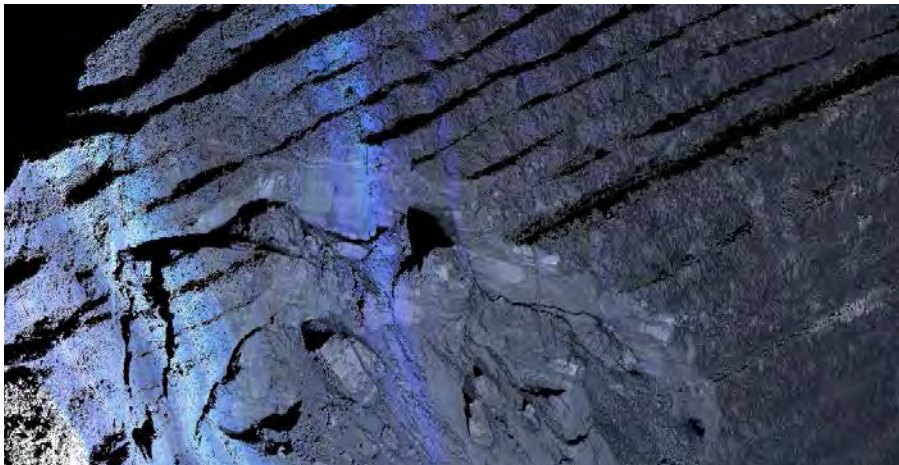# Survey solution for safety offsets

When sites need accurate mapping of the interface between underground and open pit operations, the Maptek™ I-Site™ laser scanner provides detailed survey data.

Modelling the interaction between underground and open pit operations helps to ensure that safety offsets meet regulatory standards and allows development to proceed with confidence.

During 2014 the Sichuan Safety Science and Technology Institute combined 3D laser scanning with other measurement techniques for mine survey projects.

Laser scanning & TEM

Lanjian Iron Ore mine near Panzhihua City in Sichuan Province employs sub-level cave mining. Managing the interaction between open pit and underground workings is key to the ongoing success of the project.

The Institute combined laser scanning with transmission electron microscopy (TEM) to measure the thickness of material between surface and underground operations.

The Maptek™ I-Site™ 8810 laser scanner was used to survey the open pit. Surface digital elevation models generated from the point cloud revealed several locations where subsidence had occurred. These were then viewed alongside 3D models of underground tunnel sections created from existing survey data.

Using TEM, which focuses a beam of high energy electrons for micro-structural examination, the interface between the overburden and bedrock was determined.

This information was then combined with the 3D surface model to accurately calculate the covering thickness of transverse drifts in sections.

One of the biggest challenges was in registering the surface and underground data together. Once a surface local survey and control network was established, a total station was used to obtain coordinates of underground features, including scanning locations, back viewing points and TEM measurement points.

Finally, the surface and underground data were merged into the same coordinate system.

The combined laser scanning-TEM approach is suitable for stratigraphic and non-stratigraphic operations. It provides a relatively simple methodology for capturing data over a wide area and delivers accurate results.

Scanning & georadar

Chujiang coal mine, in Chengdu City, Sichuan Province is now used for safety training. When operational, longwall mining was used to extract coal.

The Institute conducted 40 scans over 3 days with the Z+F Imager 5006EX laser scanner. Data was also collected using georadar and total station. Georadar is a non-invasive geophysical technique for rapidly imaging shallow subsurface regions.

The areas surveyed included an underground parking area, inclined tunnel, pump house and substation. Two major issues arose during the tunnel survey.

First, manually lighting both the target and the total station was a slow process. The narrowness of the tunnel was also an issue. The 2.6m clearance had a major impact on the range and data accuracy by constricting the incident angle. The effective scanning range was reduced to only 20-40m, with poor data capture beyond that.

The study proved that combining laser scanning and georadar techniques provided accurately positioned data points (with an acceptable distribution of abnormal points). The method allows extraction of a centreline and sections of the tunnel for drawing up a surface-underground contrast plan.

The data is then exported into .dwg file format for conducting deformation analysis.

Laser scanning evidenced several advantages over total station when measuring underground sections.

The 3D laser scanner captured all of the tunnel. The resulting point cloud data is accurate and particularly detailed. If more section data is needed, the detail is already available in the point cloud.

Total station methodology requires about 10 points to be set from each section, but those points are not in the same plane. If more section data is needed, the total station needs to remeasure.

Summary

Changing conditions are the reality of mining. Updating mine plans is never more critical than where surface and underground mining intercepts. Sichuan Safety Science and Technology Institute proved that laser scan technology is a safe, effective system that delivers accurate results.

Thanks to
Sichuan Safety Science & Technology Institute