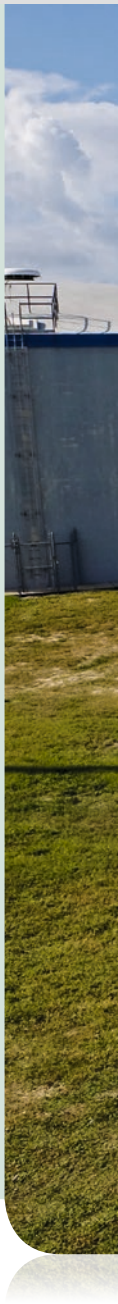


Renovating complex structures with 3D laser scanning

by Bruce Bowditch

The project engineer at a wastewater treatment plant in Tampa/Florida was faced with a challenging renovation – demolishing one of their pump houses and replacing the piping in the plant's digesters. While existing two-dimensional drawings documented the pipes, they did not include the level of detail necessary to plan the reconstruction in a way that guaranteed the new installations would not clash with existing structures.

The project engineer and his team required a thorough understanding of the labyrinth of pipes that wound around each other, changed elevations, and wove in and out of assorted plant structures. To assess the water tank's capacity, they needed measurements inside the tank that included a representation of the fill line to the highest part of the tank, as well as the point where water exits the tower. Finally, they wanted an overall site plan showing building footprints and their relationship to each other. This documentation would help them to understand the dynamics of the water flow, determine digester capacity, establish their connection points in the water tower and make informed decisions regarding the plant's restoration.

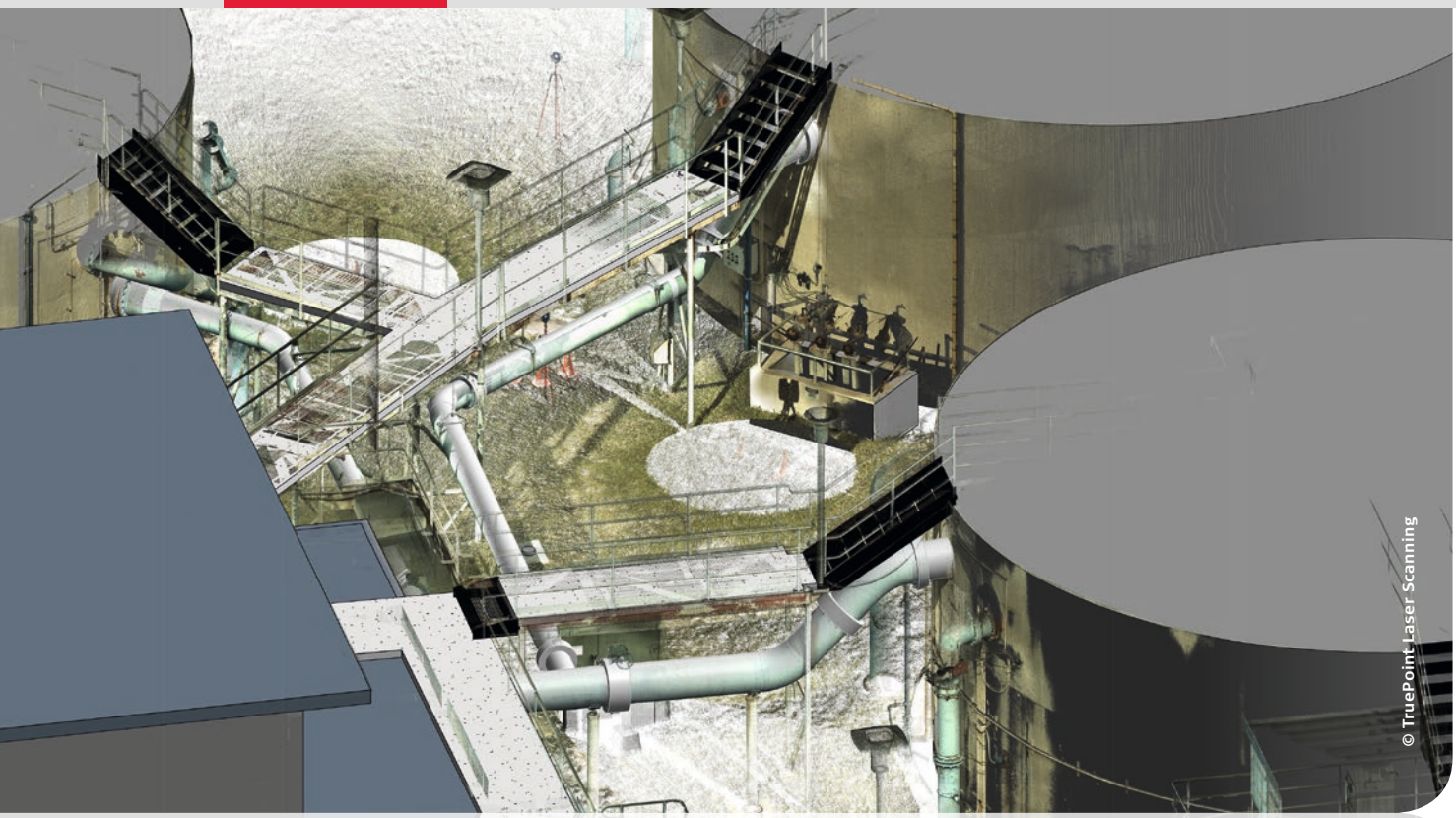
Point clouds, 3D visualisations and models provide valuable insight on a complex network of pipes and valves.

To complete the documentation manually would not only be complex, but it could also be dangerous. First, because the water tower was 53 metres (175 feet) tall, it was difficult to access. In addition, there was the ever-present risk of falling and drowning when taking manual measurements of wastewater digesters, open vats that are used to stabilise the solids removed from the wastewater during treatment.

Manual documentation would also be time consuming due to the complexity as well as the logistics of manoeuvring around the plant and, for example, negotiating catwalks that narrow to about 41 cm (16 in) wide in some places. It probably would have taken a team of four engineers around two weeks to take measurements, and they still would have only been able to gather a bare minimum of data.

From difficult and dangerous to simple and safe with laser scanning

The project engineer realised that laser scanning could be the solution to their problem. After searching for service providers, he contacted Ryan Hacker, president of TruePoint Laser Scanning. Because laser scanners methodically and quickly capture data points that represent all objects within their range, they could easily capture the complex piping and plant layout. In addition, since the TruePoint Laser Scanning team chose to use the Leica ScanStation C10, they were able to document buildings and structures accurately within a 300 metre (980 feet) range while capturing thousands of data points in a second. This long-range capability meant the technicians could safely scan the interior walls of digesters from the catwalks and record the water



A colourised point cloud of the water treatment plant with modelled tanks and building footprint.

tower from the ground, eliminating the need for man lifts and repelling equipment.

Two TruePoint technicians determined that they needed to take scans in thirty-six locations. Laser scanning captures everything in line of sight. To assure thorough documentation, however, they took scans from multiple angles. Each scan represented a fragment of the puzzle that TruePoint associates would later piece together. While the project engineer had originally planned a multi-phased project in order to continue operations while replacing specific pipes and valves, TruePoint was able to complete the data collection in a day. The quick process also saved money by reducing the need for several documentation projects. In addition, because all the data was available immediately, engineers could make a full plan that reduced the need for future change orders. The scans produced a series of point clouds, three-dimensional data sets that represent the scanned objects at the facility. Back at TruePoint's headquarters, the workflow fell into an easy rhythm as the team imported the multiple point clouds into Leica Cyclone software. Then, to gain a complete view of the plant they assembled the puzzle, registering the point clouds and joining them into a single data set. They sent the 3D representation to the engineers at the water treatment plant who also use Leica Cyclone software. The engineers imported the point clouds into their Autodesk AutoCAD software to create a model. In addition, TruePoint provided Leica TruViews that give a panoramic 3D view of the scanned area. The TruViews are intuitive for people to use; they can easily zoom in to see points of interest and look at them from all angles.

Taking measurements and analysing the data in the office

The engineers were able to scrutinise the data from the comfort of their offices and calculate factors such as the necessary rise over run for the pipes, water flow, and specific measurements. Having all the data at their fingertips enabled them to give a fabricator the exact size and shape of the new pipes they needed. Once they received the pipes, all they had to do on the site was to assemble them; thus, they saved money on manual labour time. As a result, the engineers at the water treatment plant were able to plan their renovations more accurately and comprehensively, increase safety, reduce costs and achieve their goals more quickly. Due to the success of this project, the project manager has now incorporated laser scanning into additional projects. ■

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