EVALUATION OF STRONG GROUND MOTION CHARACTERISTICS FOR DESIGN OF STRUCTURES

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Data on strong ground motion characteristics is required for design of structures subjected to earthquakes, underground blasts or other dynamic forces. Data on strong ground motion due to underground blasts can be readily obtained from ground motion measurements at various distances from the blast points. However it is difficult to produce strong ground motion due to a major earthquake near a project site.

Detonation of explosives in large scale rock excavation in open cast mining operations results in strong ground motion detrimental to safety of the structures. Ground motion measurements were made due to various charges at an iron ore mine. Two bench blasts of 4775 kg of Powerflow-2 Slurry and 2029 kg of LOX explosive with 3 and 2 delays respectively and three linear blasts of 1629 kg LOX, 67.5 kg Special Gelatine (80%) and 26 kg Special Gelatine(80%) without delay detonators were made. The following correlations were obtained from the ground motion records

$$a = .0234\, C_p^2 \quad W^{.16} \quad \Delta^{-1.45} \qquad \text{cm/sec}^2 \qquad (1)$$

$$a_{rms} = .0156\, C_p^2 \quad W^{.2} \quad \Delta^{-1.57} \qquad \text{cm/sec}^2 \qquad (2)$$

$$T = 37.8\, C_p^{-1} \quad W^{.13} \quad \Delta^{.59} \quad N^{-.86} \qquad \text{sec} \qquad (3)$$

where 'a' is the peak ground particle acceleration in cm/sec^2, C_p is the longitudinal wave velocity in the medium in m/sec, $W = Q \times RWS/\rho_e$ where Q is maximum weight of the explosive (in a particular delay if delay detonators are utilised in the blast) in kg, RWS is the relative weight strength of the explosive expressed as ratio, and ρ_e is the density of the explosive in gm/cm^3, Δ is the distance in m, a_{rms} is the root-mean-square value of ground particle accelerations in cm/sec^2 and T is the duration of strong ground motion in sec.

Thus in order to study the behaviour of structures or ground due to a major earthquake, quarry blasts with suitable number of delays can be utilised to simulate the strong ground motion with the probable peak ground acceleration and duration. The quantity of charge for the probable peak ground acceleration at a particular distance can be evaluated from equation (1). A blast can then be designed with suitable number of delays to give the desired duration of strong ground motion as a model of the prototype earthquake motion.

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