Model Citizens

Utah Raises the Standard for Construction Design with 3D Survey Technology

By Lance Greer

It's a race to produce the first standardized autonomous vehicle. In the heat of the pack, Google and Uber are caught up in a legal battle over LIDAR – an acronym for Light Detection, And Ranging technology – a vital component of self-driving cars. While these tech companies fight to own a custom version of this digital measuring tool, the state of Utah is utilizing LIDAR to change the way we build roads, bridges, and other infrastructure projects.

LIDAR is a surveying method that measures distance to a target by illuminating that target with a laser. The machine – available in static, mobile and aerial applications - collects very dense and highly accurate points, which allows precise identification of objects.

In just 90 seconds, LIDAR can capture everything in every direction for 300 meters, collecting 1.4 million points per second. To put that in perspective, the LIDAR technology can capture more data in two minutes than my surveyor grandfather captured in his 50-year career.

To make the data meaningful, measurements are taken at various set points and then automatically pieced together to create a computer-generated 3D-model of any project site. The result is an almost precise replica, viewable from any angle with an eighth of an inch degree of accuracy.

When combined with video and photography footage captured through small unmanned aerial systems (sUAS), these 3D models provide the project owner, engineer and contractor with the most accurate depiction of existing conditions the industry has ever seen.

Capitalizing on this technology, UDOT has initiated a series of projects called Intelligent Design Construction (IDC), where paper production plans are reduced or eliminated from the project. Instead, the entire contract is based on a pre-construction 3D-model and a post-construction 3D-model. Essentially, the industry is moving from marking plans with a red pen to identify final changes, to actually giving the owner back a 3D-model at project finish to prove the work is complete, to specifications, and fulfills the design intent.

In October, UDOT completed its first IDC project and the country's first state-funded road project built around a 3D computer-generated model.

SR-20; Passing Lane MP 10 to MP 12 was awarded to W.W. Clyde & Co. in April of last year. The project required creating an additional lane for two miles of winding road on a state highway in Iron County. The entire project was constructed using LIDAR-generated models. The job was completed early and under budget, receiving a Project of the Year Award and an Innovation Award from UDOT.

With the success of the SR-20 project, UDOT has classified multiple 2017 projects as IDC jobs.

UDOT's vision to eliminate the substantial amount of money and time spent on plan production is not the only benefit resulting from LIDAR technology and high accuracy 3D-modeling. We are seeing favorable outcomes throughout the entire construction process for multiple involved parties.

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PRECONSTRUCTION

At the get-go, having the 3D-model gives the project team an amazingly accurate as-build to start preconstruction planning and engineering. Instead of relying on potentially outdated survey data, same-day LIDAR scans make it possible to verify the design plans – and shorten the overall design schedule.

LIDAR picks up even the smallest details. We're talking everything: paint markings, cracks in a structure, bumps, rutting in the asphalt, roadway markers, powerline interferences, utilities and manholes, etc. This benefits the contractor in two ways. One, potential problems are identified before construction begins. Two, the pre-construction model can be used as proof of initial condition if concerns are raised by citizens or other impacted parties throughout the construction process.

CONSTRUCTION

As the physical work begins, subsequent models provide as-built progress surveys for the project team. The LIDAR and sUAS technologies allow the contractor to produce progress photos and quantity surveys to simplifying the billing process.

With the availability of current, accurate data, engineering modifications or changes to the design can be made quickly and effectively, without the burden of reprinting various plans and specifications that were affected by the change.

POST CONSTRUCTION

Another huge benefit to the project owner and future contractors is the final model. As-built data is collected for features installed underground and updated in the 3D-model, allowing for easy location in the future and for clash detection software to find potential conflicts in the computer before the work starts, not during construction when these conflicts can cause major delays and impact costs.

Access to the final as-constructed 3D-model helps UDOT and other agencies with maintenance of roads, including: striping, mile-markers, and placement of rail posts.

MOVING FORWARD

Every part of this technology is improving the way engineers and contractors work. It's safer, faster and providing more accurate surveying to improve design and reduce the cost of rework.

You can either help make the rules and be part of the conversation early, or you've got to live by someone else's after the fact – like it or not. We're happy to share our experience on what works and what doesn't to make sure the expectations are re-written in a way that makes sense for the work in our industry. It's exciting that Utah is taking the lead on making 3D models the standard for transportation construction. ■

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