Getting Easier Part 2: In the office

Special viewing modes in point cloud office software make it easier to interpret laser scan data for conversion into deliverables. Image on the right is in standard "intensity map" mode; image on the left is the same view, but using friendly "silhouette" mode.

Part one of what was originally planned as a two-part series (in the July issue) described advances that have made laser scanning much easier in the field. Advances in the office have been very significant, and organizations considering laser scanning tend to worry about those the most. In order to do the "Easier in the office" topic justice, part two has now become parts two and three.

Office steps for handling and processing high-definition survey data into deliverables follow a basic sequence:

1. Data management
2. Multi-scan registration and geo-referencing
3. Data cleanup
4. Conversion of registered, cleaned data into survey deliverables
5. Export/import into drafting or other software for creating final client deliverables (if needed)

Let's look at how software advances have affected the first four steps.

Data Management

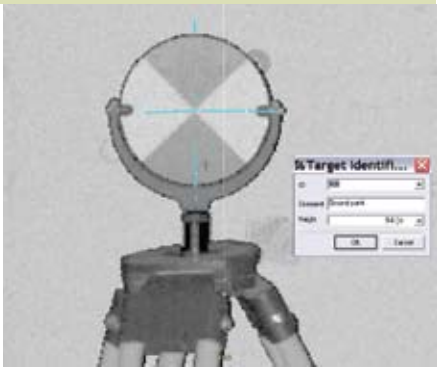
Most organizations today use office point cloud processing software provided by the same vendor that makes their scanner. In this case, there is no need to convert the format of scan data collected by the scanner into another format for office processing.

However, in the case of a user who wants to use scan data collected by one vendor's scanner in another vendor's office software, a data format conversion step may be required. Since high-definition survey data sets can be quite large (e.g., in the hundreds of megabytes or even terabytes for the largest projects), this batch conversion can take extra time, especially for large data sets. It can even lose certain types of data.

To make things easier for users wanting to mix and match different vendors' scanners and software, scanner vendors are increasingly sharing their scanner data formats with software vendors. In addition, ASTM International (a voluntary organization for technical standards) is working on developing an industry-standard data format, although it's not clear how widely such a format would actually be used.

A key data management step for many projects is organizing scan data for post-processing. Some software approaches are file-based or individual scan-based. Others prepare scan data into a single, unified database. Some file-based or individual scan-based approaches can require significant manual effort when it comes to searching for and selecting all of the scan data needed for certain spatial areas of interest.

Database approaches allow multiple users on a network to automatically access the same scan data without having to make copies for each user. In addition, software designed for use with a unified database that also features dynamic, real-time viewing and navigation can provide automation advantages over manual, iterative segmentation and scan density selection methods.



▲ Software can automatically find and extract center coordinates of black-and white registration targets, popular with phase-based scanning.

Multi-scan Registration and Geo-referencing

There have been dramatic gains in office productivity over the years for this key step. In the early days, registration could consume 50 percent of all the office time. Today it typically takes 10 percent. Some projects require no office time for registration—it's done automatically in the field using traverse methods.

Automation has made registration easier. For example, software can automatically find scan targets and extract center coordinates. For projects using phase-based scanning (that may have hundreds or even thousands of targets per project), this can save days in the office.

Other automation tools include automatic matching of targets based on user-specified target IDs, as well as geometric matching. Support for "target heights" allows the use of familiar, industry-standard target poles over known or assumed points.

The introduction of "cloud-to-cloud" registration simplified both field and office procedures by not requiring as many targets. It has also benefited from automation. For example, given an existing registration (based on targets, traverse, and/or a prior cloud-based registration), some software can automatically find additional matches between overlapping point clouds, thus increasing the accuracy of the overall registration.

Supporting a key geo-referencing QA step, some software can automatically compare elevation shots taken conventionally against nearby scan points.

Data Cleanup

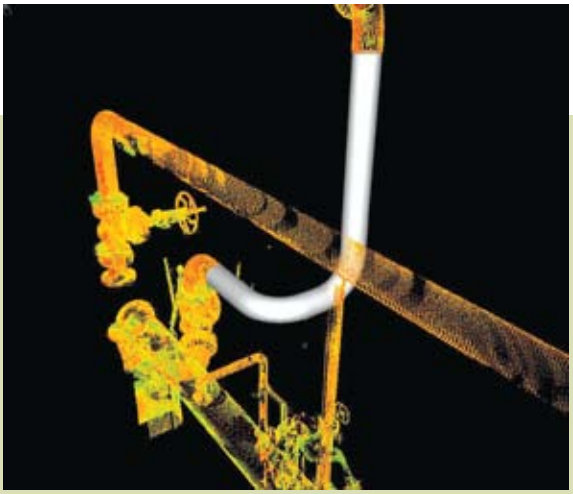
Laser scanners capture the surface geometry of scenes and sites with extraordinary completeness … including some items you'd rather not capture. This includes scan points on vehicles or people that move across a scanner's field of view, as well as certain vegetation. Some scanners can also produce spurious scan points near edges, from bright sunlight effects, and from reflective surfaces such as mirrors.

Many users remove this "noise" before processing the scan data into deliverables. One field method is to scan the scene in multiple passes and let the scanner software automatically remove the transient noise (passing vehicles and people). However, this adds scanning time and does not address stationary vegetation.

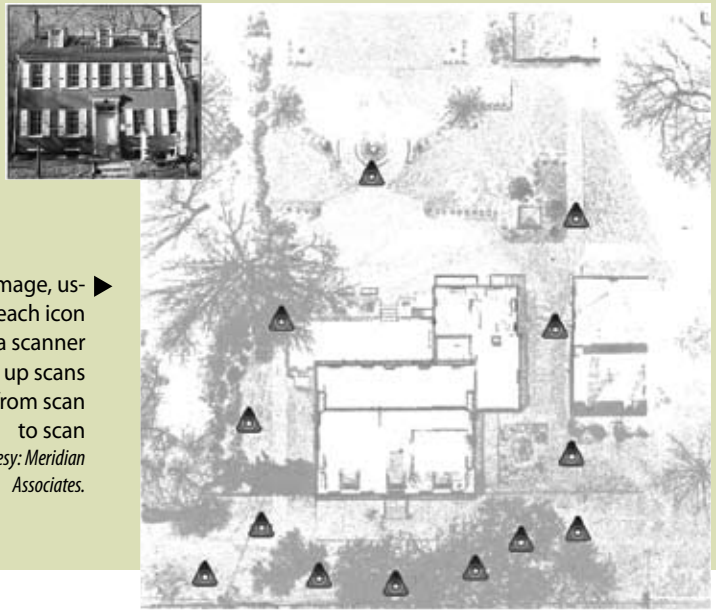
A second method takes advantage of office software automation. A user first picks a single scan point on the desired surface (e.g., ground or road). Then the software can automatically find neighboring points on the smooth surface, excluding noisy and transient points. The result is an automatically cleaned surface.

Conversion into Deliverables

Today, the steps of data download, registration and data preparation typically consume 10 to 25 percent of the total office time. The rest is generally spent processing cleaned, registered high-definition survey data into deliverables.



◀ Users can select a single scan point on a pipe to automatically create a piping run CAD object.



On this plan image, users can click on each icon that denotes a scanner location to open up scans and navigate from scan to scan ▶

—image courtesy: Meridian Associates.

Some conversion workflows are simple (e.g. clearances, interferences, and volumes), while others, such as making maps, can involve many steps. All conversion processes involve navigating point clouds and visualizing them in just the right way. Many conversation processes also involve tagging or modeling selected scan points into deliverable elements. "Easier" advances abound in each aspect, including many options for primary user interfaces.

Modeling and tagging (feature coding) points

Just as a single-pick command can remove noise from scan data, single-pick commands can also model specific geometric objects from scan data. For example, a user can pick a single scan point on a pipe, and software can automatically fit neighboring scan data to a cylinder. Similar commands exist for modeling scan data into planes, spheres, and entire piping runs. Users can also pick individual scan points and assign a survey feature code to each.

Today, for linework, picking and tracing over a series of scan points to create linework is intuitive. In addition, software can also automatically find the centerline of lane stripes, create contours, and automatically follow breakline and curb-and-gutter templates to create topographic linework.

Navigating and viewing scan points

Several advances have made the tasks of viewing and navigating through 3D point clouds much easier.

1. Full-dome, panoramic viewers

This major ease-of-use advance provides a viewer for point clouds (and associated digital camera images) similar to a QuickTime viewer that's used to pan around a hotel room over the web. A panoramic viewer for a scan scene virtually places the user's eyes where the scanner was when it did the scan. Users intuitively relate this view to how they see the world from their own eyes.

A panoramic point cloud viewer further allows the software user to virtually rotate his/her view and tilt it up or down, just as you would turn and tilt your head to view a scene. But a panoramic point cloud viewer goes a step further: it gives the software user an owl's neck and Superman's zoom-in powers.

2. Navigating with key plans and scanner icons

A key plan for a high-definition survey is simply a plan view (or isometric or section view) of a site that has been laser scanned. The key plan, however, also includes icons that indicate each scanner location for a project. A user simply clicks on a scanner icon to open up a view of the scanned scene. Depending on the software/mode being used, the view may be a panoramic view or a 3D view.

To view point clouds from another scanner location, a user can either return to the key plan or click on other scanner icons visible in the panoramic or 3D viewer, thus conveniently hopping around the site from one scanner location to another.

3. Navigating with automatic "seek" commands

"Seek" commands automatically take a user to a particular view or specific point. For example, a user can select a scan point, automatically place it in the center of the screen, and then zoom in as needed. Or a user can pick a point and automatically get a panoramic view of the surrounding scene from that point.

Some software tools can also automatically locate specific points, such as highest, lowest, drainage points, etc. within selected areas of scan data. Such tools also ensure that the absolute maximum or minimum point has been identified.

4. Other friendly viewing modes

Other viewing modes, such as silhouette mode and point shading modes, can make it easier to interpret scan data for buildings that have been scanned both inside and outside. It can otherwise be difficult to distinguish fronts and backs of walls and window features in 3D scan views. Likewise, users today can select scan density display modes (e.g. low, medium, high) with a single click.

Thanks to continuing innovation, point cloud processing office software has become significantly easier to learn and use. The final article in this series, part three, will focus on major advances in the primary user interface that have made point cloud software easier. Part three will also include case-study metrics from users who have taken advantage of some of the very latest point cloud software advances.

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