3D Scanning in BIM
– a Cost/Benefit Analysis

It's amazing how quickly technology can move from "nonsense" to "science fiction," and then to "reality." It only takes a generation — or these days less — for technological innovation to dramatically change how we do our jobs and live our lives.

The construction industry has seen more than its share of change on the tech front in the last several decades. And yet, a recent article in The Economist noted that **construction project inefficiency** in the United States is at its worst state in over 50 years!

So, it raises the question: with so much new, shiny hardware and software at our fingertips, how can construction professionals use these innovations to quantifiably improve their efficiency, quality, and profitability of projects?

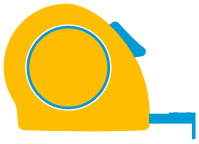
In a previous resource, we took a wider-angle view of improvement through tech investment with a goal of project success. In this one, we're going to drill down specifically into one aspect of the BIM construction workflow — the collection of as-built data and location verification for existing mechanical systems during the planning and layout phases of a renovation or retrofit project — and focus on how tech investment can result in solid ROI.

Where money disappears in the planning and layout of a renovation or retrofit project

When an estimator is putting together a bid for a renovation or retrofit project, having access to general measurements, material lists, and configurations (such as they could get from generic paper blueprints) is usually sufficient.

However, once more thorough job planning commences, designers and detailers are going to need highly-accurate measurements of the as-built layout if they're going to be able to plan an efficient and cost-effective job.

Manual layout measurement

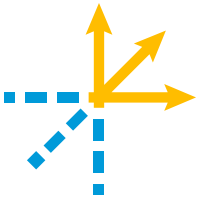


The measurement of a large space for layout and design purposes can be handled in a number of ways. Traditionally, two guys with a tape measure and a clipboard can map out the basics of a space over the course of several hours (or days, for an entire floor of a building). Combining their efforts with detailed images, schematics, and blueprints, the designers working on the renovation plan should be able to pull together enough data to do what they need to do.

Inevitably, in this kind of scenario, human error creeps in, measurements need to be confirmed and/or redone, and some ambiguity remains. The result is either a longer-than-necessary planning/design phase involving multiple measuring projects, or a list of preventable errors or changes occurring onsite once the project commences and it becomes obvious that some details of the plan are based on inaccurate measurements.

The use of more modern equipment, such as laser distance measurers and inclinometers can certainly help the process, both in speed and in accuracy, but it still remains very much a manual process. Anywhere a human being is involved, there's the potential for human error.

Moving back and forth between 2D and 3D design plans



In the modern era of BIM construction, the use of 3D models throughout the building process is becoming more and more common. However, it hasn't supplanted 2D drafting work completely, and, at least in some disciplines, it has a long way to go. So, the modern construction project often requires a lot of back-and-forth collaboration using 2D and 3D versions of the needed plans.

When a construction firm is caught between advanced 3D BIM design work being done in the office and a field crew who prefers (or is only able) to work from traditional 2D plans, a number of inefficiencies and room for error are created. Likewise, when different trades need to work concurrently to meet a tight deadline, but one's following a 2D plan and the other's using a 3D model, collaboration may be difficult.

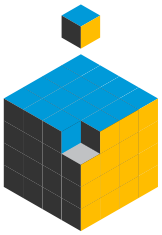
The end result is more required back and forth discussion between the design team and the field, more errors and rework needed at the jobsite, and even safety or performance issues making it to the completed project.

In just these two examples, it's easy to picture money being siphoned right off the top of the already-thin profit margin as hours are wasted. Many other similar scenarios exist. But what you really came here to learn is: How can I avoid these time- and money-wasting issues and get that profit back?

What technology tools are available to solve these issues?

The issues we've been discussing, which can waste untold amounts of money over the course of a year or more, can be solved fairly simply and quickly using a few hardware and software tools that make up a comprehensive 3D scanning solution for BIM.

Capturing the data – 3D Laser Scanners



To capture a highly accurate rendering of as-built conditions — including precise measurements, inclines, and configurations — without allowing human error to interfere in the data collection process, 3D laser scanners have become the gold standard in the construction trades.

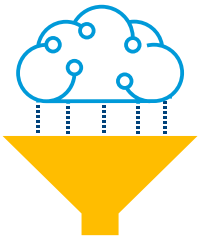
These powerful instruments combine powerful laser scanning technology and color image capture to create detailed point cloud measurement data of a given space. These point clouds can then be processed and fed to CAD programs or other BIM software to develop 3D models.

For example, the **Trimble TX6 3D Laser Scanner** captures precise data at high speed over its full measurement range of 80 to 120 meters. Generating a 360-degree, 34 million-point cloud requires approximately 3 minutes of scanning time. To colorize scans, an integrated camera can quickly take full field-of-view HDR images.

Additionally, the TX6 requires no supervision or control while scanning, so the device can simply be placed in an optimal position to capture the space needed, and left to carry out its task. An operator can move the scanner as needed to complete all necessary scans. These multiple scans (station set ups) are used to make a composite point cloud of the space being captured. When all the necessary scanning is done, the data can be retrieved via high-speed USB.

Another option is the **DPI-8 Handheld 3D Scanner**. The DPI-8 can add a new dimension if you're already using a tripod scanner like the TX6. Since it's portable, requires just one hand to operate, and features start/stop scanning technology that allows you (via Trimble RealWorks software, described below) to seamlessly append new scanned data onto previous point clouds captured by either scanner, the DPI-8 reduces the need to acquire highly detailed and time consuming scans with your static scanner. With its small size it can also get into tight spots like plenum spaces and electrical vaults where traditional scanners can't reach.

Translating the data – Point Cloud Modeling Software



While the output from a quality 3D laser scanner is impressive, it's not able to be put to use just yet. The millions of points and measurements captured by the scanner need to be registered to create a composite point cloud for use by designers and detailers in modeling and BIM applications. Point cloud processing software fills that need. It enables you to register, visualize, explore and manipulate as-built data collected from your 3D laser scanner.

Trimble RealWorks is a powerful point cloud modeling application that works seamlessly with the TX6 and DPI-8 scanners to import point cloud data and images to efficiently register, analyze, model, and create deliverables using data from virtually any source and convert them into usable 3D models.

Trimble EdgeWise works hand-in-hand with RealWorks to provide an automated modeling tool for accurate BIM-ready models. From scanned point cloud data, the software automatically extracts elements such as pipes, conduit, ductwork, structure, and walls, then precisely models them using the dimensions and geometries included in a vast library of industry standard specifications.

Together, these applications take the powerful and accurate data collected by the scanners, and translate it into BIM- or CAD-ready 3D models that can be imported to any design software for estimation, planning, designing, or detailing work.

Most importantly, they do so quickly, intuitively, and — to some extent — even automatically. This reduces labor costs above and beyond the time and cost savings realized by avoiding the errors and inefficiencies described earlier.

Analyzing potential ROI of 3D scanning in BIM

So, let's really dig down into the financials at this point. Despite all the interesting items discussed above, anytime new technology is being considered the real question has to come down to: **Is it worth the price? Are we going to earn back our investment?**

We encourage you to contact Trimble directly for expert recommendations on which solutions will best accomplish your business goals, and for up-to-date pricing on every option. Then, consider the following section carefully.

How much will these solutions save and/or earn you over their lifetime?

Only you can supply the actual dollars and cents your firm is potentially losing due to inefficiencies and errors in the renovation planning process, but **a comparison** of the TX6 and TX8 scanners against other, more expensive, phase-shift scanners revealed that the Trimble scanners delivered faster, cleaner scans (increasing productivity in the field and office,) and better ROI with up to $30,000-$50,000 price difference in favor of the TX6 and TX8.

As an MEP professional, it's pretty plain to see the impressive time- and money-saving power of tech innovations like those described above.

Moving far beyond the limited scope we've been discussing here, when errors and delays can be prevented anywhere along the construction project lifecycle, profit margin is being maintained and positive ROI is the result. That's the result when firms leverage technology to support better collaboration, more accurate planning and estimation, and greater transparency across the project.

If you'd like to explore how strategic tech innovation can boost your firm's ROI potential, **contact Trimble MEP today**. We'll help you determine what options are available with your unique circumstances.

For more information on 3D scanning in construction, download the free guide, "The Evolution of 3D Laser Scanning in Construction: Past, Present, and Predictions".

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