CASE STUDY

HIGHWALL STABILITY IMPROVEMENT THROUGH LESS BLAST VIBRATION AND DISPLACEMENT

BACKGROUND

HIGHWALL DETERIORATION LEADS TO POTENTIAL HAZARDS

At this Western U.S. surface coal mine, cast blasting is done in all dragline pits. Bench heights are from 150 feet to 200 feet. The geology consists of clay, shale, sand, coal rider seams, and occasional rock lenses. Water conditions vary from dry to severe.

Due to the above mentioned conditions coupled with sleep time from start of loading to blast time, highwall deterioration may occur. This poses a hazard to those working under the wall during the coal drilling, blasting, and removal. Damage to the highwall from blasting is often cited as a contributing factor to highwall instability.

In an effort to minimize highwall damage associated with blasting operations, vibration reduction has been sought as a means to reduce damage to the new highwall created by each cast blast.

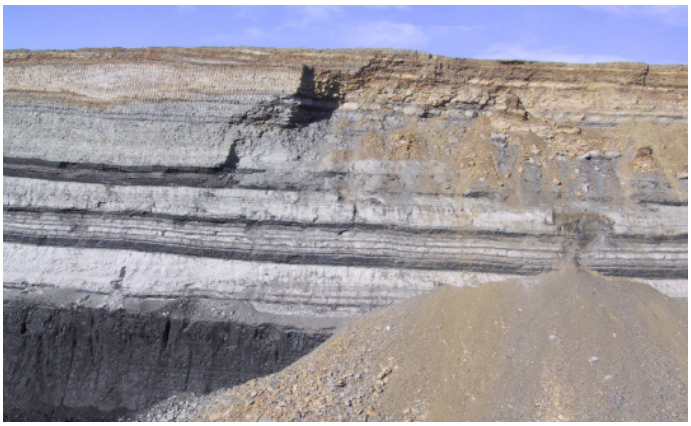
TECHNOLOGY APPLIED

DYNO 42 SOFTWARE WAS USED TO PICK THE BEST DELAY SEQUENCE THUS REDUCING THE POTENTIAL DAMAGE TO THE HIGHWALL

Current delay sequences have been chosen based on giving good effective cast performance. The impact of vibration was only addressed if there were engineered structures such as power transformer stations or gas wells in the area.

Usually peak particle velocity (PPV) was the only vibration measurement that was considered. Now, particle displacement is being reviewed with respect to influence on final highwall conditions post blast.

After shooting a signature hole, delay times were chosen to minimize vibration and particle displacement. A blast was divided into two sections. A seismograph was set up 523 feet behind each shot. The first section was shot with delay times derived from DYNO 42 software analysis with a priority of reducing overall vibration and displacement while still maintaining nominal cast results. The other section was shot using progressive timing that was chosen by a competitor for maximizing cast with no regard to resultant vibration effects near field or far field.



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RESULTS

DYNO 42 SOFTWARE ADDS VALUE BY REDUCING PPV AND DISPLACEMENT

The first shot that used the DYNO 42 software had PPV of 7.84 inches per second. Displacement was .40 inches. The second shot that used progressive timing had a PPV of 9.84 inches per second. Displacement was .52 inches. There was no appreciable difference in effective cast benefit. The results of this test indicated an approximate reduction in peak particle velocity and associated particle displacement of twenty percent (20%), again with no discernable impact on effective cast.

NEXT STEPS

VIBRATION MEASUREMENTS WILL BE TAKEN AT THE NEW HIGHWALL, APPROXIMATELY 40 FEET BEHIND THE BACK ROW OF THE CAST

An 80 inch per second geophone will be buried behind the cast where the new highwall will be. The seismograph reading will be a baseline. Future shots will use DYNO 42 software to choose delay sequences that should reduce vibration. Wall stability will be watched for any changes.

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