MONITORING OF GROUND VIBRATION AT A STONE QUARRY

Aswin Raj[1], Jobin Thomas[1], Krishnajith[1], Sarfraz Muneer [1], A. C. Kumar[2]

[1]B. Tech, [2]Associate Professor, Department of Mining Engineering, Godavari Institute of Engineering and Technology

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Abstract – *The ground vibration is one of the major problem in open pit mines and often it causes severe damages to building and sensitive structures. Release of energy during blasting produces reactive forces, which causes the damage to the near civil structures and sensitive structures. This paper mainly deals with monitoring of blast induced ground vibrations at Stone quarry in North Kerala region in India. The monitoring of ground vibration will helps in calculating the safe charge of explosive to be used. The maximum charge of explosive (MCD) and peak particle velocity (PPV) were recorded for 8 blast events at various distances. Minimate is used in order to measure the vibration levels. All the vibration reading were obtained from varying distances from blast location.*

***Key Words*: Open cast mining, ground vibration, blasting, Minimate**

1.INTRODUCTION

Quarries are used to extract bedrock from the earth in order to generate aggregate materials for the construction industry. The blasting of the rock is the initial stage in this procedure. To shatter and displace the rock, explosive charges are put in holes drilled into the boulder and detonated. Mining, road construction, utility installations, and even residential basement excavations employ this technology. The fragmented rock can be readily handled, transported, and processed to generate the range of aggregate materials required by the building industry once it has been split apart by explosive pressures. Controlling impacts is done using a variety of approaches that are widely utilised in the business. Blasts are monitored and carried out in accordance with blast design studies to ensure that vibration and noise levels are within the damage threshold limit standards. The most common method for fragmenting cemented mineral deposits and rocks is blasting. Blasting is used mostly in open pit mining operations to break up the rock. This procedure, which involves the use of explosives to shatter rock, is sometimes referred to as both a science and an art. Drilling and blasting for hard rock excavation produces noise pollution, fly rocks, and ground vibrations that can harm adjacent inhabitants and sensitive buildings. There are several hazards involved with blasting operations, which might lead to overly cautious design assumptions and excessive expenses. Underestimating ground vibration hazards, on the other hand, might result in unanticipated structure damage, public complaints, and additional expenditures and delays. Cost-effectiveness may be improved without causing unmanageable issues by implementing a planned risk management strategy. Previous attempts by various researches for monitoring ground vibrations can be found in different literature. In this study ground vibrations were monitored in a stone quarry in India.

2. Blast monitoring

With the aid of Instantel's Minimate Blaster, ground vibration monitoring is carried out. The monitor has an inbuilt LCD and an eight-key tactile keypad, as well as a neatly designed, menu-driven interface. Figure 1 depicts the placement of a Minimate in the mine. The PPV collected from different locations were presented in Table 1.

Figure 1: Minimate placed for recording vibration

Table 1. Measured PPV values at different distances.

Blast No	MCD (Kg)	Instrument	Distance (m)	PPV (mm/s)	Scaled Distance (D/√Q)
1	3	mm1	180	0.3	104
		mm2	65	1.78	38
		mm3	120	1.27	69
2	3.3	mm1	210	0.14	116
		mm2	55	4.19	30
		mm3	45	4.83	25
3	2.7	mm1	140	0.51	85
		mm2	40	7.24	24
		mm3	36	8.89	22
4	3.8	mm1	120	0.89	62
		mm2	50	4.95	26
5	4.8	mm1	140	0.41	64
		mm2	55	6.73	25
6	2.7	mm1	65	2.29	40
7	3.7	mm1	70	2.54	36
		mm2	120	2.29	64
8	4.2	mm1	140	2.67	68
		mm2	42	4.44	20

From the Table 1, it is seen that the minimum PPV recorded was 0.14 at a distance of 210m and maximum PPV recorded was 8.89 mm/s at a distance of 36m from blasting site.

3. CONCLUSIONS

The monitoring of ground vibrations was carried out in a stone quarry. The monitored data shows that the PPV collected from the mine is within the DGMS standards. In this study the maximum PPV recorded was 8.89 mm/s at a distance of 36m from blasting site, which is less than 20mm/sec. 20mm/sec is the safe PPV value defined by the DGMS for industrial buildings.

REFERENCES

[1] Kahriman, Ali. "Analysis of parameters of ground vibration produced from bench blasting at a limestone quarry." *Soil Dynamics and Earthquake Engineering* 24.11 (2004): 887892.

[2] Müller, B., J. Hausmann, and H. Niedzwiedz. "Control of rock fragmentation and muck pile geometry during production blasts (environmentally friendly blasting technique)." *Proceedings of 9th Rock Fragmentation by Blasting Symposium, Frgagblast*. Vol. 9. 2010.

[3] Kahriman, A. "Analysis of ground vibrations caused by bench blasting at can open-pit lignite mine in Turkey." *Environmental Geology* 41.6 (2002): 653-661.

[4] Ak, Hakan, et al. "Evaluation of ground vibration effect of blasting operations in a magnesite mine." *Soil Dynamics and Earthquake Engineering* 29.4 (2009): 669-676.