IMAGINiT TECHNOLOGIES

WHITEPAPER

Leveraging the Power of Reality Capture for Buildings and Construction

When it comes to client satisfaction and enhancing the bottom line, the building and construction industry is discovering the value of reality capture technologies. Companies enjoy benefits such as more accurate customer deliverables, new revenue-generating services for clients, and more. Some firms use the measurements and data generated through reality capture to reduce design revisions and field change orders. Others offer reality capture as a service to their clients for tasks like project status tracking, quality checking, accurate as-built conditions, and automatic generation of layout points during construction.

Different technologies fall under the reality capture umbrella. In this white paper, we'll explore how building and construction companies can leverage photogrammetry, robotic total stations, and 3D laser scanning to support their businesses. We'll also discuss which technology is best suited for different applications.

Drones & Photogrammetry: Visualizations of Buildings and Work Sites

Drones equipped with a camera are a great way to gather conceptual information about a building or work site. Photogrammetry is lower-cost than using a 3D laser scanner, but the resulting data is not as detailed. This is not necessarily bad. It's just important to recognize that different reality capture technologies have different applications that they are well suited for. It's also important to remember that the more one spends on a drone, the higher the quality of the information that can be obtained.

Photogrammetry derived from drone data is an excellent tool for capturing high-level information about a building for a visualization. For example, let's say that a firm has won a project to remodel a school or a shopping mall. The team can gather a conceptual point cloud through a drone flight that lasts less than 30 minutes, followed by a couple of hours of data processing. After snapping walls to the point cloud, the firm has a tool that they can show to clients which illustrates the current structure and how it could look after a renovation. Firms can also use photogrammetry to capture unique features of a building, such as a statue or gargoyle. That data can be exported as a mesh which can be used in designs. When using photogrammetry for a building visualization, it may be necessary to take two paths with the drone—one from above to create a bird's eye view and a second that takes oblique images of the sides of the building.

Work Site Calculations & Progress Monitoring

Another good application of photogrammetry is project calculations and work site progress monitoring. Drones do a good job of capturing square footage and volume calculations. For instance, when a firm was working on re-tarring the roof of a school, it used drones to estimate how much tar and how many shingles would be needed.

Photogrammetry is also helpful for monitoring materials on a job site. Drones make it easy and cost-effective to capture visual snapshots in time through weekly or even daily flyovers at sites. Teams can stitch together the resulting images to create a Google Earth file which can be layered on top of Google Earth imagery. Photogrammetry data is useful for volume calculations, such as how much dirt is in a stockpile, as well as for cut and fill calculations.

Robotic Total Stations: Using Models for Pinpoint Accuracy

A detailed model of a building can provide value far beyond the time, effort, and money saved during the design phase. Typically, generation of layout points is a manual process that requires measuring tapes or lasers. With the right modeling techniques in place, however, construction firms can use a model for automated generation of layout points. The system used to create the layout points communicates seamlessly with the model. As a result, less error is introduced and construction firms save both time and money. Using a model and automated machine guidance in this way gives construction firms a competitive edge in the market.

3D Laser Scanning: As-Built Conditions and Validation Work

3D laser scanners generate highly accurate point cloud data that firms can use for modeling as-built conditions, as well as for validation work. One great example of where 3D laser scanning excels over traditional measurement techniques is in structures with a lot of piping. Data about existing conditions is essential when adding to existing piping systems. However, the typical process of measuring existing conditions is very manual, with tape measures and pencils.

In many cases, the solution is “field fit”—that is, cutting pipes to fit onsite. Usually this process is wasteful. 3D laser scanning reduces the need for field fit because it captures the real-world conditions with a higher level of precision and accuracy than manual data collection techniques.

In terms of validation, 3D laser scanning is a good technology to use before pouring a concrete slab. On many projects, construction firms embed pre-tensioned cables in concrete. Using photogrammetry to capture information about the location of the cables before the concrete is poured would not work well. The tolerances would not be precise enough to locate the cables at a later date. 3D laser scanning, in contrast, is a much better match.

Next Steps: Evaluating an Investment in Reality Capture Technology

As your firm is considering whether to invest in reality capture, a good first step is to evaluate the opportunities that may exist to enhance workflows and launch new business offerings. Here are five questions to think about:

1. **How much time and money does the firm currently spend collecting existing conditions data and what is the quality of that data?**
   Reality capture technologies capture greater volumes of data and higher quality data about existing conditions than manual techniques. Although every project is different, in most cases, 3D laser scanning is more time efficient than manually collecting information about existing conditions.

2. **How often do team members have to revisit worksites to collect existing conditions data either because (a) the scope of the project changed or (b) things aren’t coming together and more data is needed?**
   3D laser scanning collects comprehensive and accurate information about existing conditions, which eliminates the need for manual measurements. Since 3D scanning captures more data, more accurately, and in a shorter period of time than manual methods, it reduces the need for return visits, if the scope of a project changes.

3. **How often is key information missing from as-built documentation?**
   Design work is extra challenging when the as-built information is limited. 3D laser scanners make that problem disappear, since rich data related to the as-built environment can be easily accessed.

4. **How are you currently creating existing conditions models for bid and conceptual work?**

When it comes to winning new work, visualizations can be a powerful tool. However, it doesn't make sense to spend a lot of time and money on a visualization before a client awards a bid. Drones in conjunction with photogrammetry offer a fast, cost-effective way to develop visualizations.

5. **Are you providing clients with visual project status updates?**
   A picture is worth a thousand words. Drones make it easy to capture frequent visual information about work sites. Teams can compare images over time to confirm work progress, to monitor contractor activity, and more.

Conclusion

Reality capture technologies have the potential to help building and construction firms work more efficiently, generate higher levels of customer satisfaction, and potentially win new business. Before making the investment, however, it's important to assess which technologies will best fit your needs. IMAGINiT Technologies has worked with numerous clients to integrate reality capture into their workflows. If we can help your firm in any way, feel free to contact us.