Prediction of blast induced vibration at Lafarge Quarry in Kanthan, Ipoh, Perak

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Introduction

Blasting is the most common method of excavating rocks for various purposes. The energy from blasting cannot be completely utilized for rock breakage. The waste energy produced undesirable environmental effects that can cause human discomforts and structural damage. Such blast effects may lead to ground vibration air blast and fly rock. A good blast must be designed to minimize such harmful effects by predicting the likely level of the blast discomfort. The level of such effects varies with the site geological condition, explosive usage and blast geometry amongst other factors.

Results and discussion

In current practice, to predict blast induced ground vibrations quarry operators use square root scaled distance equation by taking site constants, K and β values as 1140 and -1.6 respectively. However, these values are adaptation from Australian Standards (AS 2187.2 -1993), where Standard Association of Australia has developed a Scaled Distance chart to predict blast-induced ground vibrations when blasting is to be carried out to a free face in average field conditions. This is due to currently no suitable standard to be uses in ground vibrations prediction as reported by Ghani (2013).

This study evaluates the site constants (k, β) for Lafarge Quarry located in Kanthan, Perak Malaysia. The constants were further used to predict the level of vibration for a given distance and maximum instantaneous charge (Q). Ten blast events were studied and the maximum instantaneous charge per delay was recorded for each blast.

The Peak Particle Velocity (PPV) for each blast was measured using an Instatel MiniMate Plus fixed at 600m from the blasting site. The scaled distance (SD) was also evaluated for each blast. A regression analysis was carried out to evaluate the specific site constants (k and β) for the studied quarry as -1.66 and 2,262 respectively.

These values further proved that no numerical fixed constants can be universally accepted to evaluate blast damages because of varying geological factors across the globe. A model was generated to predict ground vibration for the studied quarry using these site constants and was found to provide closer PPV values to the actual reading compared to the Australian Standards (AS 2187.2 -1993).

Conclusion

Blasting can be seen to give rise to many unwanted and sometimes disturbing effects, but with modern technology and techniques, these impacts can be minimised. Hence, the approach to predict blast-induced ground vibrations is essential to ensure that the quarry operation run smoothly and safely (Roy *et al*., 2016). Furthermore, by running the blasting efficiently, it also promotes good fragmentation (in term of desirable size reduction) hence promotes low energy consumption, higher productivity and overall sustainable operations.

Acknowledgements

The authors wish to acknowledge Universiti Sains Malaysia for the financial support through the grant no. 8014043.

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