Study of Production Scheduling Parameters Used in Granite Mines

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Abstract : Granite is one of the valuable mineral of the mining industry. Its production and proper excavation is a prime concern in today's scenario. The determination of the quality for fundamental purposes are carried out by means of identification of geological, geotechnical and aesthetic factor that characterize the granite. This paper focused on the study of the scientific production scheduling parameter which were discussed in brief. Also, a detailed study of the machinery employed in the mines was reported in the paper. The subject of this study involves the economical and dimensional view of granite blocks in order to maximize the productivity and minimize losses.

***Key words*- Granite, Mining, Production scheduling, geological factor.**

I.INTRODUCTION

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 [1]. It remains beneath the surface as it is cooling it forms large crystals. Granite is composed mainly of quartz& feldspar with minor amounts of mica amphiboles & other minerals [2]. Opencast method of working is carried out in this mine by manually & semi mechanization by using compressor operated jackhammer drills, excavators & dumpers etc. Transportation will be made by trucks to dispatching point. The mining operations are carried out by semi mechanization as opencast mining.

Drilling &Blasting acts as a vital role in determining the size and shape of the rough blocks [3]. Drilling pattern is important to developing a working face and also the rough blocks suitable for their use in progressing units. Drilling and blasting currently utilizes many different varieties of explosives with different compositions and performance properties. Granite is then extracted from the mine which is in itself a difficult process [4]. Granite is usually drill then hammered to separate to individual blocks which are then lifted to the surface of the mine with cranes to be transported to a nearby processing plant. Polishing granite is done in multi stages, starting with a very rough course diamond polishing, and once the first stage is complete the process is repeated using a less course diamond is repeated a number of times. Once individual cuts are made from granite workshops, the process is followed again but this time by hand to achieve the desired finish [5]. We focused on method of working in granite mine. 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 [6]. 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 mine.

II. MACHINERY EMPLOYED IN THE MINES

Various machinery observation was made in the mines. As per the observation, the machinery used in the mines are excavator, wheel loader, dumper, wiresaw, jack hammer and slotter. The description of each machinery is presented in the below sections.

A. Excavator

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 65^0 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 is presented in Table 1.

Fig.1 Excavator used in the mines

Table 1: Technical specification of Excavator

Width to Outside of Tracks	3190 mm
Height to Top of Cab	3380 mm
Ground Clearance	560 mm
Counterweight Clearance	1250 mm
Tail Swing Radius	3320 mm
Length of Track on Ground	4050 mm
Max loading height	7644.4 mm
Max reach along ground	11631.2 mm
Max vertical wall digging depth	7339.6 mm
Max digging depth	8116.8 mm
Operating weight	35108.1 kg
Fuel capacity	617 L
Swing speed	10 rpm
Maximum bucket capacity	2.9 m3

B. Wheel loader

A wheel loader was another type of machinery which was used in the mines. It is used as the transportation vehicle for transporting the loosen blocks from one place to other. 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 2.

Fig.2 Wheel loader used in the mines

Table 2: Technical specification of Wheel loader

Brand	**CATTERPILLAR**
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

C. Dumper

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 3. 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 3.

Fig.3 Dumper used in the mines

Table 3: Technical specification of Dumper

Engine	Hindustan with ACERT technology
Body capacity	31.3 m^3
Operating Weight	99300.0 kg
Maximum travel speed	79.7 km/h
Nominal Payload	45 Ton
Size tires	21.00 R33

D. Wiresaw

Wiresaw is the machine to cut the hard rock. It is operated by the diesel generator. It having wire rope to cut the rock strata. The wire is containing diamond sigments which are used to cut the rock. The rope has 40 sigments per each meter.

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

E. Jack hammer:

Jackhammer is pneumatic or electro mechanical device that consists of hammer which is connected directly with chisel. It is basically used as the rock breakage equipment in the mines. Larger size of jackhammers, such as ring mounted hammers used for the breakage of building construction material. A jack hammer operates by driving an internal hammer up and down with the application of external driving force. The technical specification of the Jackhammer which is used in the mines is tabulated in Table 4.

Table 4: Technical specification of Jackhammer

Model	Atlas Capco		
Weight (kg)	24 kgs		
Length (mm)	604 mm		
Cylinder Diameter (mm)	70 mm		
Piston Stroke (mm)	70 mm		
Working Pressure (MPa)	0.63	0.5	0.4
Air Consumption (L/s)	≤55		
Impact Frequency (J)	≥27		
Air Pipe Diameter (mm)	19 mm		
Bore Diameter (mm)	30-42 mm		
Suitable for max depth (m)	5 mm		
Working Temperature (°C)	-30~50		

F. Slotter

Once the face is setup, using slotter we will make one hole horizontally and using water level and we will make another hole exactly co-inside with the first hole that we have already drilled horizontally. Using wire saw cutting machine we can cut the bottom of the rock . After make a hole vertically which is connected at the intersection point of the horizontal holes.

Table 5: Technical specification of Slotter

Base frame	580mm*420mm
Drill rod	1m,1.5m,4ft
Type	Planetary gear system
Gear	Triple reduction
Air motor	Radial piston
Capacity	89mm to 115mm
Hole dia	120 – 180mm
Depth	20m

IV. Estimated of Mineral Reserve of the Mines

The mines under the study was located at chimakurthy in Prakasham district state of Andhra Pradesh. This area of the state is fully filled with natural mineral and it is very well known for the Galaxy Granite production which is usually found in a black color. The site is situated at the 123 m of RL from the sea level.

Estimation of mineable reserve is arrived at by taking into consideration of proved reserves which are 9,600 cu m. The reserve blocked in the 7.5 m buffer zone and blocked in mine safety benches are not considered as the area which is too small and lies adjacent to the existing quarry lease of the company. The company will amalgamate this small area with the existing area of 0.96 acres so as to enable easy quarrying operation. The recovery percentage is considered as 6%. The mineable reserves considering the above parameters are estimated to be 576 cu m and considering an average production of 115 cu m per annum.

V. Conclusion

Granite is a very prestigious reserve which are the essential components of any building related material. The production of granite plays a vital role in the market of building material. Thus, the study of the scientific and systematic approach of its extraction is very much necessary. In this paper, an attempt has been made to study the scientific approach of granite extraction. This method of study will help in understanding the technical approach of granite extraction without the cracks and faults appeared in the extracted material. Moreover, this paper also provides the detail study of the machinery used in the mines for the efficient production of the granite. The all the production scheduling parameters, which are used in the granite extraction, was discussed in the paper.

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