Differential Energy™ in Surface Gold Mining

Project Summary

INCREASE PRODUCTIVITY AT REDUCED COSTS

Dyno Nobel's Titan ∆E 1000 was trialed over a period of four (4) months at AngloGold Ashanti's Cripple Creek & Victor Gold Mining Co. (CC&V) in Cripple Creek, Colorado. Performance of the Titan ∆E 1000 product was measured against typically loaded production blasts of similar size, in similar geology. Blast designs (drill pattern and blast hole sequence) for the performance and baseline blasts were not altered during the trial, and all blasts, except for one, were initiated using Dyno Nobel's DigiShot® Plus electronic initiation system.

Measured results confirmed that significant value in productivity, cost and blast performance were delivered. The mine reduced its overall powder factor by 18%, realized an 8% increase in shovel productivity in both waste and ore, and in the case of ore, experienced no reduction in crusher throughput. Additionally, they completely eliminated visible NOx after blast fumes in even the wettest areas of the pit.

Background

NEWEST TECHNOLOGY OR DIRECT REPLACEMENT

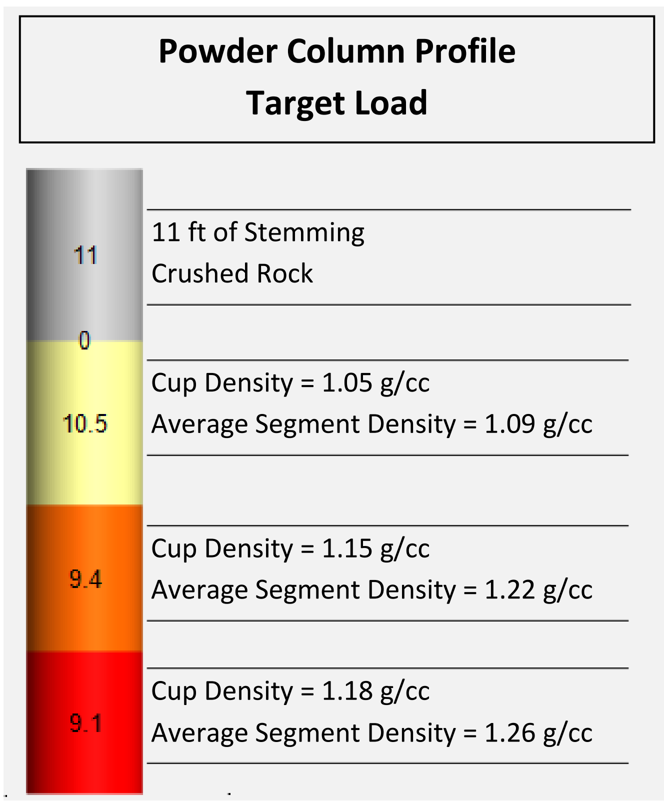
The mine's existing fleet of bulk delivery equipment was ready for replacement. It was an opportune time for mine management to evaluate upgrading equipment with Dyno Nobel's Differential Energy technology against direct replacement of old delivery equipment.

Over the past 10 years or more, the mine has been using Dyno Nobel Titan 2050G (chemically sensitized Heavy ANFO) and Titan 2070G (chemically sensitized repumpable emulsion ANFO blend). Production drill holes at the mine are 40 feet deep with a 6 ¾ inch diameter. Burden and spacing varied depending upon geology which was primarily Breccia and Precambrian.

Technology Applied

DIFFERENTIAL ENERGY™ TECHNOLOGY

Using Titan XL 1000 emulsion and a bulk truck with Differential Energy technology, the blasters were able to precisely load three (3) different density segments into a blast hole, improving material fragmentation.



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The target was to optimize the energy distribution in the holes by putting a heavier density emulsion explosive at the bottom and a lighter density up top. To do this, the bottom, middle, and top segments of the emulsion explosive column were respectively loaded with cup densities of 1.18, 1.15, and 1.05 g/cc.. Due to hydrostatic pressure, the average density of each segment in the hole was respectively 1.26, 1.22, and 1.09 g/cc.

The same Titan ∆E 1000 product was loaded into both wet and dry holes. In dry holes, the hose was placed 10 feet past the collar of the hole and then loaded. In wet holes, the hose was lowered to the bottom of the hole and then auto-retracted as the hole was loaded.

Value Added

PUT POWDER WHERE IT IS NEEDED!

Using Differential Energy technology, overall powder factor was reduced from 0.82 to 0.67 lbs/ton. Limiting higher explosive energy and detonation pressure to the bottom of the hole helped break the toe. Putting a lighter density, lower energy, lower detonation pressure explosive load in the upper portion of the hole, improved explosive distribution throughout the rock. This allowed the mine to reduce their overall stemming by 17%.

INCREASE PRODUCTIVITY

Shovel productivity was measured in tons/hr and increased overall by 8%. At the same time, there was an overall increase of 1% in the primary crusher throughput.

ELIMINATE NO_x

Post blast NO_x fumes were readily apparent when the mine's normal Heavy ANFO blends were used in rock that was damp, wet, and unconsolidated. The Titan ∆E 1000 blasts showed no visual signs of NO_x in any areas.

Figure 1 (L-R) Baseline blast fumes vs. Titan ∆E blast fumes

REDUCE AN DISSOLUTION

Titan ∆E 1000 has excellent water resistance. As a result, it limits the amount of ammonium nitrate that can dissolve in run-off and groundwater. The Heavy ANFO bulk delivery trucks left roughly 6% of the total powder weight loaded around the collar, which makes it available to contaminate groundwater. Titan ∆E 1000 eliminated this problem with bottom up loading.

Figure 2 (L-R) Heavy ANFO after loading vs. ∆E after loading

DISPLACE, DON'T DEWATER

With Heavy ANFO blends, the mine was required to dewater wet holes before loading. With Titan ∆E 1000 there was no need to dewater. The blaster simply put the hose down to the bottom of the hole and loaded the hole, effectively displacing the water with Titan ∆E 1000. This eliminated the need for the dewatering truck and significantly reduced the overall loading time for wet holes.

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