

High-wall Control at Anglo Gold Ashanti, Navachab Mine

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Abstract

Navachab Mine experiences difficulties with pit wall stability in certain areas of the mine. The main reason for the instability is the fact that the geology comprises many joints and faults. Blasting, without impacting negatively on the stability of the pit walls, poses a major challenge.

The mine has installed a technologically advanced seismic monitoring system with monitoring sensors positioned at various locations and depths throughout the pit. The electronic data recording system records all relevant information on a continuous basis with early warning signals in cases of potential danger. From the information recorded by this micro-seismic system it was established that the energy release into the high-wall is predominantly influenced by the mining rate, water content and mining tempo and to a lesser extent by the blasting operations.

To limit the negative effects of blast vibrations, the use of Electronic Delay Detonators (EDDs) was introduced. The optimal delays were determined through signature trace analysis. The vibrations obtained during blasts initiated by means of electronic delay detonators were monitored and compared to those traditionally obtained when standard pyrotechnic delay detonators had been used. The measured vibration data indicated an improvement of 25% to 100% drop in vibration amplitude compared.

The accuracy and programmability of EDDs presented huge potential for blast optimization in terms of limiting the vibrations without compromising fragmentation.

The whole project was conducted over a 12 week period with some 4000 EDDs. The average size of a blast was in the order of 350 holes using about 40kg explosives per hole, which equates to 14,000 kg explosives over 12 different blasts.

The paper deals in detail with the blast optimization process with regard to:

- determining the rock response time;
- establishing the signature traces;
- analyzing the wave interference patterns;
- predicting the direction of constructive and destructive wave interferences;
- optimizing of the inter-hole and inter-row delay periods;
- measuring the ground vibrations.

The results obtained during electronic blasting are compared to those obtained during pyrotechnic blasting. Comparisons are being made with regard to the following:

- ground vibration measurements;
- pit wall stability measurements;
- blast safety.