

Clouds and CAD Together

New software combines point cloud data from laser scanning with traditional CAD techniques, creating opportunities for one surveying and engineering firm.



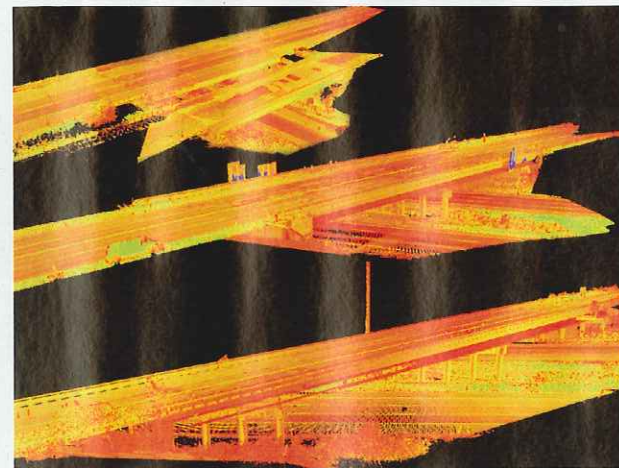
Scanner Setup at I-275 and I-94

Survey firms that have moved to laser scanning realize that seeing through the point cloud to generate line drawings can prove an onerous task. Because the cloud offers so much information, many CAD technicians do not have the skills to select points necessary to create accurate line work. In response, equipment manufacturers and survey software companies recognized the need for a user-friendly way to generate accurate topographic maps quickly without specialized knowledge of 3D systems.

As one example, Leica Geosystems has released Cyclone II TOPO as a way to wrestle a large point cloud into line drawings. Avatech Solutions' client, Spicer Group, adopted Cyclone II TOPO for use in their infrastructure and road-work design surveys. A civil engineering, land surveying, planning, transportation services, and consulting firm, Spicer Group works primarily in Michigan. Early this year, the firm began to use laser scanners in their survey work for private and municipal clients such as Michigan's Department of Transportation (DOT).

"We moved to high-definition laser scanning equipment for two reasons," states Spicer's director of survey Jeff Wood. "One, our survey team can work

A big job had Spicer scanning I-275 for the Michigan DOT near Detroit. Point clouds of three bridges are shown in software that works with CAD.



farther away from busy roadways and are less exposed to danger. Two, shutting down an interstate for survey purposes is not a popular move for obvious reasons. One of the projects we worked on was I-275 near Detroit Metro Airport, probably one of the busiest freeways in the state. For this project, we had to survey three major bridge structures. We knew remote scanning could help us get better field information and keep survey crews out of flowing traffic, and we didn't have to shut down arterial highways to do it."

As a result of using scanning equipment, the company is seeing savings in field crew expenses, reducing the number of man-hours spent on some sites by

over 25 percent. Furthermore, the need for rework or going back to the field for information not gathered during the first visit is virtually eliminated. Instead of running a crew of two people for ten days, the new equipment allows Spicer crews to do the same work with one or two persons on site for just six to seven days. The advantage is that now Spicer can run more projects with the same amount of staff.

Wood adds another angle to the equation: "The workflow using scanners is different since a lot of work we did in the field in the past we can now do in the office, working with the point cloud using mapping software to build a highly realistic line-based model of a project."

Advanced Skills Not Necessary

Spicer implemented new procedures and got the software talking to the hardware in an efficient way. This meant CAD technicians did not have to have high-end 3D software skills to work with the data crews brought back to the office. The firm sought an entire survey-to-design system that improved overall workflow and efficiency.

With the new program, Spicer technicians can code points and draw the line work from within a single interface. Spicer's survey team registers scan data using Cyclone and exports it to the .pci format that can be read by TOPO. Automated views let CAD technicians navigate through volumes of point cloud data to accurately locate features. Spicer surveyors project multiple views simultaneously on a single display, meaning they do not have to close and open multiple windows, which is time consuming.

Of particular value, says Barden, are the built-in edge detection, line-stripe detection, lowest points, highest points, and ground points functions. "For example, in plan view you can select the pick type to 'ground point,' then select a tree top, and the pick will drill down through the data until it finds a ground surface and insert a feature coded point."

In addition, the vertical section tool allows you to set an exaggeration—1x, 2x, all the way up to 20x—and alter section thickness," says Barden. "This works in conjunction with the ground pick and lowest point tools, which facilitate the generation of sections. Restore from the exaggeration after you've completed your picks, and the line moves back to the right place ready for export."

One of Spicer's most important requirements for mapping was compatibility with engineering software. All of their point-coded data and line work

needed to easily export to .fbk, .dbx, or .txt files for integration with downstream software applications such as AutoCAD Land Desktop, AutoCAD Civil 3D, or Bentley Microstation. Like many survey firms, Spicer runs different platforms to meet the needs of different clients and now uses a custom program they've developed to convert TOPO .fbk files for direct import into CAiCE Visual Transportation Products, which the Michigan DOT uses.

Experimenting Bears Fruit

"We experiment with what we can do with scans all the time, and we've been able to provide clients with interesting value-added services as a result. Now, we not only provide a 2D design on paper, but we can show clients a highly realistic 3D simulation of how a design works in the real environment,"

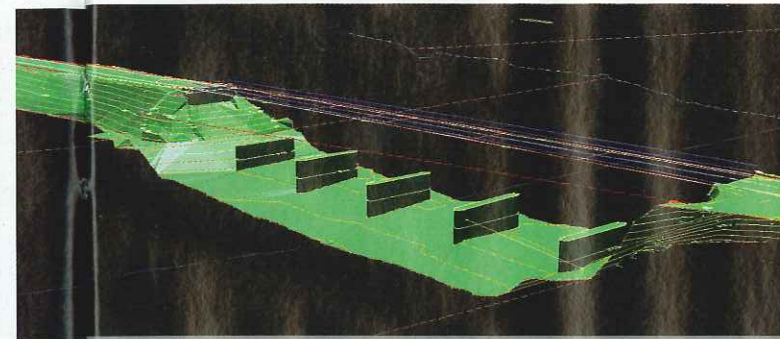
Barden reports. This allows Spicer clients to assess the design against real environment changes, making them better able to collaborate on the project in the early stages of development.

The ability to offer clients an accurate 3D rendering creates possibilities of many new services for Spicer. For example, on a large bridge project over the Menominee River between Wisconsin and Michigan, Spicer scanned the bridge substructure and mapped the approaches and river basin where a new six-span structure will replace an existing bridge. Then, they mapped features of the bridge substructure, including bridge abutments, piers, pier footings, and the bottom of beams. In another program, they constructed a model of the river bottom, mapped using dual-frequency, 3D depth sounding technology. Barden adds, "We took the river model, conventional mapping data, and the scanning information and combined them all to build a three-dimensional rendered surface model from river bottom up to the road surface. We can simulate different water flows to show how the bridge piers impact flow in flood and drought conditions and everything in between as well."

Wood and Barden both see the not-too-distant day when dynamic modeling will change the landscape for civil firms. They have used Land Desktop as their primary design tool for several years but are setting up styles and standards to take advantage of dynamic modeling technology in Civil 3D. The firm plans to standardize and use a combination of high-definition scanners, mapping and 3D modeling software by mid-2009.

The future looks bright for the Spicer Group. "Turning to laser scanning technology has brought us to the forefront in technology use," says Barden. "Leveraging mapping and combining this with dynamic modeling will allow us to continue to innovate and provide better value to our customers." ▽

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▲ Combined mapping data shown in CAiCE Visual Transportation depicts this bridge carrying US-141 over the Menominee River from Michigan to Wisconsin.



▲ Scanned US-141 bridge substructure with rendered road and river bottom surface.