3D Laser Scanning for Topo Survey

A recent project carried out by J Breheny Contractors on behalf of Cambridge University showcases the economics of using a high definition 3D laser scanner for topo surveying.

The rate at which geospatial technology is changing is increasing, and with it, our ability to collect more data more rapidly. 20 years ago it would have taken several seconds and possibly minutes to get a single point using GPS; today we can collect one million points per second using a 3D laser scanner.

The methodologies and workflows of data collection by total station, GNSS, video, images, laser scanning, terrestrial and mobile are now becoming simpler, faster and more cost effective. This evolution in data capture methods, data storage and handling mean that we are moving beyond a digital world that is composed of map and CAD layers to a world full of 3D and 4D models.

According to the "Future trends in geospatial information management: the five to ten-year vision – United Nations Initiative on Global Geospatial Information Management" report, this trend of moving from 2D to 3D and on to 4D visualisations is both user and technology driven and will accelerate in the next five years. Users are likely to expect more complex and realistic 3D models to enable better planning and decision making. In short, the report states that 3D will increasingly be an intrinsic part of core geospatial data, rather than a distinctive add on as it is now.

It is these expectations that have driven the demand for 3D laser scanning, which in turn have pushed manufacturers to develop scanners with higher specifications to meet these demands, typically:

- A desire for increased speed of data capture, breaking the million points per second barrier.
- A scanning capability beyond the 100m mark AND a consistent level of accuracy across the entire dataset, no degradation of accuracy with range.
- Usability is key to maximizing take-up of scanner use.

Consequently, we have seen several new products on the market that meet these new trends, Trimble’s TX8 being an example with its incredibly high scan rate and very low scan times. Its usability is key to its performance and the J Breheny Contracting case study reproduced below illustrates this perfectly.

However, the question is always “Where next?” and one of the stronger opinions to emerge at this year’s Intergeo is that we are suffering from a data overload and creating more data than we can efficiently handle. For this reason, we can expect to see huge growth in anything that helps us to better process and model what we’ve generated from automatic edge detection, breakline detection, asset extraction and simply processing huge datasets, all of which will enable us to extract even greater value from our surveys.

Case Study - An Educated Decision

Cambridge University’s 63 hectare West Cambridge campus is undergoing a 15-year development programme to provide new faculty and research & development buildings for the engineering and science disciplines and related commercial research and development organizations. Phase 3 works were completed in 2012 and Phase 4 in August 2014.

Post-completion of the works, it was noted that sections of a paved area (5,340m²) needed the levels re-affirming to the designed/as-built levels. J Breheny Contractors Ltd were therefore contacted to undertake a survey of the terrain on a rigid 0.5m grid interval to allow a digital representation of the area in question to be reviewed.

As the work needed to be carried out and the deliverables sent within a fortnight, a Breheny engineering surveyor was sent to the site with a Trimble S6 robotic total station to complete a traditional optical survey. However, after establishing a set-up, the first row took an hour to survey and with over 90 rows to survey in total, the company felt that this was not a great use of resource and began a discussion on other methods of data capture.
Minimal Site Time Required

Familiar with Trimble’s TX8 time-of-flight laser scanner and its reputation for the fast capture of high resolution, noise free, data even over its full range of 340m, Breheny contacted KOREC to assist with the survey and post-processing and registering of the data.

With control already established on site, checkerboard targets were positioned around the area and the TX8 set up for an initial scan. The location is open to the public and home to much street furniture including cycle racks and ornate flower filled planters which resulted in more set-ups than would normally be required. Despite this, the site work was completed in just 2.5 hours compared to up to two weeks if the work had been completed with a total station.

Breheny’s client required a digital terrain model for interrogation and a CAD drawing showing the levels of paving. The scan data was registered and post-processed using Trimble RealWorks, software specifically designed for point-cloud processing and analysis. The software automatically registers the scan and office work was further speeded up by the RealWorks sampling tool which semi-automatically removes points in the cloud above ground level. The end result was a clean scan of just the paving stones with all noise such as weeds, street furniture, bollards etc removed.

Andrew Dobrucki, senior land surveyor at Breheny concludes, “The survey took just 2.5 hours to complete compared to the two weeks of a total-station survey, which is a vast saving of field time. With data collected at 100mm intervals, the TX8 provided far more data than a traditional survey would have done, which is particularly useful for our client. Additionally, we were able to view on site the data that was scanned, which is a great way to quickly verify that the correct area and data is collected as intended before moving on to the next set-up location. The TX8 performed perfectly and we were able to provide our client with their requested deliverables on time.”

All information and images kindly supplied by Andrew Dobrucki, senior land surveyor, Breheny.

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https://www.geomaticsworld.co.uk/content/article/3d-laser-scanning-for-topo-survey