DON'T GET CAUGHT STANDING STILL

The future of mobile 3D laser scanners

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Technology is zooming ahead in leaps and bounds and mobile 3D laser scanning is no exception. Twenty years ago for 3D laser scanning, we needed a minivan to transport the 40-plus kilograms of boxes to site, which was an achievement in itself.

When turned on, the acquisition rate was an amazing 100 points per second. Today, the latest mobile 3D laser scanners weigh typically about 1kg and measure 300,000-plus points per second at distances of up to 100 metres. Mounted on a pole, the weight is similar to a GNSS receiver.

How mobile 3D laser scanners are deployed in the field has changed drastically. Until recently, they were typically a handheld unit. The user walks through the work area mapping line of sight objects within a 30m range.

Today, the one model of mobile 3D scanner can be deployed in the field in a variety of techniques including:

1. **Pole mounted** to pickup survey control, boundary pegs and other points of interest during the survey
2. **Suspended on a cradle** and being lowered into a shaft or manhole to depths of 250m
3. **Vehicle/quad bike** mounted and being driven at speeds of up to 50km/h
4. **UAV/drone** mounted and mapping the site from the air
5. **Integrating with customers' existing GNSS** for georeferencing without ground control

These recent developments have made the mobile 3D scanner ideally suited for land survey applications.

Field procedure on survey pole

Accuracy is similar to using GNSS. A root mean square RMS accuracy report is created showing errors relative to the survey control on site.

When arriving on-site, the initial setup time is similar to GNSS except it's a mobile 3D laser scanner being mounted on the survey pole.

The survey time is how long it takes to walk or run through the work area and measured in minutes, not hours.

During the survey it is recommended to tie into the existing survey control on site. Plumb the pole over the control point for 10 seconds.

The system automatically logs the point as a survey control point via the IMU detecting no movement for 10 seconds. A minimum of three points is recommended but the more the better.

During the survey, pick up any other critical points of interest such as boundary pegs by plumbing the pole over the peg and waiting for 10 seconds. Each of these points will be exported at end of survey as a CSV file.

At the end of the survey, to download the data just plug a standard USB memory stick into the device and the data is automatically downloaded to the USB stick. The download time is typically a few minutes.

Land survey applications

This technology is now suitable for a range of land survey applications including:

1. Daylighting surveys
2. Topographical surveys
3. Volumes
4. Construction progress monitoring
5. BIM/as-built
6. BOMA surveys

For a field survey, to 3D scan an established 800sqm section with an existing house and lots of vegetation, pickup survey control and boundary pegs, the measurement time is five minutes.

To survey the same site using GNSS would take a minimum of one hour. Some points are not suitable for measurement by GNSS so a total station would also have to be used adding to the survey time.

Sites that are heavily covered in vegetation are very time consuming to survey by GNSS or robotic. A mobile 3D laser scanner performs effortlessly in such demanding environments, making it a walk in the park.

Surveying a public area is always a challenge especially in inner city areas. GNSS often performs poorly in these areas and traversing with a robot is not fun. Lots of pedestrians and traffic are always in the way. Mobile 3D laser scanners do perform well in these environments.

Ground penetrating radar surveys (GPRS) to locate underground services and determine ground condition often rely on GNSS for positioning. This is often a problem in inner city areas where the GNSS performs poorly.

The mobile 3D laser scanner can be used for positioning of the GPRS system solving the GNSS outage issues. An accurate ground model is generated from the LiDAR data.

Surveys of roads are often performed at night. The mobile 3D laser scanner records grey scale intensity (reflectivity) for each of the 300,000-plus points per second that it measures.

When the 3D point cloud is rendered to display intensity in the office CAD system, any line work and paint marks on the road are clearly displayed.

The most complex surveys are often completed in a few hours, not days or weeks as in other methods of survey.

Office processing

From the field the data is copied to the office PC via USB memory stick, which takes a few minutes.

The SLAM office processing software is used to process the data from the field consisting of LiDAR plus inertial motion unit (IMU) data. It's a drag and drop process of the data into the software. Have a cup of coffee while waiting for the results.

The ratio of office to field for this is typically 2:1 so for the above example of a five-minute scan time for the 800sqm property, the SLAM processing time is 10 minutes. A 3D point cloud is produced in LAS/LAZ format.

Then apply adjust to control (A2C) to link the control points measured in the field to the real-world coordinates and an accuracy RMS report is generated.

Control points are imported/exported as a CSV file.

Critical points of interest such as boundary pegs are exported as a CSV file.

The 3D point cloud is automatically stored as industry standard LAZ/LAS file but can be exported in other formats like e57 and when exported can be spatially sampled to reduce the volume of data.

For extracting deliverables from the 3D point cloud, there are many software options available on the market now. Some are starting to use artificial intelligence (AI) to train the software to process data efficiently. Deliverables include:

1. Digital orthophoto maps 2D (DOM)
2. Digital surface model /TIN 3D (DSM)
3. Contours
4. 3D models

When doing the above processing for deliverables, having a software to automatically classify the points is essential to speed up the process. Points are typically classified onto layers such as ground, buildings and vegetation. Each layer is then individually worked on.

Extracting basic deliverables using the right software can take 1-2 hours' CAD time for a small residential property of 800sqm.

Surveyor shortage

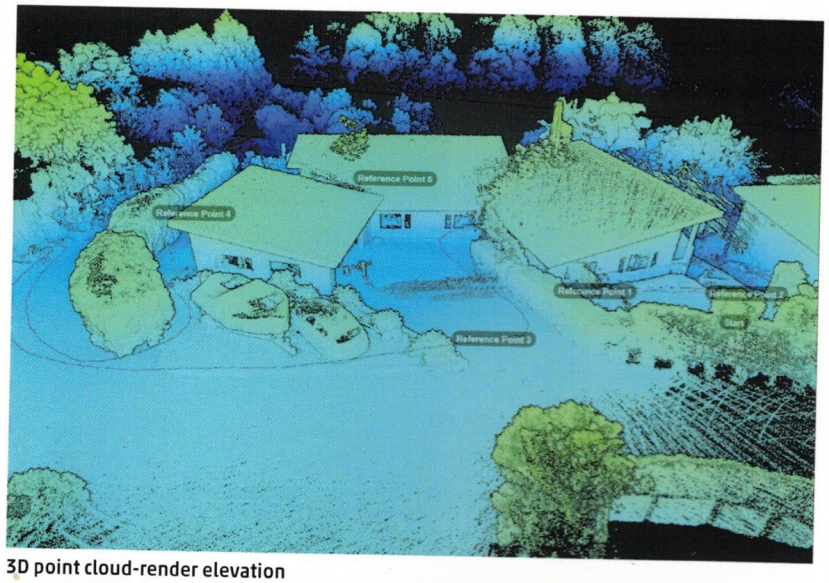
There is a shortage of land surveyors in New Zealand. The situation has worsened since Covid-19 due to the difficulties of immigration.

Workloads continue to grow for survey companies and the waiting time for clients is lengthy.

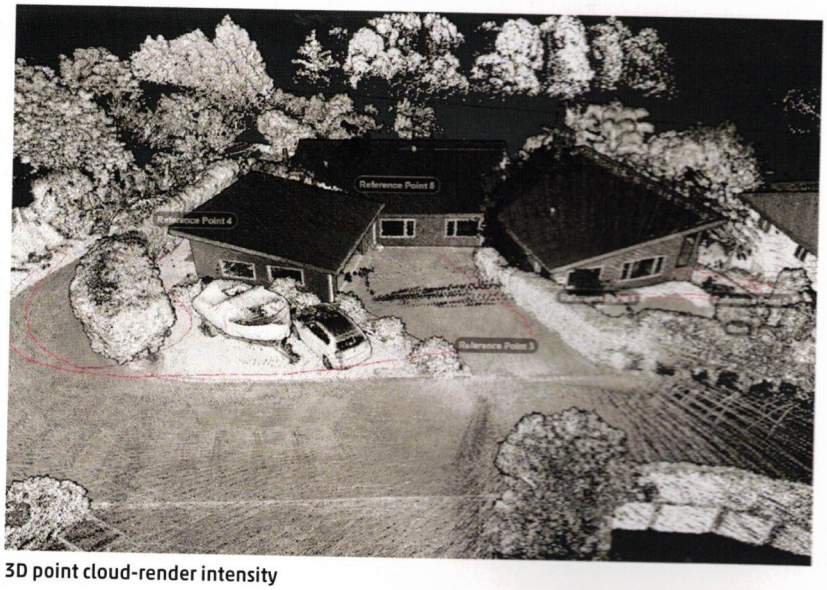
The use of a GeoSLAM HORIZON mobile 3D laser scanner can solve the above problem. Productivity can be drastically increased using existing numbers of land surveyors. For example, with each residential property taking only five minutes to survey several more properties can be completed in one day. The larger the project, the more time is saved.

Increasing your charge-out rate and sending out more invoices per day is positive for business. The client gets the job completed faster (not cheaper) and the survey company increases its turnover.

Office processing of 3D point clouds can take slightly longer than traditional GNSS or robotic survey data. However, with the right software and experience, it's no big deal. It's certainly a lot easier to recruit and train a CAD operator than it is to recruit and train a land surveyor. ●



3D point cloud-render elevation



3D point cloud-render intensity