



Uncovering the Value of As-Built Laser Documentation™ for Engineering Firms

A Quantapoint White Paper

ABSTRACT

Meeting Project Objectives Through Quantapoint As-Built Laser Documentation™

As Engineering firms move from the historically time-consuming and inaccurate manual recreation of as-built documentation towards the adoption of Quantapoint as-built laser documentation, the revamp landscape is beginning to dramatically change. Quantapoint clients have significantly improved the profitability and risk profile of industrial revamp (“brownfield”) projects. Based on our extensive industry experience, Quantapoint has performed an in-depth analysis of the key revamp challenges facing Engineering firms and the significant value as-built laser documentation can provide for cost, schedule, quality and safety, bringing them in-line with grassroots projects.

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QUANTAPOINT WHITEPAPERS

As the acknowledged industry leader in laser scanning technology, Quantapoint has published several papers, some of which are listed below. These are available in the Resources section of www.quantapoint.com.

- Understanding and Specifying Laser Scanning Services
- Seven Things Every Project Manager Should Know About Laser Scanning
- Contract Terms & Conditions for Laser Scanning Services
- Combining 3D CADD with Laser Scanning
- Uncovering the Value of As-Built Laser Documentation for Engineering Firms
- Uncovering the Value of As-Built Laser Documentation for the Power Industry
- Uncovering the Value of As-Built Laser Documentation for the Processing Industries

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Key Challenges Facing Engineering Firms for Revamp Work

With the adoption of 3D CAD tools and new work processes, the processing industries have enjoyed year-over-year quality and efficiency improvements on capital projects. In particular, grassroots (“greenfield”) projects have become considerably less risky with more predictable costs and schedule. Quality has even evolved to the point where Owner/Operator organizations have come to expect near zero design errors.



Unfortunately, these measurable improvements have not easily transferred to industrial revamp work for many reasons, including inaccurate and incomplete information on physical dimensions and location of piping and equipment (the “as-built documentation” for the facility), frequent site visits for manual measurements and construction interferences and high rework rates due to incorrect or missing measurements. Based on our extensive industry experience, Quantapoint has performed an in-depth analysis of the key revamp challenges facing the processing industries. The following four challenges were identified as the key roadblocks in preventing processing companies from achieving world-class performance.



Challenge 1: Delivering ever Tightening Project Budgets

Project managers are being pushed to control costs as a means to improve capital project profitability. However, they have also come to expect certain incremental costs on maintenance and modification projects that have to be covered, whether they are budgeted or not. Recreating as-built documentation is one such item that must be completed early in the project to ensure that accurate and reliable information is available for design, fabrication and construction. This is a crucial step in the design process as all subsequent steps are based on this information. Manual measurement processes are time-consuming, expensive and error prone, which drives up costs and adds pressure to the project schedule.



“The average large size revamp project (\$50MM total installed cost) requires either a constant crew presence in the field throughout the design phase or a dedicated three- to six-month data collection period to create the as-built documentation we need.”

- Piping Designer, Major Engineering Company

Another cost is the need for field fit-up welds to compensate for inaccurate and incomplete as-built documentation. This limits the amount of fabrication work that can be accomplished before the turnaround and increases the amount of field routing that must be completed during the turnaround.

“We plan for one fit-up weld per tie-in across approximately 70 to 80 tie-ins and approximately 150 new pipes on (a typical) project. Only a handful of rewelds can be performed in a given day.”

- Senior Manager, Foster Wheeler

There are additional cost savings that can be gained by optimizing the engineer and design processes. However, confidence in the as-built documentation and inability to effectively share this information across geographically diverse teams limits ability to take advantage of some of the non-traditional approaches to reduce engineering costs.

“The man-hour rates in India are about 50 percent of that in Houston.”

- Piping Engineer, Major Engineering Firm

Challenge 2: Meeting the Turnaround Schedule

Given the inherent obstacles associated with field construction, Engineering firms face a significant risk from turnaround delays. Lost production can cost a typical processing plant \$500,000 per day or more, thus the penalties for missing the schedule can also dramatically hurt a project’s profitability.. Inaccurate and incomplete as-built documentation used for designs significantly increases the risk of field rework for many reasons, such as as-built documentation that assumes all equipment and structures are orthogonal, piping is always round and columns that are always plumb, which is rarely the case in the real world. Additionally, many installed components – such as small-bore piping, conduit, cable trays, ductwork and instrumentation – are often not documented at all. These challenges add not only cost, but also time to projects in the form of rework, field trips and re-design.



“In a process related turnaround, you always push yourselves to meet or beat the schedule, so cutting a 19-day turnaround by even one day is very meaningful. If you can avoid interferences and ensure the pipe is going to fit at the site, that’s worth a lot.”

- Venture Manager, ExxonMobil

Challenge 3: Achieving Quality Expectations

Despite quality improvement initiatives, it is not uncommon for maintenance and modification rework rates to run as high as 5 to 10 percent of a project’s total installed cost (TIC). There is considerable pressure to bring this quality metric down, but the lack of accurate as-built documentation and resulting rework or interferences cause constructability issues that keep this rate high.

“Rework rates are traditionally 6 to 15 percent of TIC.”

- CAD Manager, Major Engineering Firm

Challenge 4: Protecting Safety in Hazardous Conditions

The inherent safety risks of working at the plant site increase as a result of having to send crews to the field for prolonged periods to collect as-built documentation. Active plant hazards include material exposure, having more personnel in the plant for manual data collection and having to measure structures in cramped work environments.

Many believe that any activity that drives up the time spent in the field as a percent of the total project time is bound to negatively impact recordables. Driving the risk factor even higher is the fact that the majority of Engineering firms and processing companies are self-insured. Given the high cost of both medical and liability issues, companies are always looking for ways to improve safety.



“Recordable incident rate (RIR) for the entire U.S. Petroleum Industry is 3.9.”
- API, weighted average from 1999 U.S. Bureau of Labor Statistics

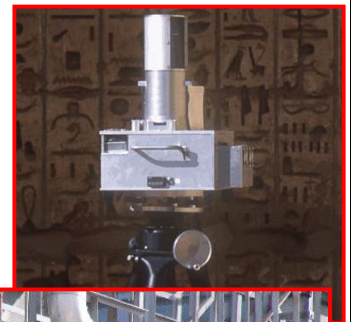
“1998 Construction Operations Recordable Injury/Illness rate of 2.98 translates into 1 out of 35 employees in construction operations incurring a recordable injury while doing offshore construction work during 1998.”
- “Drilling Standards”, PMSC, 1998

Key Sources of Value for Quantapoint As-Built Laser Documentation

In today’s highly competitive environment, processing companies are only able to achieve world-class performance and sustainable competitive advantage by seamlessly executing maintenance and modifications on existing facilities. To this end, processing companies are beginning to capitalize on the significant benefits that Quantapoint as-built laser documentation has offered the chemical process, oil & gas and refining industries for several years.

Quantapoint provides a “turnkey” solution that rapidly integrates billions of facility measurements to create 2D or 3D images that resemble a black-and-white photograph or CAD model, but are actually as-built laser documentation, with each point representing a highly accurate facility measurement. It is the fastest, easiest and most cost-effective way to obtain consistent and highly accurate as-built documentation for any facility. Our trusted as-built laser documentation is interactive and can be easily shared across the project team, with an accuracy of one-quarter inch or greater across the entire facility. Quantapoint clients have significantly increased the profitability and reduced the risk for maintenance and modifications in their existing facilities, with clients being able to reduce construction rework by 80%, with a greater than 10 times return on investment.

The value derived from using Quantapoint is immediate and demonstrable. The following example focuses on a typical revamp project managed by a representative Engineering firm named XYZ. XYZ is a large, global provider of engineering services to the Oil & Gas, Petrochemical, Chemical and Power industries. The firm generates \$5 billion in global revenues and a 2.8% profit margin. They manage approximately ten large revamp projects per year with an average total installed cost (TIC) per project of \$50 million. It typically takes a crew of 6 people approximately 16



Quantapoint 2D Laser Image
(not a picture)

weeks to collect as-built data on-site. Approximately 25% of their design hours are devoted to 3D design. Construction teams are generally 500 or more people and the work involves hundreds of pipes and an average of 250 tie-points per job. Their revamp rework rate is typically 5%.

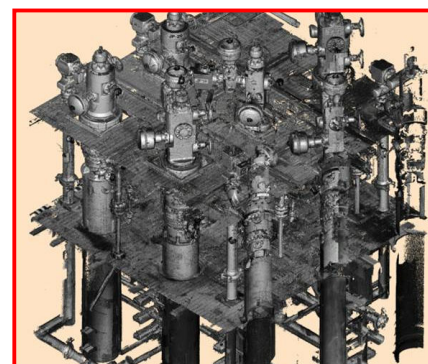
Using our proven track record, Quantapoint has identified the key sources of value as-built laser documentation for the processing industries fall into four main categories: cost, schedule, quality and safety. The table below lists these main sources of value and the specific benefits clients receive that provide the value. These are detailed in the following section.

Value	Specific Benefits
Reduce Costs	<ul style="list-style-type: none"> • Reduce field trips • Reduce fit-up welds • Improved information sharing and increased offshore design
Optimize Schedules	<ul style="list-style-type: none"> • Reduce as-built documentation collection time • Reduce new design modeling time
Increase Quality	<ul style="list-style-type: none"> • Lower rework rates • Increase shop fabrication • Create better pipe routing plans
Improve Safety	<ul style="list-style-type: none"> • Fewer personnel in the plant collecting data

Source 1: Reduced Costs

Quantapoint’s laser scanning services have been proven to reduce costs in both the design and construction phases of large industrial maintenance and modification projects. Project managers point to a number of distinct cost savings, which include:

1. *Reduced field trips:* By collecting more comprehensive and trustworthy as-built documentation, Quantapoint practically eliminates the need to return for additional measurements or information. Whether flying engineers back to the job site to capture data that was missed or keeping several designers in the field throughout the design phase, the savings can be considerable.



Quantapoint 3D Laser Model for an Offshore Platform (not a picture or CAD model)

- Reduced field trips: eliminate 75 percent of return trips → \$210,040 in cost savings

“There is air travel expense 80 percent of the time and at least one day of safety training per project for each crew member. The scaffolding cost per day is typically absorbed by the plant, but is significant since it can equal the number of days for survey work.”

- Mechanical Engineer, Major Engineering Company

2. *Reduced fit-up welds:* With Quantapoint, prefabricated equipment and pipe require much less incremental fit-up time and costs, such as additional measurements, cutting, cleaning and inspections. Based on customer results, 25 to 50 percent or more of field fit-up welds have been eliminated.

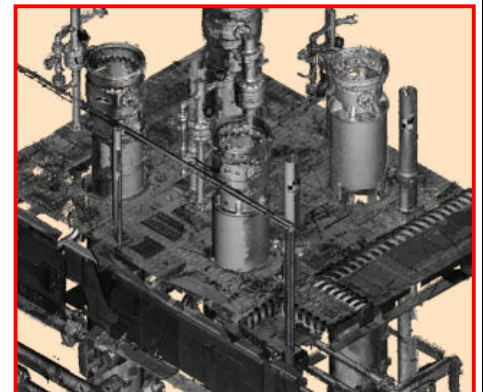


- Eliminated fit-up welds: 50 percent reduction → \$468,750 in cost savings

“We planned for roughly 2 to 3 field fit-up welds per line on the 50 line project. Quantapoint helped eliminate about 25 percent of these welds with better accuracy.”

- Piping Designer, Major Engineering Company

3. *Improved information sharing and increased offshore design:* Quantapoint provides the trustworthiness and accuracy required to give companies the confidence to share as-built documentation. Additionally, Quantapoint provides clients with software that enables them to access the as-built documentation from their desktops, making collaboration significantly easier. Further, as prevalent as offshore design work has been on grassroots projects, it remains quite rare on revamp work. Quantapoint offers the trustworthiness and accuracy required to give Engineering firms the confidence they needed to explore offshore design on revamp projects. For many firms, Quantapoint enabled offshoring for the first time on revamp work, and it now accounts for up to 25% of their design mix.



*Quantapoint 3D Laser Model (not CAD)
Share Across the Entire Team*

- Improved teamwork and increased offshore from 0% to 25% → \$375,000 in cost savings

“Quantapoint enabled offshore design work for the first time. We did about 40% of our design work offshore at a 30-50% lower man-hour rate.”

- Project Manager, Bechtel Engineering

Source 2: Optimized Schedules

By embracing as-built laser documentation, companies have been able to meet and improve critical turnaround schedules in several ways. Whether the time saved is through faster initial data collection, more efficient design or by encountering fewer design issues during construction, the ultimate result is the improved probability of delivering and perhaps even beating the turnaround schedule.

This improved schedule can also significantly impact an engineering company’s ability to capture incentive fees on cost-plus contracts. According to a project controls manager at a large

engineering firm, incentive fees can amount to as much as 5 percent of TIC and can represent the factor that pushes a firm to either meet or miss its annual revenue projections.

1. *Reduced as-built data collection time:* This benefit is one of the early reasons project managers use Quantapoint. The cost of sending six designers to the field for up to 4 months on a large project can now be avoided. Alternatively, the firm needs only to send one engineer with the Quantapoint team, and Quantapoint delivers the scan to the project team members' desks ready-to-use within 2 to 3 weeks.

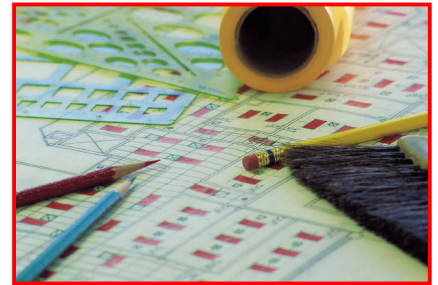


- Reduced as-built data collection time: 16 weeks to 3 weeks → \$325,500 in cost savings

“We would have required 3 to 4 crews of 3 people each approximately 4-6 weeks to sketch and measure the existing conditions. The Quantapoint work was done in 2 weeks with only 1 engineering project manager on-site.”

- Piping Designer, Major Engineering Company

2. *Reduce new design modeling time:* Quantapoint offers not only trustworthy and highly accurate point dimensional information, but also automated modeling and 3D visualization that makes design work much more efficient. On average, new design modeling time is reduced by 25-30%.



- Reduce new design modeling time: 30% faster → \$150,000 in productivity gains

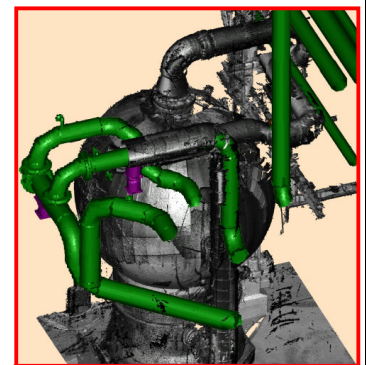
“Quantapoint saves about 30% of the 3D model design time with the aid of visualization. A picture is worth 1000 words.”

- Mechanical Engineer, Major Engineering Company

Source 3: Increased Quality

The impact of working with more trustworthy and accurate as-built documentation impacts the entire project lifecycle. Critical quality improvements have been reported across the following areas:

1. *Lower rework rates:* Many Quantapoint clients have seen their rework rates on maintenance and modification projects fall from 5 to 10 percent or higher to similar levels as grassroots projects at 1 percent. The traditional rework issues that Quantapoint helps to mitigate include: reducing the need to scrap and reorder materials; eliminating procurement errors as bid with firm specifications; reducing the labor associated with redesigning and re-engineering pipes and equipment; and avoiding the costly expense of idle rigging equipment. Quantapoint helps our clients measure rework in individual events, not as percentages (“events, not percents”).



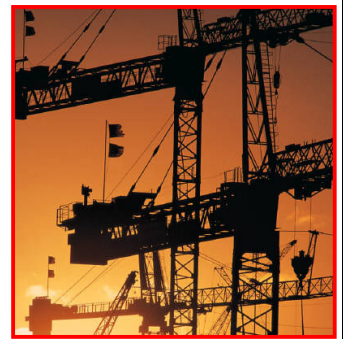
Quantapoint 3D Laser Model with a CAD Model

- Lower rework rates: conservative 1 point reduction → \$500,000 in cost savings

“Traditionally, when drafting with paper and pencil, error rates would range around 6 to 15 percent of TIC since the data was so incomplete. Now with the use of the ‘electronic image of the existing facility’, we measure and design correctly to avoid problems when we assemble in the field. This has helped bring revamp rework rates to the same level as CAD grassroots projects at about 1 percent. Also, because we can see everything, we are able to catch and mitigate potential clashes in the design phase. With Quantapoint, there are virtually no clashes.”

- Senior Manager, Foster Wheeler Engineering

2. *Increased shop fabrication:* With Quantapoint, owner/operators benefit from fewer as-built documentation omissions. They now have the detail required to increase the scope of work done in the shop environment before turnarounds. This includes information on small-bore piping and conduits that are less than inches in diameter, which are typically ignored when plants are re-modeled. In a typical project, 10 to 20 percent of field fabrication is eliminated in favor of less costly shop fabrication.



- Increased shop fabrication: shift 10 percent from the field → \$75,000 in cost savings

“Using Quantapoint, we eliminated about 15 to 20 percent of field fabrication in favor of shop fabrication.”

- Piping Designer, Major Engineering Company

3. *Better pipe routing and lifting plans:* By running automated clash detection against the new design, each engineering discipline can determine where demolition work will overcome an interference issue versus where they need to modify their design or construction plan. Quantapoint clients have reduced construction by days with better routing and lifting plans.

- Better pipe routing and lifting plans: eliminate 1 construction day → \$300,000 in cost savings

“Quantapoint enabled Parsons E&C to deliver an ‘interference free’ design and allowed us to keep our overall project on schedule.”

- Engineering Manager, Parsons E&C

Source 4: Improved Safety

A key consideration driving many firms to standardize on Quantapoint as-built documentation is safety. Although the rationale supporting improved safety is strong without attaching a monetary value, there are quantifiable business benefits. For the majority of Engineering firms that are self-insured, the ability to limit expensive liability suits and medical expenses is a very real potential benefit. For those that purchase liability and worker's compensation insurance, Quantapoint has been shown to reduce the recordable incidence rates (RIRs), which impacts a plant's EMR (experience modifier rate). The EMR ultimately correlates to the premium paid for insurance. Two estimates are provided below, depending on if the firm is insured by another company or self-insured. Note that because the quantification of the safety benefit is less well validated, Quantapoint used the lower value in the overall savings estimate.

- Fewer personnel in plant collecting data: insured → \$626,791 in cost savings
- Fewer personnel in plant collecting data: self-insured → \$248,211 in cost savings

“This was our best turnaround in history. We had no recordable incidents at all. This is very rare.”

- Project Manager, Major Engineering Company

“Quantapoint impacts the absolute recordable rates or ‘how many total hours on a project without an accident’. The amount of hours climbing and otherwise capturing field dimensions under risky conditions were taken out of our hands. The more time out of the field the better.”

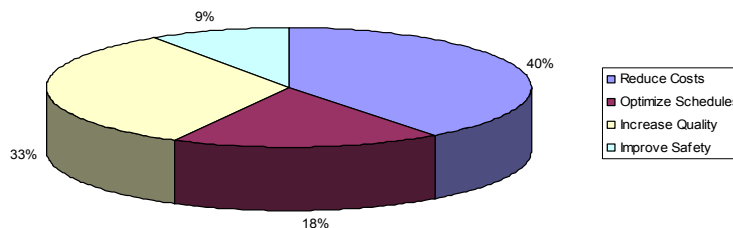
- Project Manager, Fluor Engineering

Overall Value

Based on the cost savings and productivity gains detailed above, the projected financial benefits for the sample project amount to \$2.65 million, as shown in the figures below. As shown below, cost reductions and quality enhancements are the primary value drivers.

Category	Specific Benefit	Value	Percentage
Reduced Costs	<ul style="list-style-type: none"> Reduced field trips by 75% Reduced fit-up welds by 50% Increased the amount of offshore design by 25% 	\$1,053,790	40%
Optimized Schedules	<ul style="list-style-type: none"> Reduced as-built documentation collection time by 80% Reduced new design modeling time by 30% 	\$475,500	18%
Increased Quality	<ul style="list-style-type: none"> Lowered rework rates by 1% Increased shop fabrication by 10% Created better pipe routing plans to save one day 	\$875,000	33%
Improved Safety	<ul style="list-style-type: none"> Fewer personnel in the plant collecting data and less exposed to hazardous conditions 	\$248,211	9%
Total		\$2,652,501	100%

Tabular Display of Value by Category



Pie Chart Display of Value by Category

The value was also analyzed by benefit type, as shown in figures below. As shown below, increased revenue represents a fairly small amount of the total value created compared to direct cost savings.

Benefit Type	Value	Percentage
Cost Savings	\$2,502,501	94%
Productivity Gains	\$150,000	6%
Total	\$2,652,501	100%

Tabular Display of Value by Benefit Type

Conclusion

Detailed value analysis can help project managers understand how moving forward with or standardizing on Quantapoint can achieve solid business results. To request a custom value analysis for your business, please visit Quantapoint's web site at www.quantapoint.com or contact Quantapoint at 412-653-0100 or info@quantapoint.com.