CASE STUDY

Increased Blast size with Controlled Vibration Levels JK Cement Works, Nimbahera

Site Profile

Maliakhera Mines and Karunda Mines are the captive limestone mines of JK Cement works, Nimbahera division, India. The mines are developed into multiple benches for limestone production, with Karunda mines having two different pits, North Pit and South Pit.

Both the mines are mechanized mines, being worked with shovel/ tipper combination and the excavated limestone is fed to a primary crusher, having a capacity of 1500 tph.

The Situation

Maliakhera Mines and Karunda Mines are surrounded by villages, which are at present, around 500 metres and above from the working benches. A new crusher has been set up to be fed from both the mines. With the new crusher coming in, the production rate would double up to 12000 tonnes per day from a single mine. Moreover, as the mines will expand in the future, the distance with the villages will be decreased, but it will be no less than 300 metres.

Following are the main problems mines management was facing in their operations:

- Small blasts due to higher vibration levels near the village.
- Non-availability of established benchmark blast designs to carry out bigger blasts to meet the production demand of 12000 MT/ day.
- Acceptable fragmentation with reduced vibration levels at POIs.

At the outset, a meeting was held between Orica management and JK Cement works, Nimbahera management to discuss the issue and ascertain the problem with a sustainable solution.

Technical Solutions

After scoping the site and its expansion plans for criticality, Orica proposed Advanced Vibration Management (AVM) services to deal with the situation. The agreed key deliverables were:

- Keeping ground vibration levels below 2 mm/s at POIs at 95% confidence limit.
- To increase the size of the blast in all areas and establish Drill & Blast designs.
- Acceptable fragmentation levels to be fed to primary crusher.

Orica used Unitronic™ Blasting System for site constants estimations and blast trials of suggested blast designs. After accurate data collection of vibration levels at different distances from the blast, and simulating blasts with Monte-Carlo Simulation Model, Orica planned to divide the mines into three zones based on criticality:

- Severe (less than 500 metres from the village)
- Critical (less than 600 metres from the village), and
- Safe (where village is more than 600 metres away).

A mutually agreed decision was made to go for deck charging in the severe zone of the mines, and suggested initiation pattern in the critical and the safe zone. Based on the predictions of Monte-Carlo Simulation Model and Firing Time Optimisation tool, Orica benchmarked Drill and Blast designs in the present working benches.

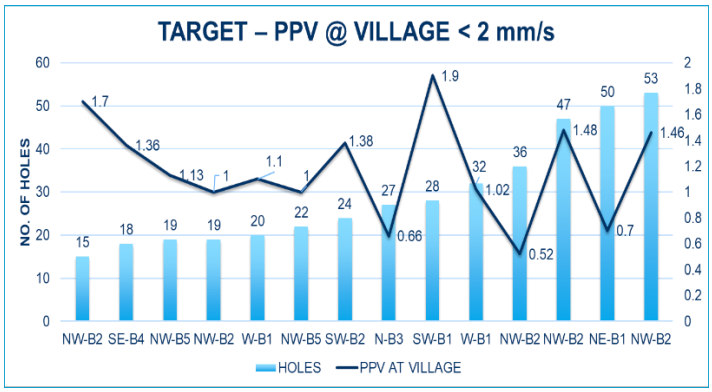

Figure 1: No. of Holes Vs PPV at Village

The Result

The following benefits were realised:

- Blast size in the severe zone of the mines was increased three-fold with Peak Particle Velocity (PPV) not exceeding 1.5 mm/s at POIs.
- The blast size in the critical zone was increased to 30 or more holes and 50 or more holes in the safe zone, which would generate at least 11000 tonnes and 16000 tonnes respectively, from a single blast.

Increased Blast size with Controlled Vibration Levels JK Cement Works, Nimbahera

- With deck blasting in the severe zone, the benchmark PPV of 1.5 mm/s was achieved at 300 metres with increased holes.

- Mine-wise Drill & Blast designs were established to be followed by the mines to continue achieving desired results.

Testimonial

Orica has been highly supportive in meeting our production requirements. After in-depth understanding the criticality of the situation, they have developed models for all our working benches, which has helped in increasing the blast size by controlling the ground vibration levels at the area of concern.

Manish Toshniwal, Assistant Vice President (Mines)
JK Cement Works, Nimbahera

Acknowledgements
Orica wishes to thank JK Cement Works for providing the opportunity to conduct the study on field and for the coordination aiding us to make this study successful. We also extend our gratitude for their support and permission to publish this case study.

Author: ORICA INDIA
Date: 01-10-2019