

# What Kinds of Projects Benefit Most?

The first article of this series on laser scanning (May 2004) characterized this technology as an “ultra-fast, high-definition, reflectorless survey” that’s proven economically beneficial for certain types of sites, structures, and projects. The most recent article described the types of “sites and structures” best suited for this technology:

- Complex geometry, surfaces
- Relatively clear of vegetation and/or many stationary visual obstructions
- Lots of detail, congested, tight fits
- Far away or difficult to access
- Limited in size/area
- Sites that are in active, continuous use
- Hard-to-reach or delicate surfaces
- Unsafe to occupy

One or more of the above bulleted items will be checked for virtually every high-definition survey. Note that a distinction is made here between types of “sites/structures” and types of “projects.” “Types of sites and structures” refers to their physical characteristics (including location), *e.g.*, a site with complex geometry that’s located very far from the survey office. “Types of projects,” on the other hand, refers to the business aspects of a project, for example, a project that may have to be done on a very fast-turnaround basis. This article delves into what types of “projects” are the best candidates for high-definition surveys.

## Project Business Factors That Favor Scanning

Project business aspects of projects that benefit most from high-definition

**Geoff Jacobs**

surveying are usually those that benefit from high-density data and/or from ultra-fast measurement. Often, such projects have one or more of the following business characteristics:

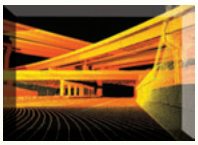
- Confidence in the as-built or as-is data is important
- Potential to re-use the data later
- Fuzzy scope or expected scope changes
- Potential for multi-discipline use of the as-built data
- Fast turnaround needed
- Short window to collect data

Each of these is discussed further below, with examples given.

**Confidence in the as-built data is important**—This aspect of high-definition surveying may ultimately have the



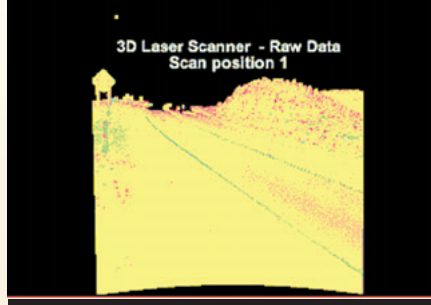
*Bad as-built data can ultimately lead to longer plant shut-downs.*



## HIGH-DEFINITION SURVEYING: 3D LASER SCANNING



High-definition surveys can aid forensic investigations.



most profound impact on surveyors and other measurement professionals. At a recent conference, I heard a Project Manager for a civil/survey company talk about a high-definition survey project that his company had completed for a state DOT. Scanning had been used on a number of complex overpasses and interchanges for a major highway improvement program in a large metropolitan area. The survey company Project Manager explained that the biggest benefit his DOT client had cited to him for using their laser scanning services was the client's "ability to rest peacefully at night," knowing that the data that had been collected in these challenging areas was correct. In this case, the cost of the high-definition survey was also less than the cost of a traditional survey, but the client focused on the added confidence aspect.

### Staying on Schedule

Confidence in survey results is something that many professionals take for granted; but it's also something that many don't take for granted, especially if they have been burned by errors/ omissions and the consequences were large. Plant as-built surveys are another example where this business consideration applies. The scenario is this: a plant piping designer needs to route some large piping through an already congested area. The new piping is needed because new equipment is being installed to increase plant capacity. To accommodate the installation of the new equipment and piping, the plant must be shut down, say for 72 hrs. If the pipe routing design is bad, there will likely be costly, unplanned field welding and rework and

the schedule for putting the plant back online may be in jeopardy. Even a one-day delay in getting the plant back online could cost the plant owner \$600,000 in revenues.

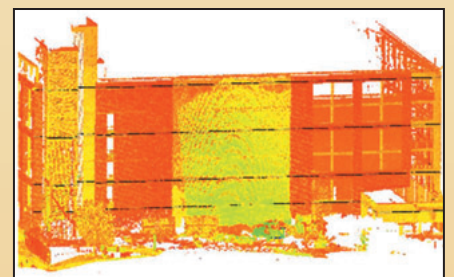
This is not a fictional example. This was a real case for one of laser scanning's early, landmark projects ("3D Laser Scanning Helps Chevron Revamp Platform," *Oil & Gas Journal*, April 30, 2001, Floyd H. Sanders). Piping/CAD designers had already done a manual as-built survey of the platform. The as-built drawings had been used for design and fabrication of new piping "spools." The Chevron Project Manager, however, had previous bad experiences with these types of retrofits and wanted to reduce project construction risks. He used contingency budget money to scan the platform area of interest to double-check the proposed design prior to actual construction. The 10% contingency budget (\$200,000) existed precisely because of Chevron's familiarity with the risk involved in plant retrofits. The high-definition survey was money well-spent. It caught several key errors and omissions in the manual as-built survey; pipe spools were then corrected at the fabrication shop. Overall, the actual installation went faster and smoother than planned. More importantly, it reduced schedule risk. By investing roughly \$50,000 (at the time) in laser scanning, the project was completed \$120,000 under budget and the platform went back online 32 hours ahead of schedule, earning the owner an additional \$850,000 in revenue!

The above example is not unusual. High-definition surveying is being increasingly used for plant retrofit projects

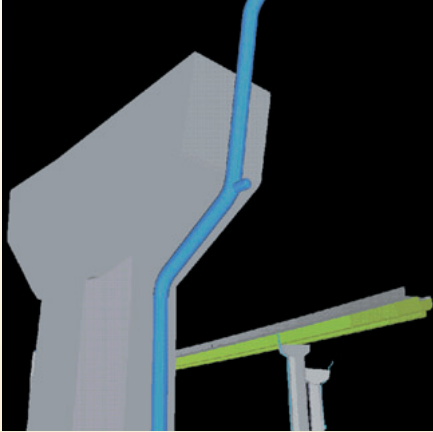
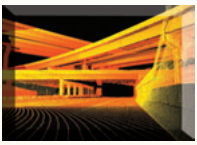
as a means of risk reduction, both for capital risk (to minimize rework costs) and schedule risk (*i.e.*, that the plant/facility will be out of service longer than planned). Thus, it's often used on "critical path" items, *i.e.*, ones that impact project schedules and availability of the site/plant/facility/asset. Likewise, it's also being used on new construction (buildings, plants, infrastructure projects) as a QA check on critical structures to make sure that they've been installed or fabricated correctly. The notion here is to ask the question, "What if this there's an error in the geometry of the construction? What would be the downstream consequences?" The bigger the consequences, the more suited that high-definition surveying is to the task.

Another increasingly common business example is the use of high-definition surveying for forensic investigations in which large financial settlements are at stake. One organization that specializes in this area, Precision Simulations Inc., has already used laser scanning on a dozen such cases. For situations in which the physical characteristics of the site/structures lend themselves to it, a high-definition survey can provide compelling forensic evidence that drives settlements more quickly.

**Potential re-use of data**—A user recently told me about a project that, on the surface, was relatively simple: a few points were needed to map the outline of an existing parking building at ground level. The survey project manager elected to use laser scanning because he was aware that further development was being planned adjacent to the building. He thought the scan data might be re-usable for subsequent requests on the project.



Original garage scan was re-used for follow-on client needs.



*Column, drain, and spout modeled from original T-REX bridge scans*

He was right. Over the next year, the project's engineers/architects came back to his company with two additional, separate survey requests for the same building/area, including cross-sections at four elevations. The survey company was able to provide the client with the additional data from the original high-definition survey without returning to the site. The roughly \$3,000 original survey required only \$3,500 in additional costs to the client to provide the additional deliverables almost immediately. Done traditionally, the client would have incurred an estimated additional \$11,000 in fees and had to wait longer for survey drawings. Over time, the client caught onto the fact that high-definition surveys often contain data needed later in a project; as a result, the client has specifically asked for laser scanning on subsequent projects.

Another example: on the T-REX highway expansion project in Colorado, a number of bridges had been laser scanned by David Evans & Associates (see *Professional Surveyor*, January 2004) to support road and bridge design. One of the scanned areas was a highway stack. A light rail system was planned to thread through the stack. Many months after the original high-definition surveys had been completed, the client requested additional information about the geometry of the structural supports in the stack. Designers needed to ensure that the rail tracks would not be too close to the existing columns. DEA found that accurate column geometry had been

captured in the original high-definition surveys, eliminating the need to send a crew back to the site. When DEA looked closely at the data they saw several interesting things: these were faceted columns with drainage piping that ran the lengths of the columns. Further, they noticed that several drain spouts extended horizontally from the pipes! DEA was able to accurately model the columns, the drainage pipes, and the spouts to give precise as-built information to the client. Over time, the value gained from these types of projects has made many clients "believers" in the technology.

### **Fuzzy scope, possible scope changes**

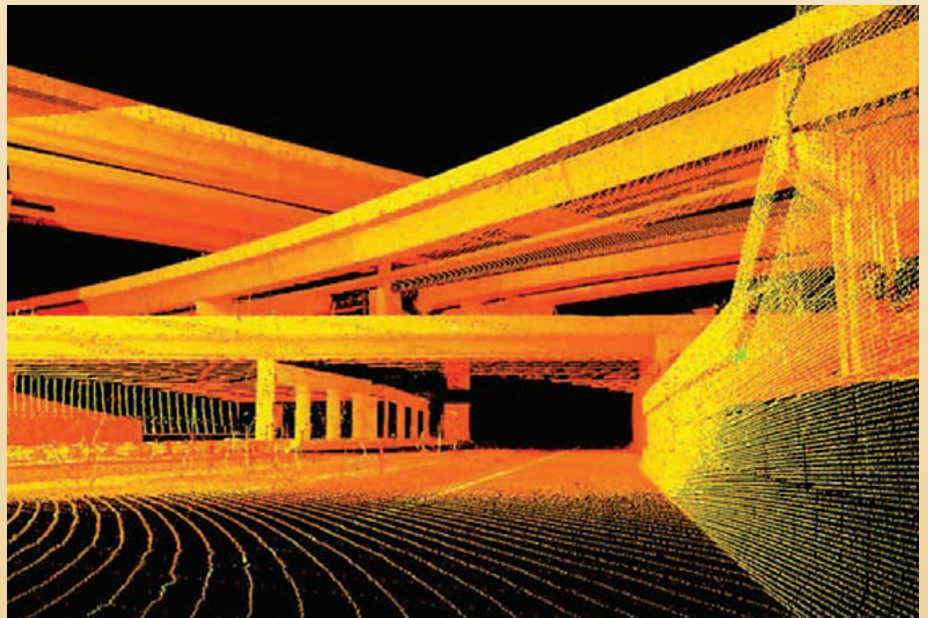
—This business characteristic could be considered a variant on the "potential reuse of data." Projects that involve scope changes during the project or projects whose initial scope is not clearly defined (the client may still be unsure about certain aspects of the project) have benefited from high-definition surveys. The reason? The scanning executed for the original project scope may well provide data that can be re-used if there are scope changes. The offshore platform project referenced above, in fact, is a good example. During the project, piping designers decided to make some additional improvements to the platform. These scope-change decisions were made after the

scanning had been completed for the original scope. Designers, however, found that the geometry data they needed for their additional design work was already captured in the original high-definition survey. No extra trips to the platform were needed and designers received their data sooner. This benefit has become commonplace over time.

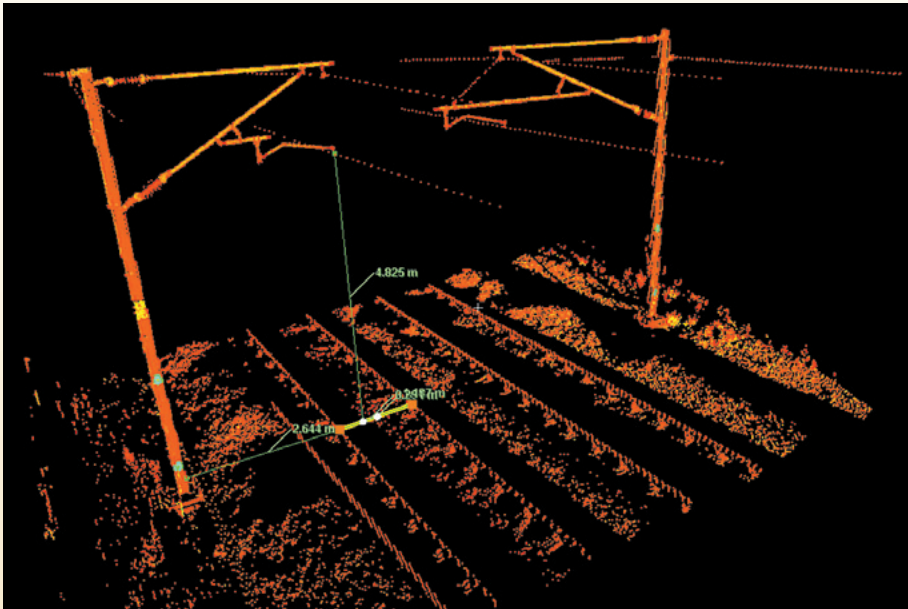
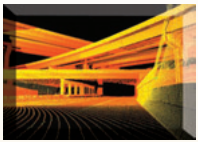
### **Multi-discipline use of the data—**

Some projects involve a number of disciplines that need geometric data from the same site. Perhaps each needs different data. Such projects are often excellent candidates for laser scanning. A common example of this would a facility that is about to undergo a refit. As-built data may be needed the Mechanical Dept. (e.g., piping and flange information), the Electrical Dept. (cable tray locations), HVAC, Structural, Construction Engineering, etc. Historically, one department might send people to the site (or retain surveyors) to measure what it needs; another department might send its own staff (or retain surveyors) to measure what it needs, etc. With a high-definition survey, a single trip to the site can provide a single source of as-built information that each discipline can draw on for its needs.

Plants and facilities are not the only example of this. In the UK, a very



*T-REX highway stack scans were re-used for column as-builts.*



Railway scan data can be used by multiple disciplines.

successful survey company has taken advantage of this in the rail industry. The survey firm found that several different departments within the railroad authority client were each dispatching survey crews to the same site to measure different aspects of the site. One discipline needed track information; others needed information about overhead lines and support structures, others about the platforms, and still others about signaling and signage. By understanding the needs of each department, the service provider was able to gather all of the information needed by the various departments from a single high-definition survey.

**Fast turnaround is needed**—Laser scanning's ultra-fast data capture or its

reflectorless feature can provide added value when as-built data is needed quickly. A good example of the latter was a survey of a rail/roadway crossing, including extensions of track in each direction. Typically, securing permits to occupy the track to survey it would take six weeks. The client, however, needed the as-built drawings in two weeks. The civil/survey service provider used laser scanning to survey the RR crossing and track extensions by simply setting up the scanner outside of the zone for which permits were needed.

Another example where fast turnaround was needed was a plant retrofit construction project that had run into fit-up and interference problems during construction. The project was in the midst of an extensive delay when the Project Managers chose to "bring in the scanner" to curtail any further construction delays.

**Short windows to collect data**—Sometimes there are very limited time windows to access a site or facility to collect data. Examples include surveys of tunnels, railroad tracks, airport facilities, or plants that temporarily shut down for maintenance.



Scanning allowed fast turnaround of maps for this intersection.

Crews have to get in and out quickly and collect as much data as they can during those shutdowns. I have even heard of examples for automotive manufacturing plants where as-built data had to be collected during assembly workers' formal breaks. In many cases, laser scanning can be a viable option. The ultra-high speed capture of phase-based (*i.e.*, continuous) scanners, in particular, can be especially beneficial in such cases.

### Site Characteristics + Project Business Characteristics Combined

When organizations are considering high-definition surveying, the physical characteristics of the site or structure are often the first driver. This is usually where cost savings related directly to the as-built survey itself are first identified. The second set of project/business characteristics is an important additional consideration. If the data were inaccurate or incomplete, how large would the consequences be? Can the data be reused for subsequent needs? Can the data be shared by other disciplines? How quickly is the data needed? These questions are an important complement to the question of initial survey cost.

### Summary

Laser scanning can offer cost, schedule, and other advantages for certain types of projects. The business characteristics of such projects have been described and examples have been given for a wide range of potential projects. When a project's business aspects are considered along with the physical characteristics of a site and/or structures, the new assessment can lead to laser scanning being determined a preferred method. †

**GEOFF JACOBS** has been employed by Cyra Technologies Inc. (recently re-named Leica Geosystems HDS, Inc.) since 1998. He currently acts as Senior Vice President, Strategic Marketing. He is also a Contributing Writer for the magazine.

