

Why Some Old-School Survey Methods Die Hard

by Christine Grahl

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When Francisco Fierro Jr. was called in to assist with the [Olmsted Locks and Dam project](#) near Olmsted, Ill., it wasn't because of his equipment expertise or software savvy, although the seasoned construction surveyor is adept on both fronts. It also wasn't because of his notoriety as an author and public speaker, though Fierro has written articles and [a book](#) on construction surveying and has presented seminars and workshops on the subject.

Instead, what has made Fierro invaluable to the construction team is his ability to combine current technology with tried-and-true survey methods to ensure that the work achieves the desired outcome. The dam portion of the project, which is being managed by a joint venture between URS Corporation and Alberici Constructors, relies on modern systems such as the Trimble S6 and S8 Robotic Total Stations with TSC2 Controllers and Trimble software, a Trimble SPS 880 Extreme Smart GPS RTK rover, Fledermaus 3D software and Autodesk AutoCAD Civil 3D. But with tolerances ranging from 1/4 inch to less than 1/16 inch, skill in applying these technologies is paramount. "To be able to set everything within these tight tolerances, we have to practice accurate and precise survey methods and be consistent," notes Fierro, who is the area survey superintendent for URS Corporation. "Not only do you need the right equipment, but you also need to utilize strict survey procedures. This is where new-school technology meets up with old-school procedures."

Fierro says three old-school methods in particular help the survey crews ensure both accuracy and precision:

- **Closing the Horizon** - A technique in traversing control for horizontal measurements. Fierro explains: "This procedure consists of measuring horizontal circle readings in four parts, with two direct (Dir) and two indirect (I-dir) readings: 1) Dir – backsight (BS) to foresight (FS); 2) I-dir – BS to FS; 3) Dir – FS to BS; 4) I-dir – FS to BS. Establish the mean for 1 and 2, then the mean for 3 and 4. (The two means compute for the inner and outer angle). The sum of the two means is then checked against 360°. The error is evenly dived to compute to the corrected sum of 360°."
- **Distance Precedes Angles** - An older technique developed by Fierro and his father, who was also a construction surveyor, before electronic instrumentation was available. "Two known points on two separate baselines are utilized to set a third point of intersection (PI point), through proposed distances," Fierro says. "The PI point is normally set for the baselines to run perpendicular to each other. It is especially effective if the original two points

are not visible to each other due to obstructions from a structure or some other obstacle. This is another alternative to the resect method."

- **Three Amigos** - A quality control technique also developed by Fierro and one that he says is applicable on most structural projects with very small tolerances. "A simple description is that the instrument, chain or measuring tape, and the string line or sighted line, are all in agreement with each other," he says. "If one of these elements is not congruent with the other two, then an error exists in the layout. This technique is especially effective in setting anchor bolts."

Technology is key in streamlining workflows and improving productivity. But there's simply no replacement for a solid understanding of the basics.

What old-school procedures do you believe are timeless in your practice? Please share your comments below.

For more details on the survey work involved in the Olmsted Locks and Dam project, see "[Precise Positioning 'In the Wet'](#)" in POB's October issue.

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