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Preliminary assessment and optimization of blasting cost and cycle time of load-haul unit of Obajana Cement Quarry

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Abstract: Blast design of Dangote Quarry was evaluated based on recommended standards for optimal fragmentation using empirical analysis. The resulting fragmentations were further analyzed using Kuz-Ram model. The current loading and haulage operations were also evaluated based on the unit cycle time to assess the possibility of minimizing operational cost and the idle time. The cost of blasting an area of Marble deposit measuring 402.5m by 9m (70,639 tons) using the initial blast design is USD12,584.85 while that of the modified blast design is USD10,782.67. This shows that a total sum of USD1,802.18 can be saved by adopting the modified design and this represents 14.32% of the initial design cost. Fragmentation analysis shows that the initial design has 95.6% of the blasted fragments within the range of 100cm with mean fragment size of 56cm. The modified design has 95.1% of the blasted material within 100cm with a mean fragment size of 64cm. The increase in the mean size has no significant effect on the primary crusher because the opening of the jaw is set at 150cm. The load – haul unit of the quarry is characterized with a waiting time of 4.35mins. The Suboleski's cycle time model adopted shows that the optimum number of dump trucks required by the excavator is three as compared to the initial four dump trucks. With this number of trucks, waiting time of dump trucks was eliminated while the idle time of excavator is at the minimum of 0.25min per cycle which is a drastic reduction to the initial waiting time of 4.35mins for the dump trucks. This empirical approach is simple and highly recommended for mine and quarry operators for optimum fragmentation. The haulage roads should be properly graded and maintained for better performance while ensuring regular scheduled maintenance of the loading and hauling equipment.

Keywords: Quarry, optimization, idle time, fragmentation, blasting