Rocklock Strikes Gold in Fairbanks

6.75-IN ROCKLOCK STEMMING PLUG FIELD STUDY	
APPLICATION	Gold mine in Fairbanks, Alaska
TESTING	Rocklock stemming plug vs. stemming only
BLAST DESIGNS	Rocklock used in 48 holes of a 156-hole production blast; Series of 4 single hole tests - 2 using Rocklock and 2 with stemming only
RESULTS	Rocklock helped the stemming to better retain the expanding gas pressure pulse and reduced stemming ejection. Rocklock improved rock fragmentation, muckpile uniformity and overall blast performance. Additionally, the cold-weather testing confirmed that Rocklock's durable design stands up to handling and loading in extreme cold, which was an initial concern of mine operators.

Using an independent consulting firm, ABTI commissioned a series of Rocklock field tests held at a Fairbanks, AK, gold mining operation. The scope of these tests was to document our plug's effectiveness in enhancing the performance of stemming material to better contain the blast energy.

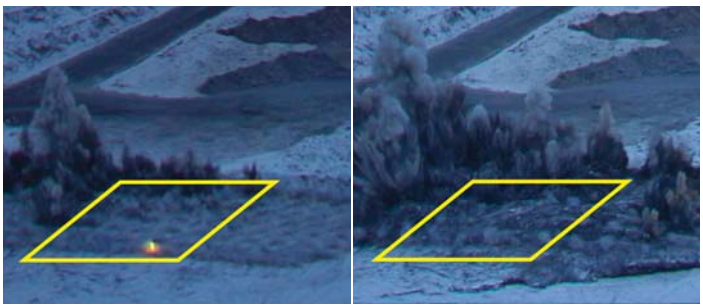
These tests were designed to answer the following questions:

1. Do Rocklock stemming plugs introduce a discernable difference in the blast's performance in terms of energy containment and reduced vertical burden movement?
2. Do the stemming plugs improve the overall rock fragmentation of the blast?

In phase one of the Fairbanks tests, 48 holes of a 156-hole production blast detonated at Mining Level 1240 were loaded using the Rocklock stemming plugs. The 6.75 inch blast holes were drilled to a depth of 33 feet and loaded with 21 feet of ANFO. Most of the holes were stemmed using 1.25 - 1.75 inch crushed rock. However near the center holes of the production blast, technicians used Rocklock plugs in addition to stemming material.

To document Rocklock's effectiveness in containing the gas energy, technicians filmed the blast using a standard digital video camera from a vantage point above the blast site. Upon review of the footage, the video data shows that the portion of the blast loaded with the stemming plugs contained the gas energy much better than the holes stemmed only using crushed rock.

Images of the Rocklock holes detail the progression of the blast and the bench heave caused by the expanding gas energy pulse. The area of the bench containing the stemming plugs exhibited a noticeable reduction in the amount of stemming ejection as do the holes on either side of this zone.



The 48 holes using Rocklock stemming plugs (highlighted) show an increase in gas energy containment.

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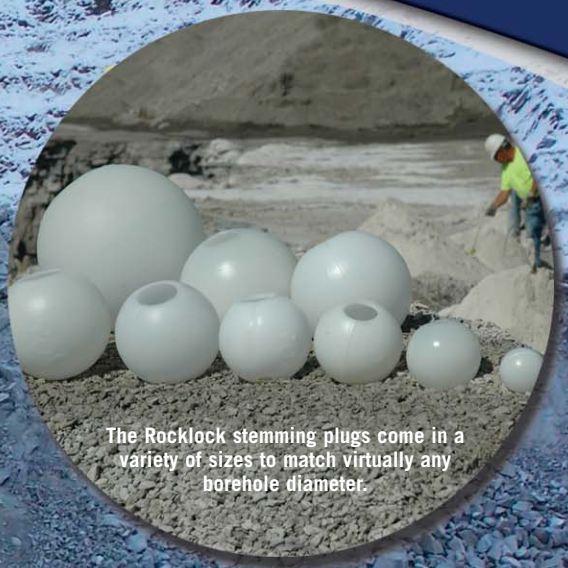

The Rocklock stemming plugs come in a variety of sizes to match virtually any borehole diameter.

The Rocklock section produced a higher muckpile with more uniform rock fragmentation

Following the blast, the consultants noticed that the muckpile in the area containing Rocklock plugs was more uniform. Vertical swell was also noticeably higher than the non-plugged areas of the blast. As the muckpile was excavated and the face row exposed, an increased vertical swell was apparent in area of the blast loaded with Rocklock stemming plugs.

Increased vertical swell indicates this area of the muckpile was heaved higher than the stemming-only areas of the blast, which implies that rock in this area was exposed to a more sustained gas pressure pulse due to the more effective confinement of the expanding gasses. This has resulted in the muckpile being stacked higher with the fragmented rock in a more unraveled condition.

INCREASED RETENTION TIME

The scope of the work in phase two of the Fairbanks gold mine tests consisted of four single-hole test blasts. These tests were designed to compare and quantify the retention times of holes loaded with and without stemming plugs. Two of the holes were loaded using only crushed rock stemming and two were fired using Rocklock plugs and crushed rock stemming.

For documentation, these blasts were filmed using a digital video recorder and a high speed digital video camera. The 6.75 inch blast holes were drilled to a depth of 33 feet and loaded with 21 feet of ANFO. Detonation signals were positioned at the collar of each hole in order to determine the firing time of the booster.

The consultants conducted image analysis of the high speed video to determine the time (ΔT) between the initiation of the explosive column (Time Zero or T0) and the initial first movement of the overburden (Tmin).

Retention times for the series of four tests are as follows.

Test ID	ΔT ms
Test 1	No Plug - 16 ms
Test 2	No Plug - 16 ms
Test 3	Rocklock plug - 20 ms
Test 4	Rocklock plug - 24 ms

The analysis revealed that the holes using Rocklock plugs increased the retention time from 4 to 8 ms. Increased retention time suggests that the stemming zone of the hole could be reduced. This would enhance the energy distribution and reduce the amount of oversize typically generated in the overburden zone of the blast.

IMPRESSIVE RESULTS

Data gathered from the series of Fairbanks tests confirm that **Rocklock stemming plugs** deliver a more controlled bench swell and **reduced stemming ejection**, increasing the effectiveness of the stemming **to better retain the expanding gas pressure pulse** of a blast. Additionally, Rocklock increases muckpile vertical swell and rock fragmentation. This indicates that the plugs do increase the overall performance of the blast.

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