Point Clouds of Possibility

Evolution of laser scanning technology delivers cost, time and long-term efficiencies

Laser scanning—the digital capture of objects using a line of laser light to produce a surface—has been around for decades. It came to prominence in the survey, engineering and construction space in the 1990s. Like any other technology, 3D laser scanners have gotten faster and smaller as has the ability to collect more data than ever.

The value of laser scanned data is in the deliverable—a point cloud of highly accurate, measurable as-built conditions. Because point cloud files are extraordinarily large, often terabytes of data, the management, visualization and storage of data had to evolved as well.

Yet, many industry professionals are still reluctant to invest in the technology. The perception is that it's expensive and can't be justified on the job where a tape measure and camera seem to work just fine.

In today's fast-track construction space, where efficiency is essential to success and profit margins are tight, laser scanning can reduce the chance of costly disconnects in the field, material overages, and miscommunication with team members and clients. The following looks at the evolution of laser scanning and its capabilities and possibilities along with a few examples of real-world ROI.

The Evolution

3D laser scanners today are vastly different than they were even three years ago. One of the many advantages of a 3D scanner in construction is the ability to capture digital 3D models with full detail with extremely low error, in some cases less than a mm—in minutes.

As well, today's solutions are more portable, automated, intuitive and very fast.

For instance, the Leica RTC360 laser scanner with advanced HDR imaging system has a measuring rate of up to 2 million points per second with a range of 130 meters and can gather colored 3D point clouds in under 2 minutes. The 12 lb. scanner also incorporates cloud to cloud field registration on the fly in the field. And with its industrial grade 256GIG USB stick, operators can quickly transfer data back to the office. The scanner's portable design and collapsible tripod fits into a backpack.

The Visual Inertial System (VIS) technology with its five cameras automatically tracks the position and movement of the scanner from station to station, coordinating the scanner relative to the previous set up. VIS virtually knows where it is placed and is preregistering points on the fly.

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With technology such as VIS, postprocessing is very fast. On-site, operators can automatically capture, register and examine scan and image data from a tablet. The user interface combines easy handling of complex calculations with a graphical user guidance which offers a remarkable user experience also for novice users. As well, voice recordings, video, images, text or documents, can be tagged to each scan and positioned accurately in the point cloud.

It's even smaller, lighter little brother, the BLK360 is a 3D scanner with integrated spherical imaging system and thermography panorama sensor system. It measures only 6.5 inches tall and weighing only 2.2 pounds, captures 360,000 points per second and range is 60 meters. The BLK360 takes less than 3 minutes to complete a full-dome scan (in standard resolution) and 150 MP spherical image generation. The BLK360 can also be used with the

Leica Cyclone FIELD 360 mobile-device app, users can link the scan data on the fly in the field. Then wirelessly transfer the scan data to Leica Cyclone or REGISTER 360 to finalize and export to multiple formats.

Leica Cyclone FIELD 360 app for the iPad will also allow tagging of measurements, videos, images, text or voice files to the point cloud. No more looking through project directory folders to try to find the photos for "the mechanical room in building 3" and, even if found, no clarity about what area of the room is shown. With Cyclone FIELD 360's geo tagging, site visit data is always easily located.

Today's scanners and associated software offer high performance, improved workflows and more portability for less cost.

Point Cloud Post Processing

One of the challenges of laser scanning has always been data management. In the past, point clouds were too large to use in a conventional CAD solution. However, post-processing and data management solutions have advanced considerably in the world of laser scanning is point cloud post processing.

Point cloud files are easily brought into engineering software such as Autodesk Navisworks or AutoCAD Civil 3D. All of the data—billions of points—are available to use as a basis for new design or quality checks.

One of the biggest benefits of the point cloud data is the ability to virtually tour any given space through the point cloud data at any time. It's like being on site, with ability to quickly measure distances and assess areas of concern.

Better yet, all the photos or tagged to locations. No more searching through thousands of generic images to remember where they were taken.

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Laser Scanning At Work

In terms of workflow, the difference between conventional practices and laser scanning is clear in terms of time savings. Case-in-point, on any given project, two surveyors using DISTO laser system can measure on point in a second, and then data has to be downloaded and analyzed. One person with a laser scanner measures millions of points in the same time.

A customer recently asked for a proof of concept to provide a realistic comparison and ROI of laser scanning versus conventional data gathering. The project required as-built measurements of a plant in preparation for an upgrade.

The plan called for two engineers and two assistances to go to a site for five days to gather the necessary data. That's five days with hotel rooms, expenses car rental. Not to mention that's five days they are not in the office. At the end of that five days they had lots on notes, SD cards full of photos and some hand sketches.

With the laser scanner, one person scanned the entire plant in under a day (nearly 100 scans) and took thousands of photos. With little post-processing, the project team can navigate the site with full 300x360 degree domed photos and measure visual objects without revisiting the site or getting on a ladder or renting a lift. It became very clear to the customer that not only did they want to get a scanner, they were considering getting one for each of their offices.

This customer is one of many. Over and over, it's been proven that laser scanning is fast, accurate and valuable in ways beyond the initial as-built visual—and there is no better way to gather a large quantity of precise data.

Bottom line: drop the tape measure, pencil and digital camera and start scanning.

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Top 5 Laser Scanning Applications

1. Capture as-built conditions of brownfield and greenfield projects before renovation or construction
2. Capture construction phases and milestones. For instance, contractors scan pre-poured space with forms and rebar and after pours for flatness quality checks. Others scan wall frames/studs with mechanical and electrical systems and then again when wall panels are installed.
3. Forensic analysis and safety inspections to document deterioration over time
4. Historic preservation
5. Crime/accident scene analysis