

# STUDY THE METHOD OF WORKING USED IN GRANITE MINES-A FIELD OBSERVATION

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**Abstract :** This paper presents a detailed overlook the practiced method of mining used in granite mines to extract the mineral by avoiding artificial cracks. This paper gives a glance of scientific extraction of granite extraction in the mining industry. As the quality of granite shows high impact in sales, quality maintenance therefore during extraction process it is very important to know the scientific technique of granite extraction. The blasting and transportation of overburden and waste rock is also studied in this paper.

**Key words-** Granite, artificial cracks, extraction, blasting.

## I.INTRODUCTION

The importance of granite having a significant role in any building related structural activity [1]. Granite is a type of igneous rock which is formed when magma is cooled. It having a highly durable and good shear strength characteristic in nature. In general, it is used in the design and building the constructional activities [2]. Quartz and feldspar are the main chemical composition of the granite [3]. Apart from these two the other components such as amphiboles, mica etc. are present in small amounts. The molten rock is formed due to the decaying process of radioactive elements for a long time [4]. This rock is extremely durable and hard, making it the perfect substance for construction uses such items as countertops or floorings. It is a common type of felsic intrusive igneous rock which is granular and phaneritic in texture. It can be predominantly white, pink, or gray in color, depending on their mineralogy constituent [5-6]. It has an enough size of grains large which can be visible to naked eyes. Granite is used in many outdoor and indoor projects. The outside projects such as bridges, monuments, buildings, paving etc., and inside projects such as countertops, floor etc [7-8]. Since, granite is a world's toughest substance (which is used since thousands of years) thus it can be used in curling balls and gym walls for training mountain climbing [9]. The granite usage in different form are as follow:

1. Building monuments
2. Granite used in jewellery
3. Granite used in fireplace mantle and floor
4. Granite used in bathroom skins, shelves, table tops, basins

As the granite is an economical mineral, thus a proper method should be adopted for its efficient extraction. The extraction procedure of granite should be carried out in such a manner that it can maintain its quality as describe on the scale. The proper and scientific method of working of granite helps to avoid artificial cracks [10]. There are three ways of extracting granites which create varying levels of quality. The three ways of extracting granite are blast extraction, air bag extraction and stone extraction. The aim of this paper is to study the proper and scientific practice method of working which is applying in a granite mines.

## II. ROLE OF MINING METHODS IN MINES

The method of mining plays a very key role in any mining industry or queries. As the granite is associated with queries (i.e., building related material) and which is also an economical mineral. Therefore, the extraction of granite should follow the careful method which is capable of extracting without creating artificial defects on it. The semi-mechanized open cast method is using to extract the mineral (Black galaxy granite) to avoid the damages. The same method will be adopted during the scheme period. The quality of granite is dependent on the way that the granite is mined or extracted.

Black galaxy granite is another type of economical mineral. Which further required a separate method extraction. Diamond wiresaw is used for separation of final block from parent rock. Cracking powder is used for splitting of the blocks. Dressing is done to get a well-shaped block which are free from defects. The mechanism of blasting is to be used only for breaking the over burden and waste rock material. For transportation of the loose material the dumpers and wheel loaders are used in the mining industry.

**III. MATERIAL AND MACHINERY USED IN THE SELECTED GRANITE MINES**

The query selected for the study is situated the east Godavari region of the Andhra Pradesh. The query consists of 5 number of working benches which is having overall slope angle of 65°. Each bench having the height of 6 meter with 8 to 9meter width. The bench slope angle was 65<sup>0</sup> with haul road gradient of 1 in 10. The excavator used in the mines is shown in Figure 1. The purpose of excavator is to excavates the hard material. The technical specification of engine capacity of the excavator and its technical specification are presented in Table 1 and Table 2.



**Fig.1** Excavator used in the mines

Table1: Excavator engine capacity

|                  |         |
|------------------|---------|
| Pulling capacity | 40 tons |
| Lifting capacity | 20 tons |
| Boom height      | 9 m     |
| Swing speed      | 9.5 rpm |

Table2: Excavator technical specifications

|                     |               |        |
|---------------------|---------------|--------|
| Brand               | L & T komatsu |        |
| Model               | PC300 LC-7    |        |
| Net power           | 242 hp        |        |
| Gross power         | 260 hp        | 414 kw |
| Power measured      | 1900 rpm      |        |
| Displacement        | 1104.5 cu     | 18.1 L |
| Number of cylinders | 4             |        |

A wheel loader was another type of machinery which was used in the mines. The main purpose of it was using as transportation vehicle for transporting the dressed blocks. It is also known as front end loader which is shown in Figure 2, the technical specification of the wheel loader is tabulated n Table 3.



**Fig.2** Wheel loader

Table 3: Wheel loader technical specification

|                     |                     |         |
|---------------------|---------------------|---------|
| <b>Brand</b>        | <b>CATTERPILLAR</b> |         |
| Model               | 998G                |         |
| Net power           | 501 hp              | 373 k w |
| Gross power         | 540 hp              | 414 k w |
| Power measured      | 1800 rpm            |         |
| Displacement        | 1104.5 cu           |         |
| Number of cylinders | 4                   |         |

A dumper is a vehicle designed for transportation and dumping of material. The used dumper in the mines is shown in Figure 3 and its technical specification is given in Table 4. A wire saw is a machine used for cutting the rock in with the help of a metal or cable. Diamond wire saw is used in combination of wire saw machine to cut the rock which is shown in Figure 4.



Fig.3 Dumper used in the mines

Table4: Dumper technical specifications

|                |              |
|----------------|--------------|
| RPM            | 2100         |
| HP             | 400 (298 KW) |
| STEERING ANGLE | 42°          |
| AIR COMPRESSOR | 372 PSI      |
| CAPACITY       |              |
| NET WEIGHT     | 28450 KG     |
| GROSS WEIGHT   | 6250 KG      |



Fig.4 wire saw machine

**Specifications of wire saw machine**

- 60 HP A.C Electric motor
- 1 HP DC motor coupled with gear box for travelling movement
- Electrical control panel with 10M control cable
- Travelling track -1 no .of 3M and 2 no. of 2M
- Guide pulley -2 no.
- Pulley guard and spine shaft cover guard
- Wire cutter
- Crimping tool
- Stand for guide pulley

Cracking powder is a non-explosive type material containing calcium oxide. It is used for splitting of blocks at the time of drilling and blasting operation. This is a primitive type of explosive which is used in the mines. Its technical specification is given in Table 5.



**Fig. 5** Cracking powder

**Quantity of mix required for 1m<sup>3</sup>**

Table5: Quantity of cracking powder required for 1m<sup>3</sup>

| Kinds of objects to be demolished |    |    |    |    |    |    |    | Quantity            |    |                              |  |          |
|-----------------------------------|----|----|----|----|----|----|----|---------------------|----|------------------------------|--|----------|
| ROCKS                             |    |    |    |    |    |    |    | Soft rock           |    | 5-8 kg                       |  |          |
|                                   |    |    |    |    |    |    |    |                     |    | Medium rock                  |  | 8-12 kg  |
|                                   |    |    |    |    |    |    |    |                     |    | Hard rock                    |  | 12-20 kg |
| CONCRETE                          |    |    |    |    |    |    |    | Plane concrete      |    | 5-8 kg                       |  |          |
|                                   |    |    |    |    |    |    |    | Reinforced concrete |    | Concrete having less Re-bars |  | 10-25 kg |
|                                   |    |    |    |    |    |    |    |                     |    | Concrete having more Re-bars |  | 20-35 kg |
| BRICK                             |    |    |    |    |    |    |    | Anti-fire brick     |    | 10-25 kg                     |  |          |
| Hole DIA (mm)                     | 36 | 38 | 40 | 42 | 44 | 46 | 48 | 50                  | 52 |                              |  |          |

**IV. PRACTICED METHOD IN THE MINES**

The semi mechanized open cast method or stone cut extraction method was practiced in the mines same will be adopted during the scheme of period. The mining will be open cast mechanized mining, employing deep drilling and blasting for breaking the over burden and black galaxy granite, using heavy earth moving machinery, hydraulic excavators to excavate the broken materials and load the same into tippers and dumpers. The over burden black galaxy granite will be hauled to the over burden dumps and stacking yards respectively. The following operations involved in this method

- 1 Separation of primary blocks from the mother rock
- 2 Secondary splitting
- 3 Dressing
- 4 Blasting
- 5 Loading
- 6 Hauling

The separation of primary blocks from mother rock was performed using diamond wire saw. The bore holes are drilled vertically and horizontally to match with each other. The bore holes are drilled with PDR machine or sladder. The hole diameter is 90mm and the depth will be depending on the bench parameters. After secondary separation, the rock mass will be carefully examined to avoid hairline cracks, mineral segregations and veins etc. The dressing of the rough blocks will be made by chipping the edges and geometrically equating the edges of the blocks at the dressing yard. The trough blocks obtained after secondary cut, it will be dressed for obtaining good geometric shape of galaxy granite. Blasting will be used only for breaking the over burden and waste rock. Techniques, explosives, chemicals and equipment have been developed / evolved to substantially increase the production.



## II.RESULTS AND DISCUSSION

- They are mainly concentrating on the benches which gives high production.
- They are maintaining the haul road gradient as 1in10. It will be safe in granite mines, but 1in16 is better maintenance.
- It is better to maintain the bench slope in between 50<sup>0</sup> to 60<sup>0</sup>.

## V. CONCLUSION

Granite is playing an important role in social economic and political history of the world. Granite is one of the driving forces of world's economy. Granite is located on different parts of the earth under the soil. Majority of the granite is available in the hilly terrain regions; thus, exploration is more demanding and challenging. This paper presents granite extraction and different technologies employing in mining industry. This paper in detail talks about the importance of scientific and proper method of granite extraction.

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