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Quarry

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SURVEYING TECHNIQUES ON SHOW AT GIPPSLAND QUARRIES

There are many different techniques that a surveyor may use to provide spatial data solutions for quarries. Several different surveying methodologies were employed on a project at two quarry sites in Tyers, Victoria earlier this year.

In February, Holcim approached land, engineering and aerial surveying consultancy Landair Surveys to determine volumes at its Tyers quarry and the neighbouring Latrobe Valley Sands quarry.

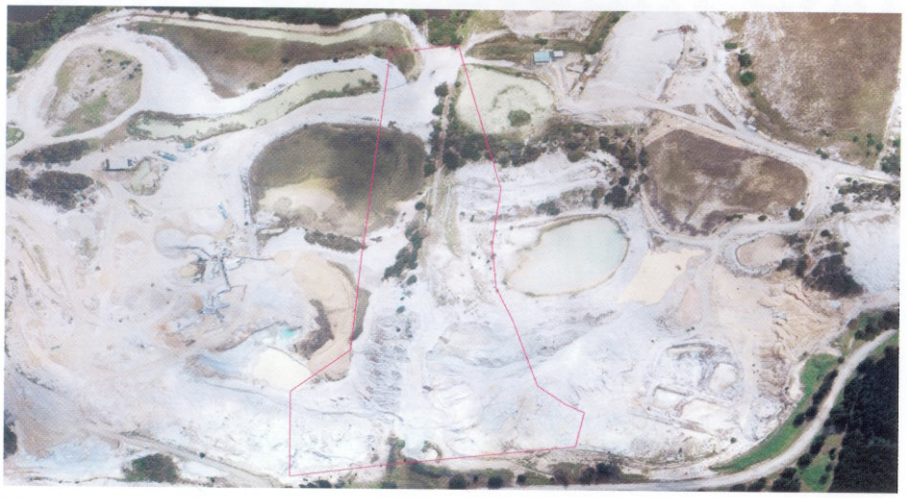
There is a common boundary between Holcim and Latrobe Valley Sands, with extraction currently taking place on both sides of the boundary.

Holcim and La Trobe Valley Sands wanted the survey of both land holdings for background record purposes and to provide detailed information for planning the single rehabilitated pit.

These sand quarries are located approximately 140 kilometres southeast of Melbourne in the beautiful Gippsland region of eastern Victoria. The town was named after 19th century Australian surveyor Captain Charles James Tyers.

The site to be surveyed was approximately 1000 metres by 600m in size and included water bodies, areas of thick vegetation, steep and rough faces as well as a typical open quarry environment. Due to these different environmental features, a number of different surveying methods were employed:

- Aerial photography and photogrammetry for most of the site, as this method allows for quick and inexpensive 3D mapping of large areas. From overlapping aerial photographs, features such as tops and toes of batters may be mapped in three dimensions to an accuracy of around plus or minus 10 centimetres (+/- 10cm).
- Total station survey for the thick vegetated areas as it is the only method that allows for accurate measurements under the tree canopies. The total station measures angles and distances to either a prism or a feature with an accuracy of around plus or minus five millimetres (+/- 5mm).
- GPS survey for open and safe access areas adjoining the common boundary. Survey grade GPS receivers require a base GPS receiver and a rover GPS receiver to communicate with each other to cancel out errors from satellites, resulting in accuracies around +/- 20mm for each point measured.
- Laser scanning survey was used for accurate measurements of the steep quarry faces adjoining the common boundary. Laser scanners measure up to a million points per second to features and provide extremely accurate three-dimensional models.
- A bathymetric survey was proposed to survey the areas under water. Bathymetric surveys determine the depth of dams and lakes to an accuracy of around +/- 10cm and use an echo sounder fixed to a boat in conjunction with a survey grade GPS receiver or total station. However, on arrival on-site, the water was identified as being only about 20cm deep so this method was not feasible.



The area inside red lines by land survey, the outside red lines by aerial survey.

Four surveyors completed the land survey work in one day. All of the data from the GPS survey, total station survey, laser scanning survey and aerial survey was combined to provide an accurate three-dimensional model of the site, including 3D lines representing linear features such as tops, toes, tracks and water bodies. This model was then used to calculate volumes.

There are many different methods surveyors use to undertake their work. It is important to recognise that there is not one single method or technology that can be used for all purposes. •

Erik Birzulis is the managing director of Landair Surveys.

A total station survey of vegetated areas.

Part of the common boundary between Holcim's Tyers and Latrobe Valley Sands quarries.