A STUDY ON GROUND VIBRATION DUE TO ROCK BLASTING AT METAL QUARRY: A CASE STUDY

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(09/8815)

Degree of Master of Engineering

Department of Civil Engineering

University of Moratuwa
Sri Lanka

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Thesis submitted in partial fulfillment of the requirement for the degree Master of Engineering in Foundation Engineering and Earth Retaining system

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DECLARATION

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Signature of the supervisor:……………………… Date:………………………

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Abstract

A Study on Ground Vibration Due to Rock Blasting at Metal Quarry

Ground vibration, air blast and fly-rock are unavoidable environmental impacts of rock blasting. Despite these, blasting is the widely accepted method of rock breaking in quarrying industry because of cost effectiveness, higher efficiency, convenience and ability to break hard rock. Among the environmental impacts, ground vibration is the most critical since it can cause damages to nearby structures.

This study was carried out to compare vertical and horizontal bench blast(s) at a granitic gneiss rock quarry located in Colombo, Sri Lanka and predict the resulting peak particle velocities of ground vibration levels.

To achieve these objectives, particle velocities and frequencies of 38 and 35 blasts respectively were measured in three perpendicular directions for horizontal and vertical bench blast(s) with the use of Instantel Blastmate II seismographs. In the blast(s), Ammonium Nitrate (ANFO)(blasting agent) primed by a Gelatin Dynamite primer were electrically initiated. Scaled distance parameters (Maximum charge weight per delay and distance between blasting points to monitoring location) were also recorded.

The extensively used equation for seismic law of propagation, proposed by Devine (1962) and Devine and Duvall (1963), was used for the prediction of peak particle velocities. Points were plotted with Peak Particle Velocity (PPV) in Y- axis against Scaled Distance ($D/Q^{0.5}$) in X- axis. Regression analysis was performed to define the line of best fit. At the end of statistical analysis, an empirical relationship with good correlation was established for prediction of peak particle velocity. Frequency analysis was also done for dominant frequency and zero crossing frequency to identify the effect of frequency of ground vibration to structural damages and identifying the most suitable type of frequency analysis to define the single frequency value for ground vibration. The established relationship, frequency analysis and result obtained are presented.

To My Loving Mother

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LIST OF ABBREVIATIONS

Abbreviation	Description
SD	Scaled Distance
PPV	Peak Particle Velocity
GSMB	Geological Survey and Mines Bureau
CEA	Central Environmental Authority
GPS	Global Positioning System
ANFO	Ammonium Nitrate and Fuel Oil
IML	Industrial Mining License
AML	Artisanal Mining License
IEER	Initial Environmental Examination Report

LIST OF APPENDICES