Application Spotlight

Ground Stability Investigations

Key Words: ground-penetrating radar, ground stability, turnaround

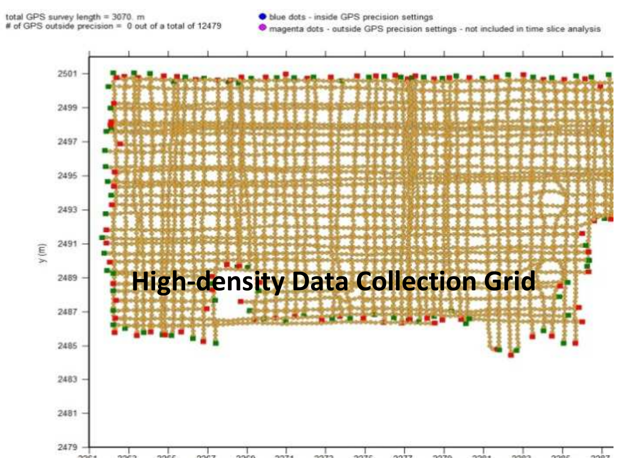
CASE STUDY: As part of maintenance activities, industrial sites often require large cranes to be placed in various areas around roadways and process units. In order to ensure safe crane placement for critical lifts, engineers and geophysicists employ Maverick to provide the quality of data needed to determine ground stability at depth. This application spotlight is from one such subsurface investigation, and it highlights the combination of efficiency and diligence that sets Maverick apart.

THE SOLUTION: A series of Ground Penetration Radar (GPR) scans were conducted over the course of several weeks, as areas became available. The systems that Maverick Inspection Ltd. utilized on this project are the Noggin250® and the Noggin500® made by Sensors & Software Inc.

The units operate at frequencies of 250MHz and 500MHz respectively. Where steel-reinforced concrete was present, the Noggin500 was generally selected. The improved resolution of the Noggin500 compared against the 250MHz system allows information to be gathered between and below the rebar with higher fidelity, and allows us to better image the shallow voids and unconsolidated soils which frequently form beneath concrete slabs. Where steel-reinforced concrete was not present (gravel pads, asphalt, grass or similar areas) the Noggin250 was selected. The 250MHz system and the 500MHz system are both limited by soil conditions, but the 250MHz system is designed to provide information at greater depth. Small and shallow voids are commonly found beneath concrete pads, but voiding beneath asphalt and gravel pads tend to be larger and deeper and the 250MHz GPR unit has historically proven to be effective in these conditions.

Additionally, the units were connected to a Robotic Total Station (RTS) system, allowing us to very accurately measure distances and locations of areas of concern in the following manner. The RTS Base-station was positioned at known points relative to plant-grid. Plant-grid locations were established by examining surveyed points and locations. Where northing and easting co-ordinates were available, these were used as preferred measurement points. Where such points were not readily available, Maverick consulted the supplied maps and drawings which contained plant-grid reference points. If no available measurement points were found in the immediate area to be scanned, then RTS transit procedures were used so that the RTS position could remain fixed to plant-grid with relatively low margins of error.

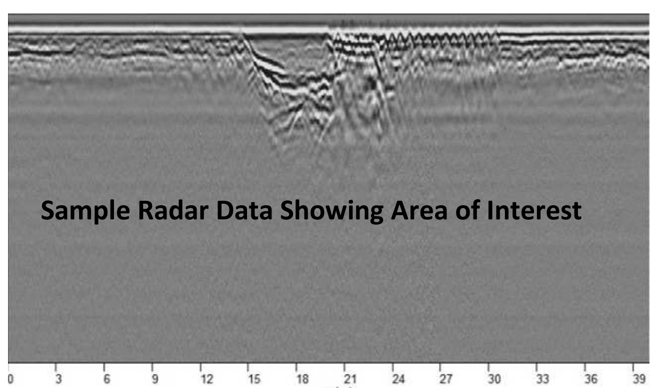

Robotic Total Station (RTS)



High-density Data Collection Grid

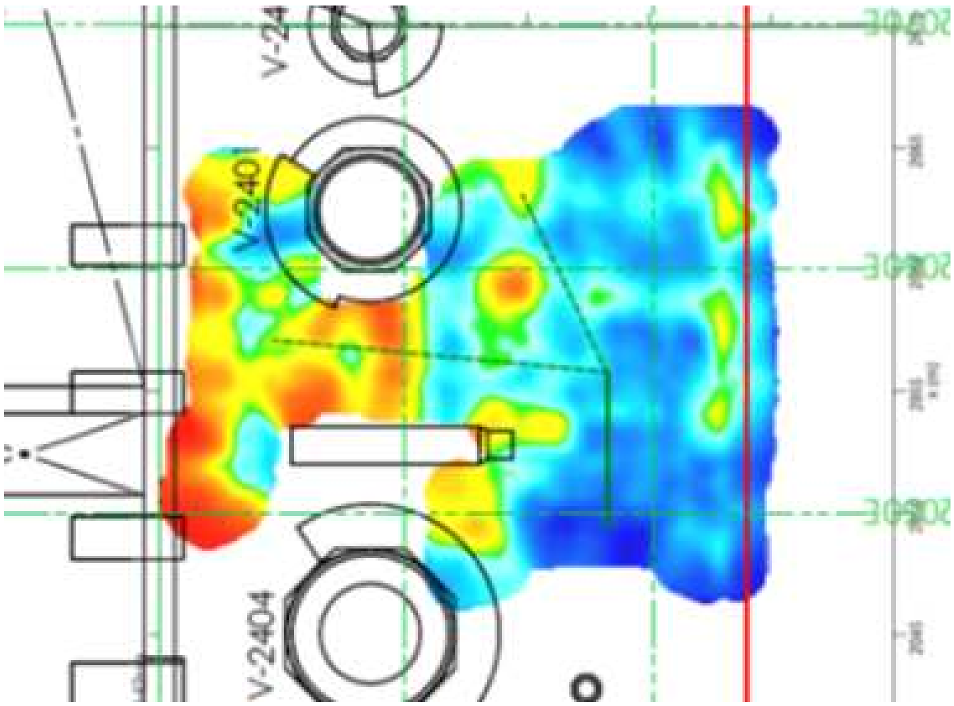
Furthermore, data was gathered in a controlled X/Y-axis grid throughout the planned scan area. The grid lines were spaced at 0.5m in each direction, which provided relatively high data density, which allowed us to image subsurface voids as small as 0.5m diameter.

Finally, the units were also connected to a "Digital Video Logger" (DVL) which captures and displays the data which can be viewed in real time, and can be transferred to a laptop or PC. Upon completion of the data-gathering process, the information was transferred to a removable storage, and was then transferred to a Maverick Inspection Ltd. PC workstation for additional analysis and review, using software applications.



Sample Radar Data Showing Area of Interest

Once collected and processed, the data was examined for specific target types which might typically represent hazards to planned crane-lift activity. Specifically, the data was examined for void-like targets in the shallow subsurface as well as shallow utilities which may act as man-made voids and collapse if exposed to extreme surface loading.



In the Above picture, reflectivity is color coded, with greater reflectivity being represented by colors closer to the red spectrum. In this case, the indication was that the more reflective areas, were likely to be of concern, in other words, high risk areas are indicated by reds, where blues are unlikely to contain areas of voiding.

An engineering and safety determination was able to be made based on the quality of the results. Not only was a subsurface scan performed, with features noted by the technician, but a report with positional data and maps was made available. This allowed the right stakeholders to make decisions based on verifiable data presented in a clear and appropriate manner.

For applications such as critical crane lifts, Maverick prefers providing quality subsurface imagery and results, mapped with accuracy, to simply providing real time field markings. **Determining whether or not a heavy crane should be set up in a particular place is an engineering and geophysical determination.** For the marking of utilities, storage tanks, and other such features, real-time staking and marking is the preferred method. The data gathering and reporting for utility locating vs. critical crane lifts will have different procedures and reporting requirements.