful dimension stone. Granite has been used for thousands of years in both interior and exterior applications. Rough-cut and polished granite is used in buildings, bridges, paving, monuments, and many other exterior projects. Indoors, polished granite slabs and tiles are used in countertops, tile floors, stair treads, and many other practical and decorative features.

Southern Rocks produces "Black Galaxy", the most sought after granite in the world market. One of the top five granite companies in India and a pioneer in the export market, Southern Rocks also produces a stunning range of granites like "Vizag Blue", "Jasmine White", "Warangal Black" from their own quarries located in Southern States of India. The company has established working relationship with quarries having materials of Black Pearl and Steel Grey, thus extended captive sources. Southern Rocks also imports certain varieties of granites from Brazil, Norway, Ukraine, and South Africa to cater to their client base.

2.3 Control Blasting

In extracting stage the ore is extracted by drilling, blasting loading and transportation. When we talk about drilling and blasting we taught of drilling the ore with drill holes and keep the explosives and stemming and charging and blast the hole with detonator. This is what we all think about but in doing this operation we must overcome so many problems regarding environment and workers they are ground vibrations and fly rocks. At the time of blasting, when explosive in the holes are detonated a shock waves are produced in association with the gas pressure. These shock waves are also called as an elastic wave which travels in all directions and give rise to the ground vibrate. The excess amount of shock waves may cause damage to nearby structure and rock strata. The ground vibration can be estimated in term of PPV. The PPV is the most elevated speed at which an individual earth particle moves or vibrates when the waves go through that earth particle.

A number of research work has been carried out to measure the peak particle velocity for the different blasting site. A study carried out on the twelve data set of a case study was analyzed in order to get a get an accurate site-specific formulation for the peak particle velocity. Fly rocks are not controlled but when blasting is going on we must not stay at the site of blasting. We must maintain 200 mts distance and stay at safe shelter which are provided by mine this basic rule of DGMS. But vibration are not controlled where ever we are in mine area we can feel the vibration with respect to distance. Above we talk about ancient and oldest type of blasting

We will not stop ground vibrations but we can reduce them with particular type blasting called controlled blasting. By this method we can control ground vibrations and also fly rocks. This operation is very effective and well planned for the reduction of ground vibrations and fly rocks. Drilling and is the main base for the blasting. So here for controlled blasting. We all know that in opencast mines drilling and blasting is the main operation of output

Explosive type- Ammonium Nitrate, slurry explosives or mild blasting as per requirement.

Quantity of explosives used 30-50 gram shot hole (depends on size & depth of the hole)

Fig-2 Detonators

The position of every deep hole to be drilled shall be distinctly marked by the Mine Foreman so as to be readily seen by the drillers. No drilling shall be commenced in an area where shots have been fired, until the blaster has made a thorough examination at all places, including remaining butts of old deep holes, for unexploded charges that the drill may strike. No drill or bore rod or pick shall be inserted in butts of old deep holes even if an examination under Clause (a) has failed to reveal presence of explosives.

Before starting drilling of dressing holes on the granite blocks a thorough examination for the presence of misfires, sockets or unexploded charge shall be made. If any unexploded charge present, the same shall be removed from the hole by safe means, destroyed carefully. However no drilling shall be carried in any socket.

No person shall remain or be permitted to remain within a radius of 20 m or within 60 m on the same bench where charging of holes with explosives is being carried out. At a given time only one operation that is drilling/toppling/lifting/shifting of equipment will be carried out on any bench.

As like normal blasting, drilling is done but holed drilled are different from normal blasting. In the controlled blasting the line drill holes are generally percussive hammer holes having spaced 2 to 4 times the hole diameter, drilled along excavation line. The blast holes directly adjacent to line drill holes as buffer holes are generally loaded lighter about 50% of primary holes and closely spaced about 50 to 75% of primary holes. This technique gives maximum protection to host rocks to preserve its original strength. This system involves a single row of closely spaced un changed holes along the next excavation line. This provides a plane of weakness to which the primary blast can break. It also occurs some shock waves generated to the blast to be reflected which reduce shattering and stressing in finished wall of host rock.

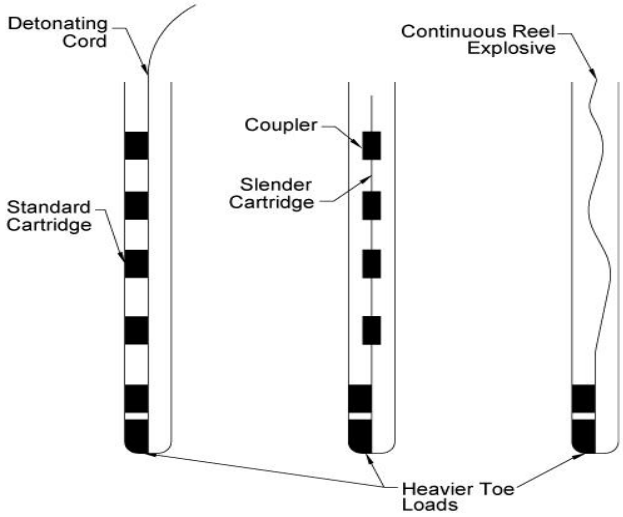

Fig-3 Charging of hole

Then blast the holes by detonators. It is all about controlled blasting. Now the blasted ore is separated from mother rock and this is loaded by excavators into dumpers which dumpers will transport it into the ore dump yard for ore handling at the top of the mine. From here machinery will take key role as for loading and transportation.

3. CONCLUSIONS

The blasting operation plays a vital role in the performance characteristics of any surface mines. The blasting operations induces severe ground vibration which may affect the nearby structure. Thus, its safe operation is a prime concern for every industry. Therefore, the proper information of any blasting operation is very much necessary for its safe operation. The controlled and uncontrolled parameters of blasting affect its operation. In this paper the blasting performance under the influence of controlled blast parameters was studied. The main focus of this paper is to monitor the peak particle velocity at a particular distance under the varying hole spacing condition. This study showed that the PPV of ground vibration at the time of blasting is affected by the spacing of two consecutive rows. In the present study it was reported that the peak particle velocity in transitional direction is decreasing with increment in the hole spacing between two consecutive rows, whereas the vibration in vertical and longitudinal directions are increasing with increment in spacing.

REFERENCES

1) **Deshmuk, D.J.,** (1982) "Drilling and Blasting", Elements of mining volume 1 hand book, page no 49 - 68 & 170 – 221.

2) **Samir kumar das,** (1994) "Opencast working drilling machinery", Surface mining hand book, page no 279 – 280.

3) **Chinmay kumar pride & Manmit rout,** (2007), "Optimization of blast model", Optimization of blast parameters in opencast mine journal, pp. 52 – 61.

4) **Pradhan, G.K.,** (2002), "Surface mine drilling and blasting: the Indian scenario", The Indian Mining & Engineering Journal, December, pp.23-28.

5) **Bhandari, A.,** (2004), "Indian mining industry: need for adoption of technology for better future", The Indian Mining & Engineering Journal, December, pp.40-49.

6) **Bhandari, S.K,** (2004), "Evaluation of blast results and Computer aided blast design", Engineering rock blasting operations hand book, page no 154 - 166 & 277 - 279.

BIOGRAPHIES

Mr. P. Taviti Naidu,
Assistant Professor, Department of Mining Engineering, Godavari Institute of Engineering & Technology (Autonomous), Rajahmundry, Andhra Pradesh.

P. Kumar
Student 1 Department of Mining Engineering, Godavari Institute of Engineering and technology (Autonomous), Rajahmundry, Andhra Pradesh

V. Ravi
Student 2 Department of Mining Engineering, Godavari Institute of Engineering and technology, (Autonomous), Rajahmundry, Andhra Pradesh

S. R. K. S. S. Ganesh pavan kumar
Student 3 Department of Mining Engineering, Godavari Institute of Engineering and technology (Autonomous), Rajahmundry, Andhra Pradesh

D. Vamsi Krishna
Student 4 Department of Mining Engineering, Godavari Institute of Engineering and technology (Autonomous), Rajahmundry, Andhra Pradesh

B. Ravi kumar
Student 5 Department of Mining Engineering, Godavari Institute of Engineering and technology (Autonomous), Rajahmundry, Andhra Pradesh