UNDERGROUND CASE STUDY

Increasing Tunnel Advance Rates with Dyno Nobel's Electronic Initiation System

PROJECT SUMMARY

HYDROELECTRIC TUNNEL PROJECT

Procon is responsible for executing all the underground rock works for the AltaGas Forrest Kerr project; a 195 MW run-of-river hydroelectric project.

The project is located in British Columbia, approximately 1,000 km northwest of Vancouver.

The project will capture a portion of the Iskut River energy produced by the natural water flow and elevation drop to produce and deliver clean, renewable electrical power to the grid at Bob Quinn Lake via British Columbia Hydro's 287-kV Northwest Transmission Line.

Dyno Nobel's electronic initiation system is being used for 5m deep rounds for approximately 2,000m of the 9.6m wide x 9.8m water diversion tunnel.

Initially a smaller 5 x 6m relief tunnel was conventionally blasted in the top middle section of the larger tunnel excavation.

Jumbo drill in heading at Forrest Kerr.

PROJECT GOALS

INCREASE TUNNEL ADVANCE RATE

The principal goal was to demonstrate electronic initiation could be construction miner friendly and efficient to improve the overall advance rate of the underground tunnel.

Faster advance rates would also result in overall lower operating costs and help the project better meet timelines.

TECHNOLOGY APPLIED

USING DYNO NOBEL'S ELECTRONIC INITIATION SYSTEM

Improved productivity is realised using high precision timing from Dyno Nobel's electronic initiation system.

The accuracy of the electronic detonator is 0.02% over the entire timing range (0 – 20,000ms) compared to NONEL, which is in the order of 2% variance of the period delay time.

Key features of the electronic initiation system include the ability to:

- check the status of all detonators before programming, arming and firing allows the blaster to address any problems prior to the blast event;
- pre-program the timing of the development rounds based on engineer recommendations and experience, and;
- adjust timing at the face based on lost holes and misplaced drill holes.

These features provided Procon with no priming failure errors and no surface hook up errors compared to conventional initiation systems.

The development rounds were able to be primed, loaded, hooked up, and tested for leakage and failures within the same amount of time.

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Operators charging the face.

VALUE ADDED

GREATER BLASTING CONTROL AND EFFICIENCY

Using the electronic initiation system, the underground tunnel advance rate was increased with the elimination of 1m booted holes.

The rounds consistently pulled >95% with half barrels visible on nearly most perimeter holes.

Compared to traditional NONEL LP timing, the electronic system was able to deliver important benefits including:

- reduced scaling time (average scaling time went from three hours to less than one hour),
- increased fragmentation, resulting in faster mucking times and higher bucket fill rates,
- reduced overbreak, half blastholes were consistently visible on nearly all perimeter holes within the round, the only time the perimeter half blastholes were not visible was due to overbreak to a geological fault running within 1m of the perimeter wall.
- simplified inventory (only 1 detonator product instead of 19 delay periods) and;
- improved fragmentation provides an opportunity to reduce the number of holes drilled and loaded, increasing overall productivity while reducing drilling and loading costs, without increase time.

The electronic initiation system helps yield consistent results by:

- improved loading accuracy, timing pattern provides double check to insure all drilled holes are loaded, (using conventional LPs, 1 to 2 holes on average were being missed),
- eliminating operator variability in timing of rounds (same times are used for all rounds, they are pre-programmed into blast box) and;
- ensuring all loaded detonators are connected using the electronic initiation equipment for testing and verifying of detonators (on random audits using conventional LPs, 1 hole on average was not hooked up and 2 to 3 holes were hooked up in an unreliable initiation position).

The electronic initiation system proved to be user-friendly for this large civil construction project and dramatically increased the overall efficiency of the tunnel advance rate, while improving safety and perimeter control, plus reduced booted holes.

Face Tie-In.

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