AEC Industry Report

April 2018,
Sponsored by ClearEdge3D

OH, CRAP! 10 OF THE WORST CONSTRUCTION BLUNDERS AND HOW YOU CAN AVOID THEM

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Learn from Past Mistakes to Avoid Construction Blunders of Your Own.

Sometimes the push to keep a project on schedule leads to design, communication, and installation errors during the construction process. So when it comes to large-scale construction projects, it takes many capable hands, countless hours, and the most up-to-date technology and tools to ensure the final structure is safely and properly constructed.

In this report, we detail 10 of the worst construction blunders that our panel of industry experts have encountered in the last eighteen months. As we all know, errors and inaccurate construction can result in high-cost rework and weeks or months of project delays. Industry professionals know that 5-12 percent of material and labor budgets is often lost to rework, schedule delays, and downstream communication clashes.

Learn from some of the best in the business! This report reveals how industry experts discovered major construction problems before they turned into multi-million-dollar mistakes—and how they were able to remedy errors and keep their projects on track.

Now for the countdown of our top 10 construction blunders!

[#10] Rocket Launch Pad Conversion

Deviating Measurements Cause Delay of Launchpad Layout

Problem

Total station measurement errors were delaying construction (as well as a scheduled manned rocket launch). The potential for added costs were projected into the hundreds of millions of dollars.

Situation

While working as a consultant, Buck Davis of Balfour Beatty Construction, went on-site to support the general contractor who was having issues with their robotic total station implementation. The project team was seeing substantial errors with the launch pad measurements, where points were deviating in a non-linear manner from 3 to 12 inches! Even stranger, the error was increasing as they worked towards the center of the circular launch site. The project team jumped to the conclusion that the equipment must be broken and wanted to turn to more conventional measurement options. But, those methods wouldn't meet the project's quality expectations.

The errors in the measurements had brought the project to a screeching halt and Davis needed an answer fast. The construction team was turning this launch pad from a previously used test site for unmanned launches into a launch pad for an upcoming manned launch. The launch was already scheduled, and any delays would cost millions of dollars in penalties. A solution to the measurement inconsistencies had to be provided quickly.

Solution

There is no margin of error on a launch pad, even a centimeter miss could spell disaster for the launch. Davis' expertise with the equipment gave him confidence that the measurements themselves were correct, so he began to look elsewhere for the cause.

After walking the site and testing the equipment, he still hadn't discovered a reason for the error. So, he took a break and decided to talk with one of the veteran engineers. While complaining about the "circle" beating him up, the engineer casually mentioned that it wasn't a circle, that it was an ellipse that was 1' wider on one axis. This was a critical missing piece of information that would explain why the measurements were skewing.

Davis immediately went back to the computer and looked at the control points the team had exported for their layout and saw that they had mixed up their point values. With a perfect circle it would make no difference, but with an ellipse the team's inputs of EN rather than NE were enough to throw off the rest of the project, confuse the general contractor's field team, and put a halt to progress. Once the control points were corrected, all the measurements from the robotic total stations were spot on and the job jumped back into gear and made their deadline.

Takeaway: Trust Your Tools

Trust your tools, test your assumptions, and take the time to fully understand existing structures. Davis tested and trusted the equipment he was using and the process he was supporting, so he went past assumptions about the site and figured out what was actually causing the measurements to be wrong. While it is easy to blame technology or tools for mistakes, had the team switched to using more traditional measurement tools from the same bad control points, the launch pad project may have never been completed properly.

[#9] Steel Structure for Retail Store

Inconsistencies in Pre-Built Drawings Cause Improper Steel Installation

Problem

Missing annotation on the structural drawings leads to incorrect steel installation.

Situation

A subcontractor on a steel project was finishing up installation on approximately 500 different steel members and everything seemed to be running smoothly. The project team knew of some errors in the foundation made by a prior general contractor and made corrections to the steel fabrication drawings to account for those errors. However, the team had some concerns about the perimeter steel being in the right place for the pre-fab glazing system. They decided to bring in Anton Dy Buncio from VIATechnik to laser scan the completed steel to check for any errors on the perimeter that might cause headaches down the road.

While they found a few things to fix on the perimeter, what they found inside the building was the real surprise. The design model showed where there should have been sloped steel, but the scan showed that particular member as being installed perfectly flat. Additionally, the scan showed that the beams on either end of that member were installed at the correct elevation. This made it difficult to know which steel member was installed incorrectly and why.

Solution

Taking a few steps back and looking at the project's design drawings, the cause of the confusion was easy to spot. The project's architect had annotated a slope on the architectural drawings that was missed by the structural engineer. While subcontractors are supposed to look at all the drawings, it is not uncommon for them to only refer to the structural drawings. Since the slope wasn't noted there, the subcontractor missed it and fabricated and installed the element flat.

Fortunately, laser scanning and a quality check with ClearEdge3D Verity construction verification software made it possible for the problem to be discovered the day before the concrete was to be poured. If the concrete had already been poured when the non-sloping member was found, the potential rework cost could have been up to $50,000. As the error was caught, it only cost about $5,000 in labor and miscellaneous material to cut and adjust it in the field.

VERITY

Example Report

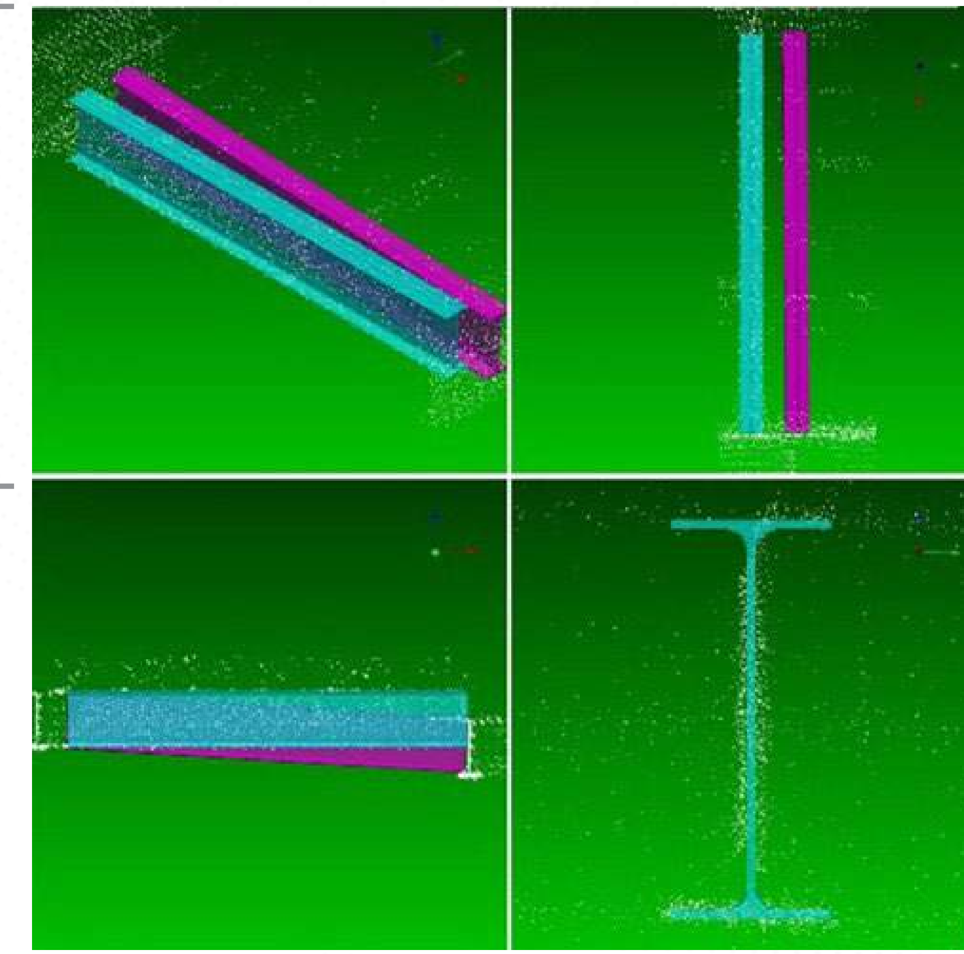
Item 16: Out of Tolerance
W-Wide Flange || Structural Framing: W-Wide Flange: W10x12

Action Required:
Yes

Classification:
Out of Tolerance

QC Status:
Examined

Confirmed By:
N/A



Date Scanned
11/18/2016

Tolerance:
–

GUID:
7fbe5c8b-1e5b-418f-8030-Ca8d1eb11f2e

Action Required:
Yes

Notes:
This element should be sloping, it was installed horizontal!

Take Away: Timing is Everything

Timing is everything and finding errors early is critical. Holistic quality checks with laser scanning and analysis tools like Verity help discover mistakes early before they become expensive problems. Insuring consistent and correct documentation from each member of the design team from the start could also have prevented this issue.

[#8] Railway Overpass

Lack of Design Details Causes Complete Rework and Expansion Delay

Problem

Insufficient design detail causes complete rework and expansion delay for a railway overpass project.

Situation

Anton Dy Buncio of VIATechnik was working with a client who was managing the construction of a simple bridge over railroad tracks for the state's Department of Transportation (DoT). While most of the project was clearly documented, only one detail was provided in the drawings for the ends of the overpass expansion joints. Unfortunately, the 2D detail provided was diagrammatic, treated all four ends of the expansion joint identically, and didn't provide sufficient information for the contractor to understand the design intent for the detail.

Despite numerous RFIs (Request for Information) sent to the engineer by the contractor for additional details or drawings, the engineers continued to respond back with "reference drawings." With no additional information given in response to their requests, the field team had to move forward as best as they could. The project team went ahead and built all four joint details from their own interpretation of the drawing.

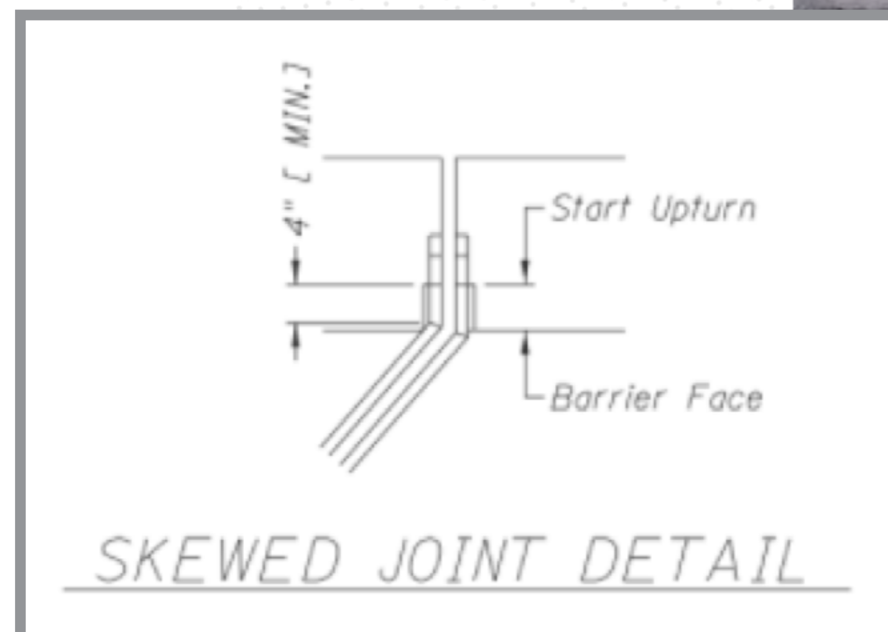
The build was later inspected and approved by the Department of Transportation as it appeared to conform to the limited information provided in the single detail drawings. It wasn't until the DOT came to view the finished project that the problems with the constructed detail became evident. They found multiple areas of concern and required the ends of the expansion joints be entirely redone. Each of the four joints had to be revised and the additional work cost upwards of $30,000 in materials and delayed the project several weeks. This delay also impacted the opening of a major thoroughfare dependent on this project's completion.

Solution

The problems in this project could have easily been solved through a simple 3D model of the existing conditions and the proposed design—or by simply providing more 2D details upon request. This would have saved the contractor and the field team a lot of time and money from the start.

Takeaway: Clear Design Intent

It's important to provide 3D models of designs to make design intent clear and prevent costly delays and subsequent roadwork. Implementation of robust QA/QC practices would have also raised issues and spotted problems earlier in the process, before concrete is poured, when they were less expensive to fix.



"A simple 3D model would have helped the bridge open on time and would have saved the project $30,000-$50,000 in rework."

— Anton Dy Buncio, COO, VIATechnik

[#7] Large New Hospital

New Construction Becomes Renovation when Building Information Modeling (BIM) Gets Ignored

Problem

Mistrust of the BIM process led a superintendent and project manager to ignore the coordinated BIM and install ductwork based on uncoordinated drawings.

Situation

Despite numerous technological advances and widespread adoption, project and field teams for some general contractors still distrust BIM and other newer technologies. This was the cause of a host of problems for Anton Dy Buncio of VIATechnik when he was leading the 3D coordination process for the MEP in a new hospital facility.

Because of the distrust in BIM, the general contractor's project manager and superintendent decided to order ductwork based on the uncoordinated MEP engineer's drawings to get a jump on the project schedule (unbeknownst to the coordination team).

Meanwhile, Dy Buncio was leading the 3D coordination process and working towards clash-free shop drawings per the client's requirements. It was only months later when the ductwork was being installed that it became evident that the 3D coordination process had been side-stepped by the GC.

With most of the ductwork fabricated and installed based on the uncoordinated design drawings, Dy Buncio and his team had to get creative and determine how to re-coordinate the building given the new conditions.

Solution

Having worked on many renovation projects in facilities with existing MEP systems, Dy Buncio knew exactly what to do. They started with laser scanning the installed ductwork and re-coordinating the rest of the trades against the as-built conditions in the field.

A lot of the work that had been done in the initial coordination had to be abandoned. This included hundreds of penetrations through the concrete structure that had been placed in the field based on the initial coordinated model. Now, those same structural elements had to be cored to accommodate the new location of pipes that would be installed around the uncoordinated ductwork.

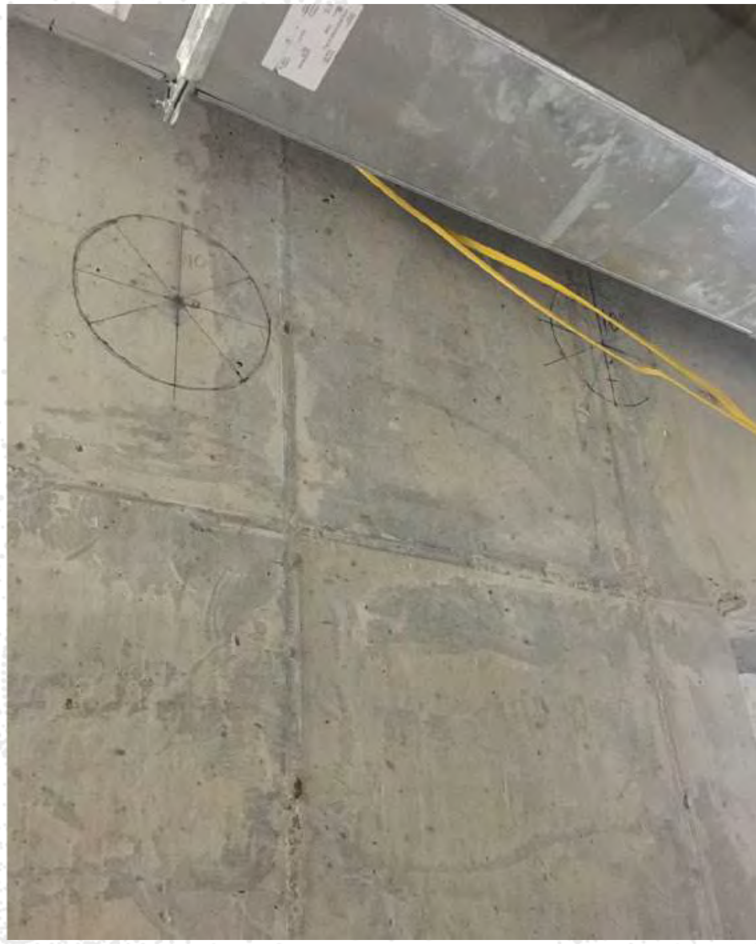
Takeaway: Beware of BIM Skepticism

BIM skepticism can lead to major overhauls costing projects time and money if it isn't addressed and resolved early. The superintendent, project manager, and field team may have assumed their choice to forgo the BIM process was essential to completing the project quickly; but, the decision to ignore recommendations in the initial coordination meetings turned a relatively simple new construction project into a far more complicated renovation project.

All the labor involved in laser scanning to capture what was actually installed, re-coordinating the models around it, and the labor and material costs for the rework in the field added up to over $250,000 in direct costs plus big schedule delays. The added costs of "renovating" this project could have been avoided if only the construction team put their trust in the BIM process.

"As a BDC services firm, we spend a lot of time working coordination. Unfortunately, for this project, the project manager and superintendant silently distrusted the BIM. So the GC was off fabricating and installing ductwork based on the design drawings... Needless to say, we ended up having to scan all the ducts, poured walls, and other existing conditions created from the design drawings, essentially turning this new construction job into a renovation project — an expensive one at that."

— Anton Dy Buncio, COO, VIATechnik



[#6] Hospital Central Utility Plant

Lack of Documentation Adds Thousands in Labor Hours and Client Distrust

Problem

A field team changed the project's MEP installation without proper documentation resulting in thousands of additional costs to re-document the as-built.

Situation

While BIM and 3D coordination provide a host of benefits to the process of installing building systems, problems can still occur by field installers. In this case, the field determined a "better solution" as they were only focused on their own work and did not refer to what was drawn or modeled. This can cause all sorts of problems for the trades that follow and can even cause problems for their own teams if they don't do a good job documenting their changes.

Kelly Cone witnessed this first-hand working on a hospital central utility plant (CUP). The project had a fully coordinated BIM for the project's CUP, but when it came time to install the water supply piping, the field team went a different direction.

The subcontractor chose to significantly reduce the linear footage of piping by mirroring the position of the valve gates in multiple places. While their solution was ultimately a better one for them, they did not document the changes made in the field. In this part of the CUP, they were the only significant trade present in the space, so their changes were missed when other teams went in and installed their work.

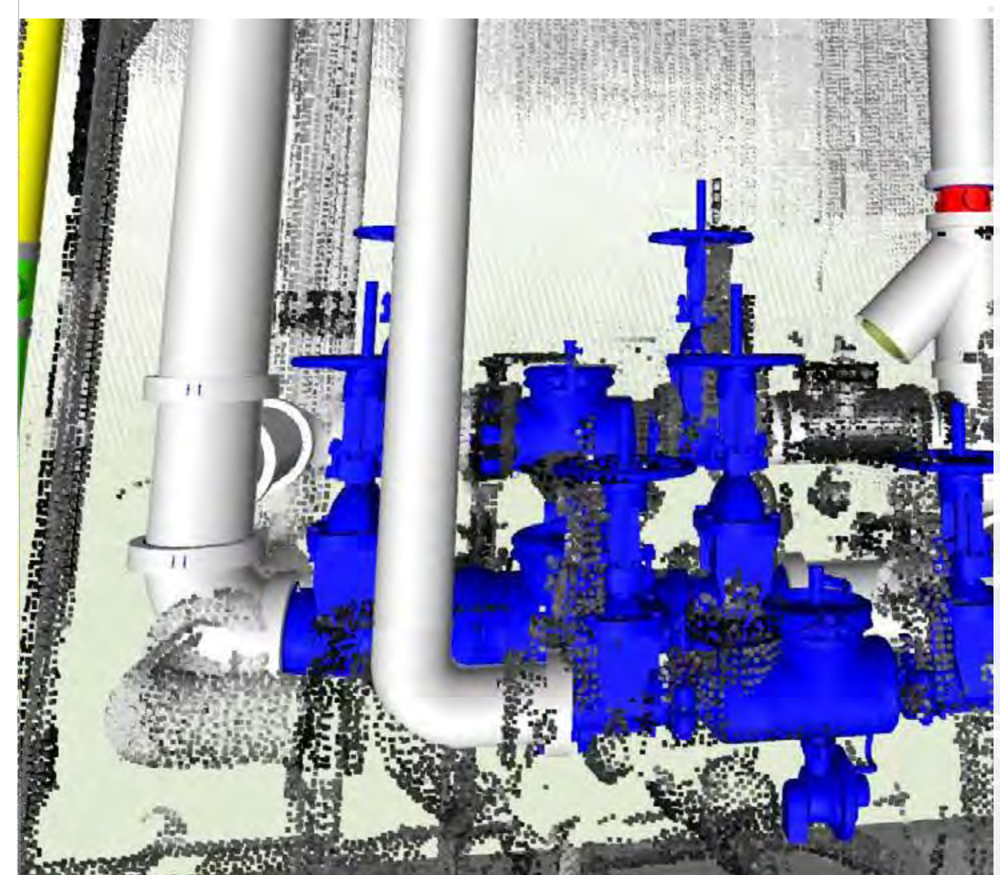
So, why is this critical? The final drawings that subcontractors provide are what the owner uses to operate the building. So, while this particular change might have been a good one for the project, failing to document it was not. Each valve in the drawing is labeled and noted so the owner knows it's function. By changing the piping going into the valves, the subcontractor also changed what each valve does. While the drawings might suggest the valve you're turning off would cut off water to the cafeteria, it might instead cut it off to the operating rooms where surgery is being performed. That could be a life or death difference.

Solution

The project team had already noted some differences between the as-built drawings and the installed work but didn't know how much was incorrect because traditional spot-checking only validates a small percentage of the work. When it came time to perform the quality control checks on the installed work prior to handing the building over to the client, Cone's team chose to laser scan the CUP and use Verity construction verification software to perform the quality analysis. Within a few hours it was revealed that 80% of the piping was not installed per the final "as-built" drawings. The detailed reports and metrics proved that the subcontractor hadn't properly documented their field changes, and they had to remobilize the CAD team to re-document the as-built work costing the client $15,000 in labor they hadn't budgeted.

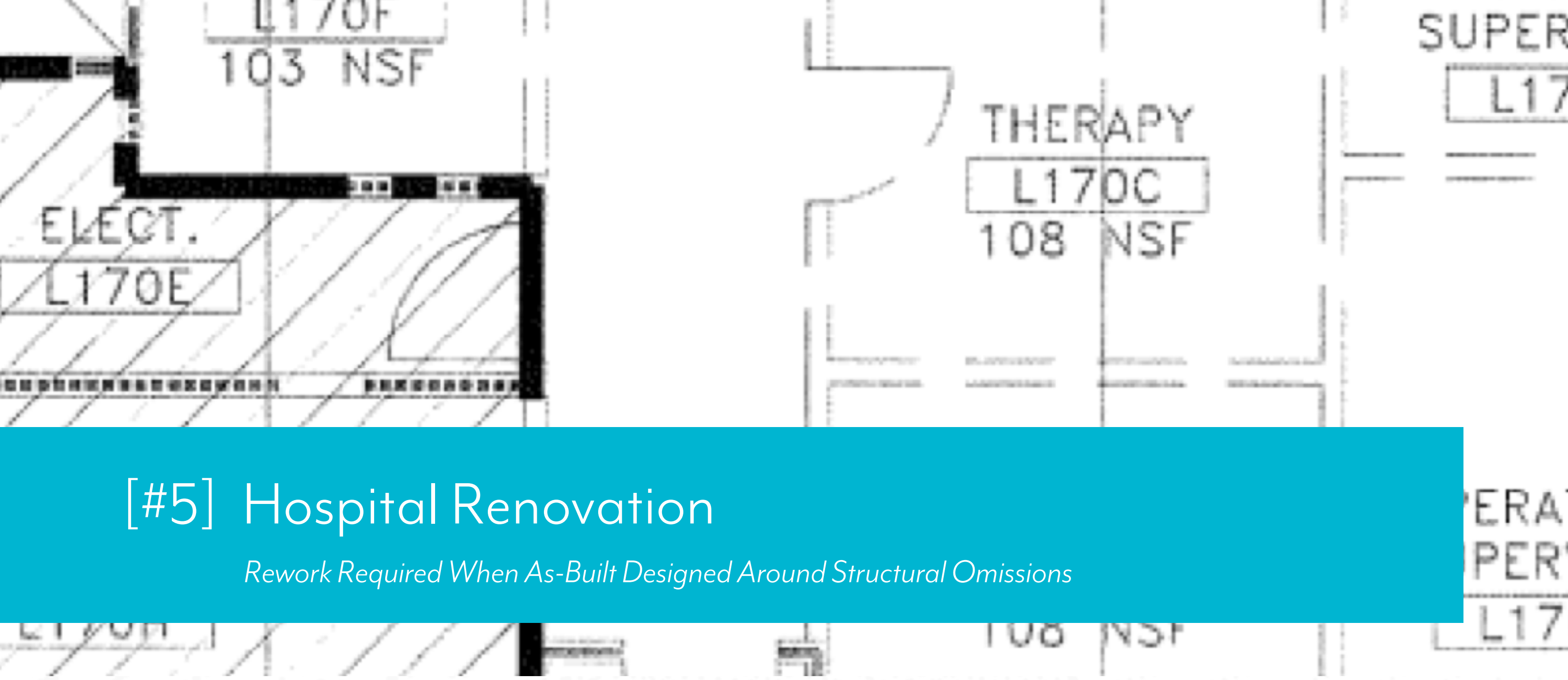
Takeaway: Document Field Changes

Traditional quality control methods in the field only validate a tiny fraction of the work. Using a more rigorous process to check all the work catches the problems you didn't even know to look for. By following the BIM or properly documenting field changes, it would have prevented all the damage to the subcontractor's budget and possible reputation.



"The field crews did a great job of reducing the linear footage of piping required, but they never documented the changes into the as-builts. When we were brought in for the final QC checks before hand-over, we chose to laser scan the CUP and use Verity to perform the analysis. Within a few hours it was revealed that 80% of the piping was not installed per the final "as-built" drawings."

— Kelly Cone, VP of Product Management, ClearEdge3D



[#5] Hospital Renovation

Rework Required When As-Built Designed Around Structural Omissions

Problem

Design team uses inaccurate as-built drawings causing significant delays and redesign.

Situation

A hospital in California reached out to Anton Dy Buncio and VIATechnik to help them resolve significant issues with the renovation of their existing facility. The hospital was originally constructed in the 1930s and underwent a prior renovation around 1990. However, the hospital had to update the space for their current needs and bring it to California's strict seismic codes. All of this had to be done on a tight schedule because parts of the building were still in use by the hospital.

Despite the client recommending laser scanning to validate the as-built drawings they provided to the design team, the project team made the decision to wait until demolition was complete to scan the facility to save money on the scanning costs. As a result, the design was completed based on the unverified as-built drawings. Much of the work performed on the building over the years was completely undocumented in the drawings.

So, when the ceiling above the main hallway was removed it was filled with existing electrical and HVAC systems that were not present in any of the current design drawings. This brought the project to a halt.

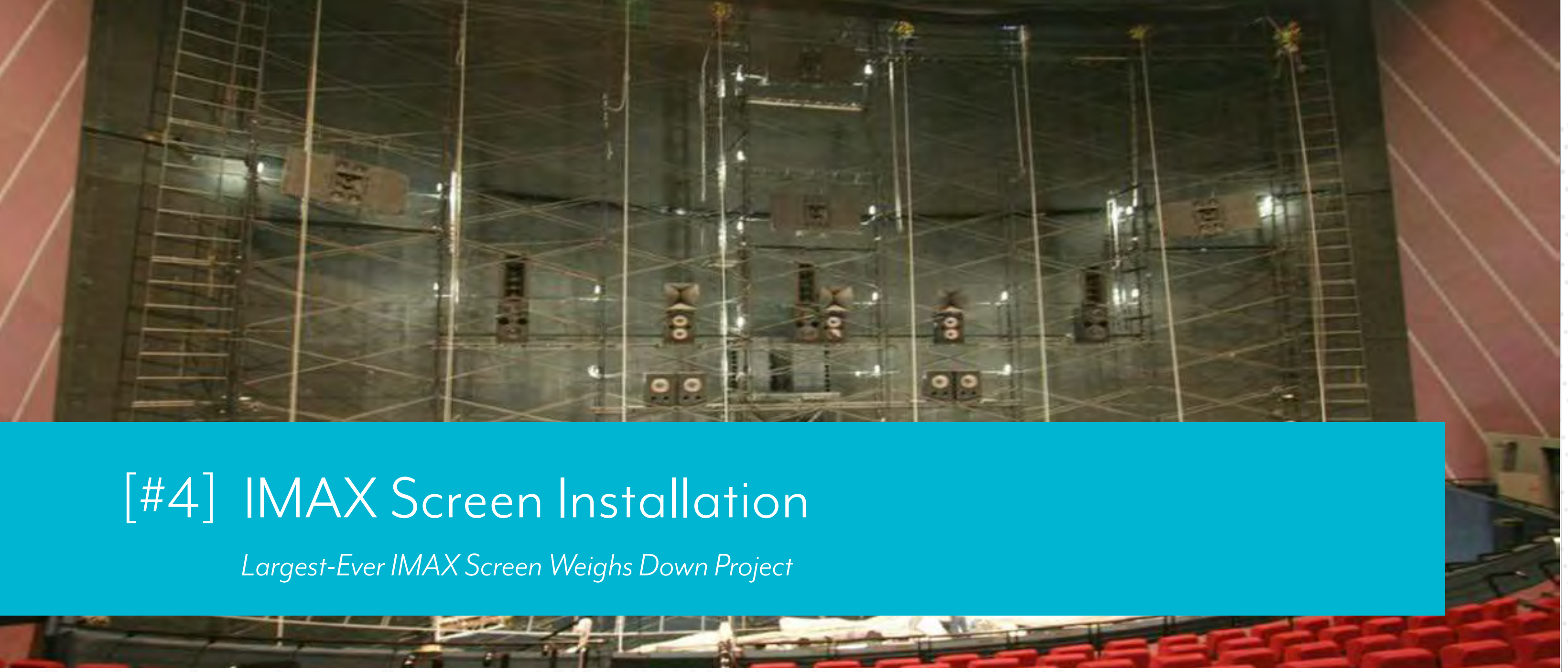
Solution

VIATechnik was brought in to perform laser scans on the existing facility and help manage 3D coordination in support of the redesign. The scans confirmed multiple locations that contained complete MEP systems and structural changes that had never been incorporated into the as-built drawings.

The discrepancies between the as-built drawings and the actual conditions meant that the initial completed design was not ready for any construction or renovation. The re-design of the project required over 100 RFIs on the as-built conditions alone, delaying the schedule by six months. This had a significant financial impact on the hospital since it had to remain in operation during that delay as they waited for the new areas of the hospital to open as initially planned.

Takeaway: Understand Existing Conditions BEFORE Designing Renovations

By investing in scanning before demolition, they would have saved significantly on delays and costs for redesign. The project was eventually finished, but the costs to incorporate all the changes during the construction was more than the savings that resulted from delaying the laser scanning until demolition. Understanding and seeing existing conditions prior to beginning a renovation project is critical to effectively managing project risk.



[#4] IMAX Screen Installation

Largest-Ever IMAX Screen Weighs Down Project

Problem

Massive IMAX screen was blurry upon completion, and the finger pointing quickly commenced.

Situation

Balfour Beatty Construction and Buck Davis were part of a team helping to discover projection issues in one of the largest elliptical IMAX screens ever built. When the design and construction were complete, the only thing left to do was turn on the projection and see the impressive screen at work. However, when the screen was put into action, the projection was blurry and skewed.

The cost of the entire project was $700 million, the IMAX room was $15 million, and the screen and support structure alone cost $2 million. When the projection results were...umm... not exactly as imagined, the client and project team needed to know where the build went wrong and what, if anything, could be done to fix it. With so much money behind the design and construction, the owner of the space and the screen vendor began to point fingers and assign blame. After hours of confrontation and with the risk of litigation, Davis was brought in to scan the screen and support structure to try and determine the cause.

Solution

Davis knew that on a project like this, laser scanning was the best way to determine the problem. Initially, the blame was with the concrete subcontractor who built the shell. However, the laser scans revealed that the concrete shell was within ⅛ inch of design across the surface. On such a massive concrete shell this was just about perfect, and within the required tolerances. So, if the support shell was near perfect, what was causing the blurry image? The scans of the screen discovered that while the screen was positioned correctly on the sides and across the center, it was several inches off along the bottom edge.

It was then determined that the fabric for the screen was stretching downward due to its own weight. The concrete was poured perfectly but it lacked sufficient bracing to support the weight of the massive screen. Laser scanning allowed for this "Aha!" moment and saved what could have been close to $500,000 of unnecessary rework. The facility opened on time!

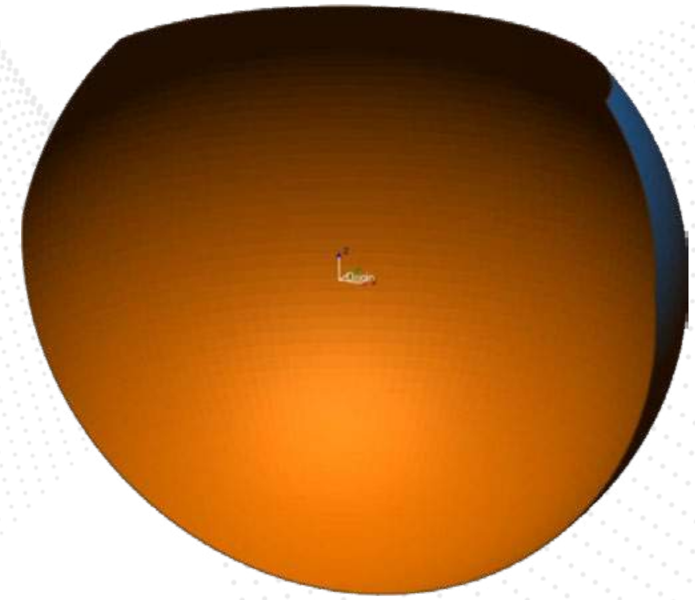
Takeaway: Scanning Can Be Critical to Success

The IMAX project proved that using scanning technology for unique projects can be critical to success. Without the ability to QC with laser scanning and verification software, the project could have fallen into nasty and expensive litigation. If the project had applied scanning early and often on the project, the two-week schedule delay while they argued and investigated could have been avoided.

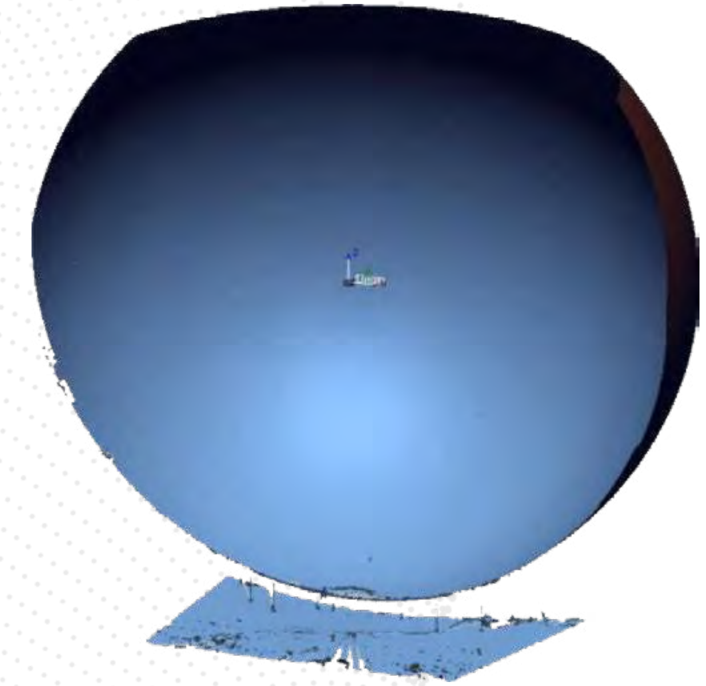
"Had we not had the ability to go out and laser scan, I don't know how we would have ever solved it. Once we were able to assess what was wrong and model new bracing options, we were able to solve the problem before things got expensive to fix or bogged down in litigation. The theater was able to open right on schedule and the screen looked great!"

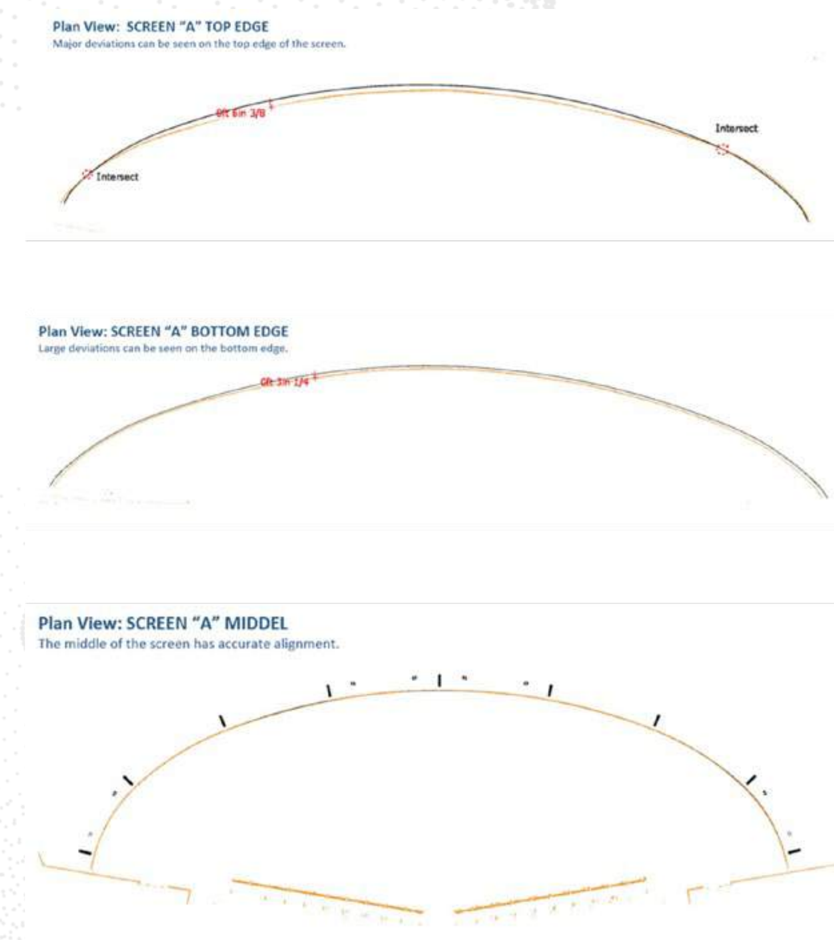
— Buck Davis, VDC - Project Solutions Manager, Balfour Beatty Construction

Concrete Shell Model



Concrete Shell Actual - Within 1/8-inch tolerance





[#3] New School Building Construction Project

Process Delayed When Structural Steel Erection Errors Narrowly Avoided

Problem

Anchor rod misalignment on over half of a structure's 40 columns causes project delay.

Situation

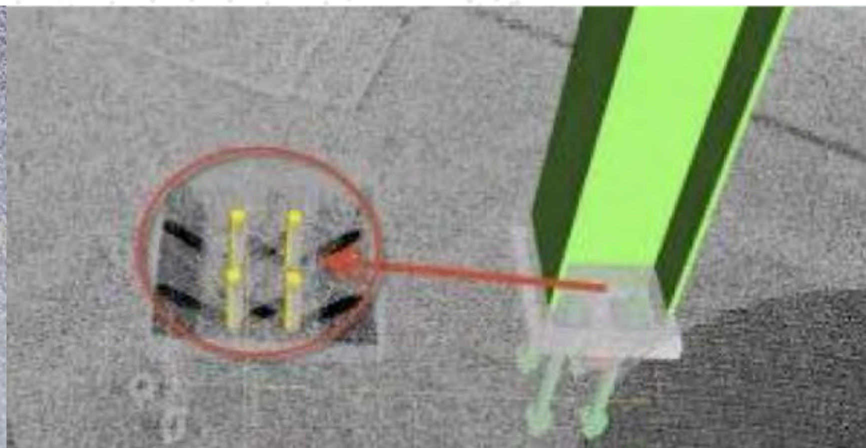
While anchor rods seem like small elements in the steel erection process, ensuring their precise installation compared to the plan is a critical link to successfully completing the structure of any steel building. Unfortunately, on this project, a layout mistake by the concrete subcontractor resulted in over half of the project's columns requiring modifications to the already fabricated steel columns.

Solution

Will Ikerd of IKERD Consulting was hired to document this significant error and help the project team find a solution and get them back on schedule. Will utilized high accuracy laser scanners to document the placement of all the anchor rods on site and utilized ClearEdge3D EdgeWise software to extract accurate anchor rod placements and sizes from the point cloud data.
This allowed IKERD Consulting to provide accurate horizontal and vertical displacements for each anchor rod and illustrate how each column's base plate could be modified to work with the out of tolerance anchor rods.
This provided such clear documentation that the owner waived a requirement preventing field modification of structural steel in order to facilitate the modification of the column's base plates so that they could work with the existing anchor rod locations where possible. By utilizing the information extracted from laser scan data, the project was back to erecting steel within three days of IKERD showing up on site. While the project was already behind by three weeks, this was a far faster turn-around than the client had thought possible, and the project was able to stay on track with their structural installation. Alternative solutions would have taken weeks of additional time and cost tens of thousands more to perform.

Takeaway: Identify Critical Areas for Scanning

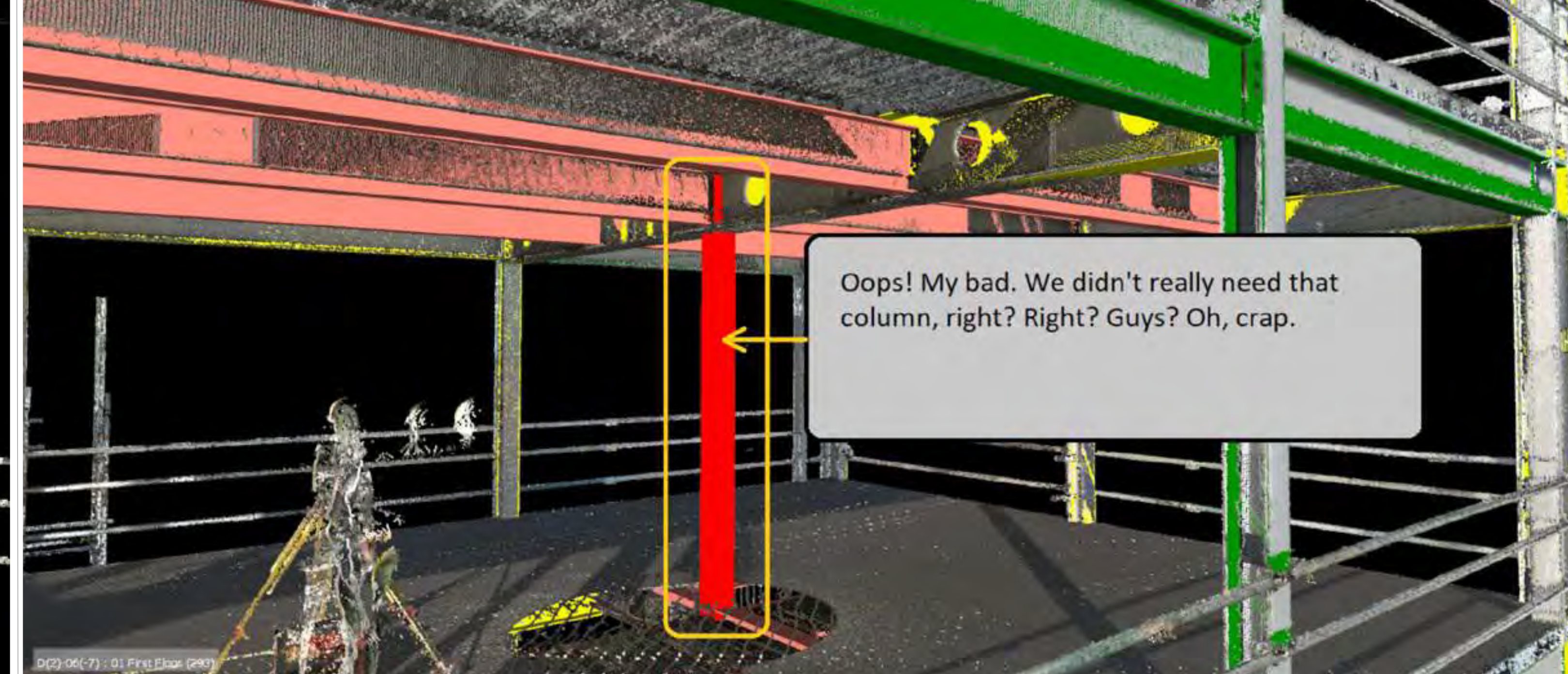
Structural steel erection is so fundamental to the construction process that a project cannot move forward until it's completed—and completed correctly. Had the GC's workflow included identifying critical areas for scanning at key intervals, the anchor rods would have been corrected before the concrete was poured eliminating significant delays, rework, and money.



"We often see problems like these anchor rods being out of tolerance in projects where cross-trade coordination fails. By using BIM and a robotic total station layout before the pour, you're creating a workflow that will invariably reduce these kinds of errors and ultimately keep costs down and the project on schedule." —Will Ikerd, P.E., Principal, IKERD

[#2] Mid-sized Commercial Office Building

Column? What Column? Unclear Design Drawings Result in Missing Structural Column



Problem

Unclear design drawings led a subcontractor to erect a critical steel column on the wrong floor and fail to place a column on the floor where it was required.

Situation

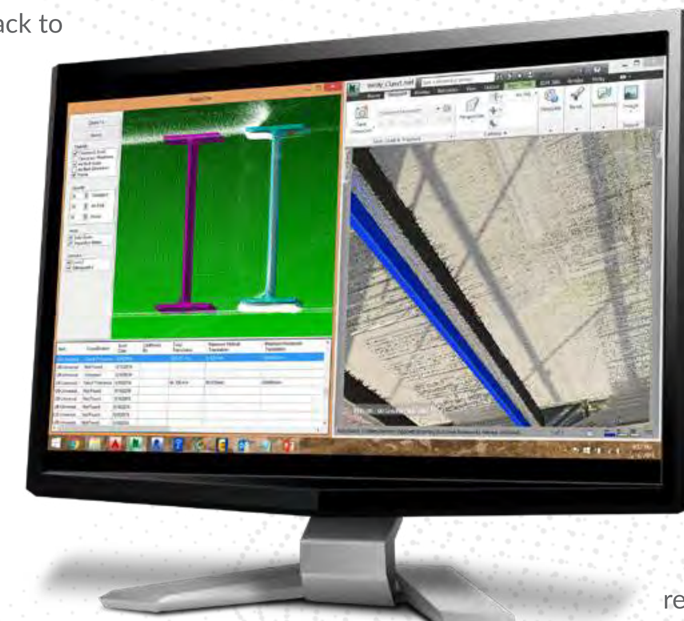
When ClearEdge3D was working with a customer to test an alpha version of their new Verity construction verification software, they noticed one project had some structural irregularities that needed explanation. As typical, this project had a consistent set of columns on each level that went from the bottom to the top of the building. But one level in particular required a column be left out to house a piece of equipment designed for that floor. The level below had a heavier column to support the weight of that piece of equipment.

However, the laser scans performed by the customer of this project exposed something a bit different, something shocking. On the level where there was supposed to be a column, none was present. And on the level where the column was supposed to be absent, one had been installed! What happened? Did they change the design and decide to put the piece of equipment on a different floor? Had they failed to update the models? It was such a big mistake it was hard to believe it was real.

The general contractor's project team started investigating the issue. As it turns out, this particular column situation was obvious in the 3D model, but the drawings did not have clear notation or explanation of the condition anywhere. The lines on paper were correct, but it took a lot of digging through the drawings to figure out what was intended from the 2D documents.

The steel subcontractor hadn't figured it out, and the end result was exactly what it looked like in the Verity software – a missing column! This was not the only mistake on the job either. This project's subcontractor had taken substantial liberties in moving from the engineer's design to their fabrication drawings. Over 70% of the beams and columns were out of the specified tolerance when compared back to the engineer's design.

Solution



Even with the majority of steel being out of tolerance, the engineering review that followed accepted the variances as being within safety factors and within the rights of the subcontractor's responsibilities to provide an engineered solution. The single misplaced column had to be corrected in the field where it took about one week of additional labor to shore up the structure, pull out the column, and place it where it needed to be. This cost the project about $20,000 and put the schedule behind by one week.

Takeaway: Make Laser Scanning & QC with Verity a Standard Practice

Beyond the extra time and money, this issue created doubt about the reliability, capability, and quality of the subcontractor. The issues discovered on this project made laser scanning and a quality check with Verity a new standard practice for structural approval for the customer. Most people think their projects are built much more accurately than they are. The results on this project came as a shock to the client. Most first-time users have similar reactions as Verity identifies problems during construction they would missed (even with traditional spot checking). Though this is the only missing column Verity has found to date!

[#1] Residential High-rise: Site Boundary Bust

As-Built Structure Outside Property Constraints Causes Year-Long Delay and Significant Costs

Problem

Site boundary and property constraints cause a year-long delay and costs millions of dollars.

Situation

On one of his first projects at a prior firm, David Thirlwell of Baker Concrete Construction found himself getting involved with a job that was not built within property boundaries. Due to Thirlwell's efforts, they were able to resolve the issue with minimal fuss, but not without reviving some memories of how this same mistake on a prior project had gone terribly wrong.

Preceding the adoption and use of BIM, the same general contractor used a civil engineer that made a mistake placing the building properly on the site. This caused cascading problems with just about everything you can imagine – changes to the plans and the building footprint, associated redesign costs, conflicts with the neighboring businesses, and litigation. This put the project into a year-long standstill (in addition to a hurricane damaging the partially built structure). The general contractor cost the parties involved tens of millions of dollars and lost hope of any future work from that client. The project did eventually get finished, but the blunder left a lasting impression on all those involved—including a commitment to better coordination between design and construction, and the value of BIM as a tool to enable that coordination.

Solution

Thirwell's discovery of a 5' discrepancy between the civil engineer's location for the building compared with the architect's location resonated in the company and with the project team.

The lessons learned from the prior project had stuck. On a future project, the team applied those lessons as they began excavations as part of a routine check of structural grids across the different designers and engineers involved in the project.

While some digging had started by the time they caught the real cause of the issue, the team was able to quickly adjust and find a solution. They were able to work together and use the tools they had (e.g., Verity, etc.) to come to a resolution and move forward. This time, the error caused only a two-week delay which was easily made up elsewhere in the field. There was no finger pointing, no litigation, no redesign. In fact, the project finished 2 months early.

Takeaway: Learn from Your Mistakes

Seeing how abysmally this kind of mistake can impact a project, it was extraordinary to witness and participate in a well-run team with good quality control processes that can find mistakes and identify solutions without putting the project in jeopardy. All the changes and adjustments that are part of the normal building process make errors inevitable – the keys are having processes to find the mistakes as soon as possible and then knowing how to resolve them quickly and inexpensively.

"What we learned on the initial project was that better coordination earlier in the design and modeling process, combined with site layout verification (using Verity) prior to construction, would have saved countless hours and millions of dollars. We proved this to be true when applying those lessons to subsequent projects."

— David Thirlwell, Sr. BIM/VDC Designer, Baker Concrete Construction

Conclusions

Verify 100% of Your Work in the Time it Takes to Spot-check 5%.

While it probably won't surprise anyone, the design and construction of a building is a complex and challenging process, and mistakes happen. When you have thousands of people and hundreds of different companies all collaborating on projects costing millions of dollars and containing millions of different components… perfection is not possible.

So, if mistakes are destined to happen, the real measure of success is how early you catch them and how efficiently you can resolve them. Thus far, that has not been a simple process. But with the falling prices of laser scanning hardware and new software tools like Verity, field engineers, project managers, and sub-contractors have the tools they need to verify 100% of work—and it's a lot faster, easier, and more accurate than ever before.

Take Away: The Value of Verification

If using tools like laser scanners and Verity software can help you verify 100% of the work in the time it used to take to spot-check 5%, why wouldn't you do it? Perhaps some of the reasons you use to answer that question are mirrored in the project examples in this report. If so, hopefully we've demonstrated through these real-world examples that early and ongoing verification for construction and renovation projects saves time, money, hassles, headaches, and litigation.

If you are interested learning more about Verity™ software or would like to apply for a trial license, please contact sales@clearedge3d.com.

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