

STAR-ORION SOUTH DIAMOND PROJECT

PRINCE ALBERT, SASKATCHEWAN, CANADA

In 2018, Star Diamond Corp. announced the positive results of the independent Preliminary Economic Assessment (“PEA”) on the Star and Orion South Kimberlites, located in central Saskatchewan about 60 kilometers east of the city of Prince Albert. The PEA estimates that 66 million carats of diamonds could be recovered in a surface mine over a 38-year project lifespan.

Star Diamond needed to accurately determine the volume of the record setting excavations. The volume was necessary to calculate the yield from the bulk sampling process. Concern that initial exploration sampling methods had negatively influenced the first site evaluation drove the selection of the second site evaluation excavation method to a hydro-mill. Validity of the second evaluation process depended on the accurate measurement of the excavation volumes in the vein of interest. Adding to the challenge, the veins zone of interest lay deeper than 350 feet and extended to almost 800 feet. An accurate

dimensional measurement of an 800 feet deep barrette was needed for a true preliminary economic assessment.

Fugro Loadtest along with DGI Geoscience provided SONICaliper equipment and personnel to perform the excavation surveys. These were the deepest hydromill panels to be profiled with the SONICaliper. The accelerated schedule required it to be deployed using two cables (100 and 200 meters) connected over the excavation. The SONICaliper accurately determined the shape with 360-degree data collected in a single pass.

PROJECT INFORMATION

- Owner: Star Diamond Corporation
- Client: Rio Tinto
- Completion Date: November 2019

SERVICES PROVIDED

- SONICaliper shaft inspection

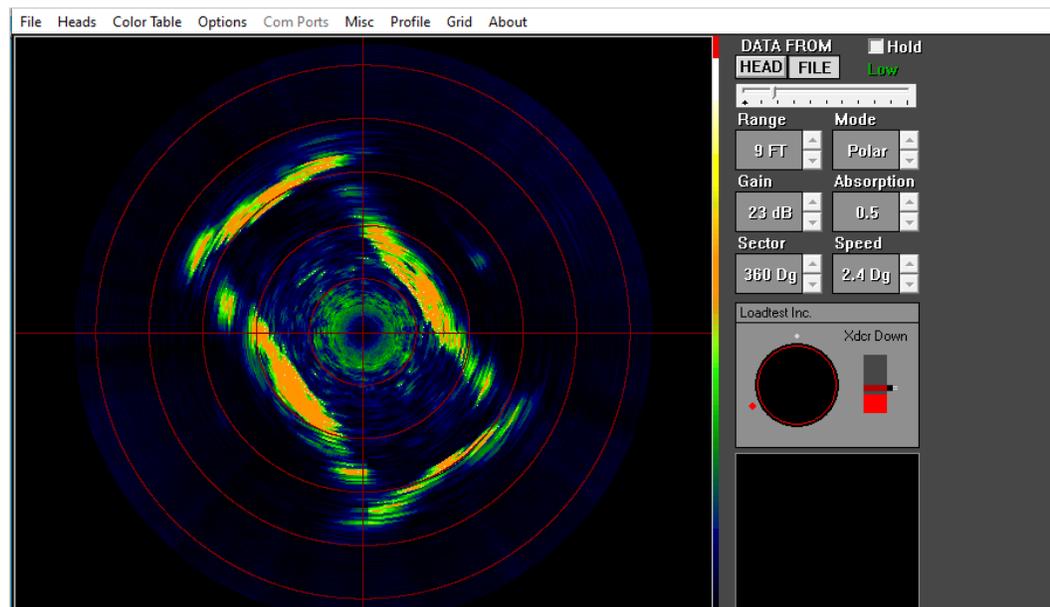
SONICaliper characteristics fit the project's needs.

- Self-suspension as a plumb bob
- Extendable cable while in use
- Rotating data head gathering 400 points in 360-degree rotation
- Error calculation and calculated volume output

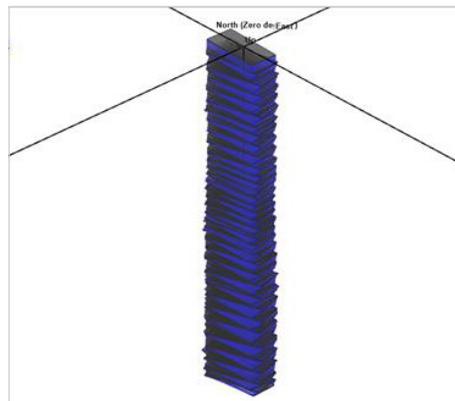
Adding to this, the SONICaliper capability to not only measure circular caisson excavations, but its ability to measure rectangular barrettes and slurry wall dimensions made it the tool of choice for the project.

When the hydro-mill excavations were made the slurry was extensively cleaned of particulate, with that from the vein of interest retained for mineral evaluation. SONICaliper inspections were then made of the extreme excavation, splicing cable extensions into the system as needed.

SONICaliper measurements, calibrated to known dimensions at the surface, proceeded at general 4-foot vertical spacings until the vein of interest was reached when the measuring interval became a 2-foot spacing. Performed in November 2019 these hydro-mill panels are the deepest ever profiled by SONICaliper.



SONICaliper's real-time results



Excavation model



CASTING PIT FACILITY

MICHIGAN, USA

An aluminum production facility engaged Fugro Loadtest for assistance with installation of equipment at their Michigan facility. This excavation was not for a foundation load-bearing element, but, was to house a large hydraulic cylinder, making verticality a very critical construction component.

After unsuccessful attempts to insert a permanent inner casing into a nominal 60-inch shaft excavation being built inside a production facility, the client called on Fugro Loadtest to use SONICALIPER™ to determine the shaft excavation's verticality. The initial excavation construction was drilled to a depth of 65 feet with plans to insert a 46-foot, 65-inch diameter oversize temporary casing for the upper part of the excavation followed by a 29-foot, 53-inch diameter inner casing to the tip of the excavation. Insertion efforts of the upper casing had proven unsuccessful.

The initial two SONICALIPER passes revealed that the auger had wandered more than 18

inches off-center as drilling progressed.

Figure 1 shows the existing excavation cross-section from these initial inspection passes. As this was a feature for the existing facility, moving the location and starting over was not an option; the excavation had to be remediated.

The contractor employed an eight-foot 60-inch diameter core barrel for the excavation verticality remediation efforts. During these actions the excavation depth incrementally increased to 73 feet. Four additional SONICALIPER inspections occurred at periodic intervals during the remediation efforts to document that

PROJECT INFORMATION

- Owner: Confidential
- Client: Confidential
- Completion Date: 2009

SERVICES PROVIDED

- Verticality determination of 73-foot drilled shaft
- Real-time monitoring of shaft remediation
- Quality control/quality assurance

verticality was improving to specified requirements. Figures 2 and 3 show the verticality remediation improvements.

After the excavation was deemed to meet verticality requirements a specially designed closed end inner casing was placed to the excavation bottom. SONICaliper was again employed to verify the verticality of this casing within the excavation. Four additional SONICaliper passes were required to confirm that the special inner casing was in position for grouting in place. Because of the verticality issues the client wanted the location of the special casing monitored during grouting to ensure that detrimental movement did not occur. The SONICaliper was suspended at a 45-foot depth during the grouting operations to monitor movements. To gather the most precise data recording speed was slowed significantly during the 4 to 5-hour grouting process. Typical movements during grouting showed encroachment hovering at 0.08-inch and off-center measurements of about 0.05-inch. Figure 4 shows the inner casing profile during grout monitoring. After final grouting encroachment settled to a 0.1-inch measurement. A final SONICaliper pass of the entire casing ensured that verticality specifications were met.

A very significant detail provided by this rigorous exercise was verification of SONICaliper Technology data repeatability. For eleven passes during nearly five continuous hours the SONICaliper produced congruous measurement data of the excavation characteristics, including consistent location of a large sidewall collapse. This is an example of the accuracy, repeatability and versatility of the SONICaliper Technology.

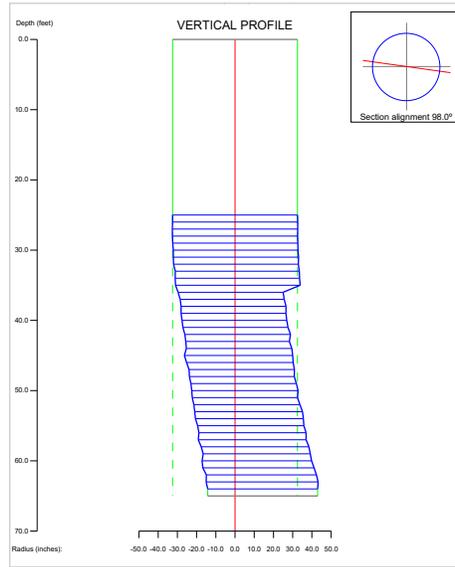


Figure 1 – SONICaliper profile - pass 1

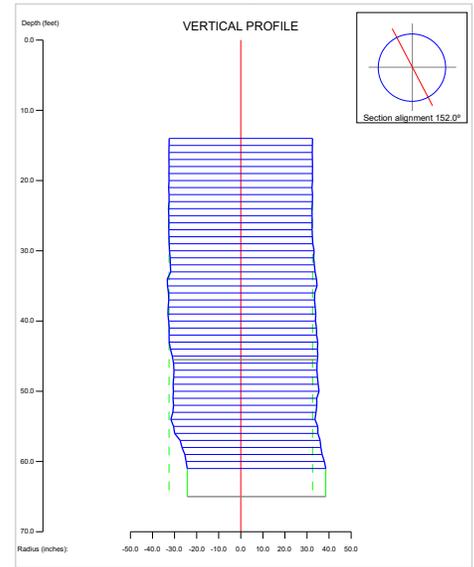


Figure 2 – SONICaliper profile - pass 3

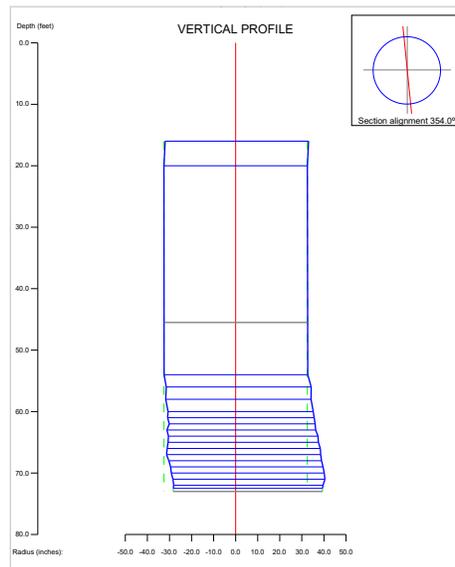


Figure 3 – SONICaliper profile - pass 6

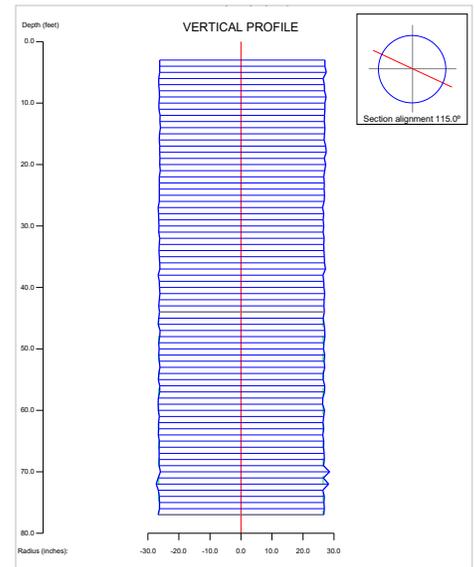


Figure 4 – SONICaliper profile – grout monitoring