Site Profile

Boral’s Mugga Lane Quarry is located near the border of New South Wales (NSW) and the Australian Capital Territory (ACT). The quarry produces aggregates and road base for the Canberra Region within the ACT.

The Situation

Orica Technical Services was called in to give advice and design a blast coming up at the quarry. The blast was situated directly in front of the main conveyor system in the quarry and was surrounded by unbroken rock. It was also approximately 20 metres from the main crusher. The required shot ranged in depth from three to thirteen metres.

Technical Solutions

As no site law had been developed for the site the vibration coefficients could not be determined accurately. Due to the time constraints there was no opportunity to complete the process prior to the blast.

Based on the rock type and the location of the blast in relation to the infrastructure a conservative k factor coefficient for vibration prediction was used:

\[ V = 1500 \left( \frac{R}{Q} \right)^{-1.6} \]

Where \( R \) = dist. (m) \( Q \) = mass (kg)

Using the above equation it was found that a single hole firing was still above the allowable vibration limit for the infrastructure. Some changes to the design were required. In order to reduce the vibration travelling behind the shot towards the conveyor system a presplit line was run along the back of the blast on the side closest to the structure. This served two purposes; since it was a final wall blast it helped to create a smooth wall, and the crack produced from firing the presplit prior to the main blast would act as a barrier against transmitting blast vibration towards the structures.
A crush zone was also designed into the blast to further minimise vibration. The last two production rows had charge weights reduced to the required MIC (maximum instantaneous charge) based on the vibration prediction. These were designed by Orica’s Technical Services engineers to be fired before the main shot to create a crushed zone and limit the vibration travelling backwards from the shot.

The blast was fired using Uni tronic™ detonators whose timing flexibility allowed the crush zone design to be executed. Centra™ Gold bulk explosive was loaded into the main pattern which contained water, and Senatel™ Powersplit™ packaged explosive was used for the presplit.

The blast was fired successfully with the PPV (peak particle velocity) at the conveyor recorded at 38.8mm/s, well below the limit of 100mm/s. Without the crush zone in place the expected vibration was calculated to be up to 135mm/s.

The shape of the vibration trace (Figure 4) was as expected with the initial peak representing the presplit and the following peaks resulting as the holes became deeper and greater charge weights of Centra™ Gold were initiated.

The vibration recorded at the crushing plant was 14.15mm/s. The blast had good muckpile shape overall with a consistent heave. There was no flyrock produced and very little material left the immediate surrounds of the blast.

Acknowledgements
Orica Mining Services would like to acknowledge the support of Brendan Armstrong and Boral Mugga Lane during this project.