What is Avvir Inspect and How Can it Help Your Next Project.

AVVIR®

BIM-focused reality analysis for the built world.

Glossary

In This eBook

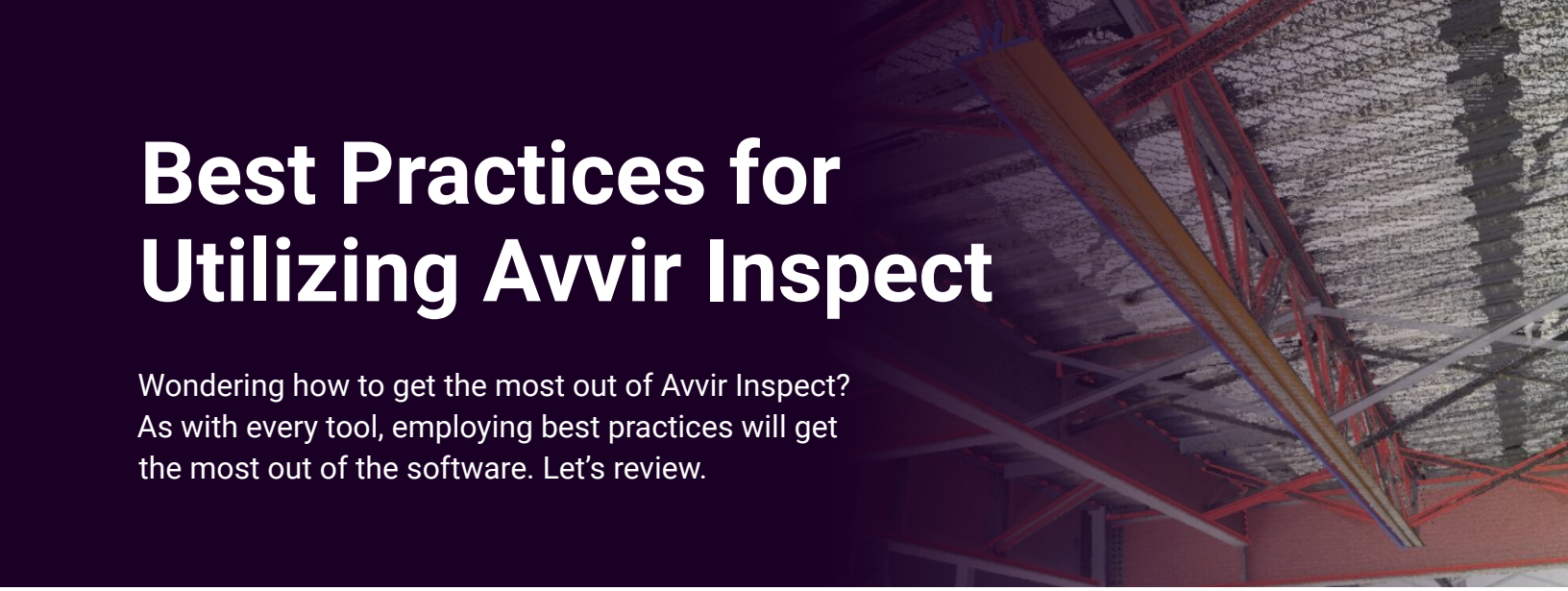
Introduction

As part of the quest to improve profitability and meet schedules, the AEC industry is relying on technology. Building Information Modeling (BIM) has become commonplace in the industry. However, the challenge remains to use data to its fullest extent so it can generate useful analysis. At Avvir, we connect data between historically siloed information sources and generate analysis based on the reality of each job site.

Avvir is a reality capture analysis platform that provides users with an objective view of progress and installation quality on their construction sites. Our core products include Avvir Inspect. The software identifies discrepancies between the design intent and the installed reality through a direct comparison of the BIM and the reality capture in the form of LIDAR (light detection and ranging) point clouds.

By using BIM as the single source of truth, the Avvir algorithm looks for the BIM elements within the point cloud to determine if they are built or not. Avvir Inspect can determine if the items are built, where they're built, and their deviated coordinates, if applicable. The BIM geometry is automatically translated to match its installed position per the point cloud, and Inspect users can accept the deviation, ignore the deviation, or generate an issue to track resolution.

The result is finding issues early in the process when they are easier and less costly to rectify.



Best Practices for Utilizing Avvir Inspect

Wondering how to get the most out of Avvir Inspect? As with every tool, employing best practices will get the most out of the software. Let's review.

LIDAR is required

To get the full benefit of Inspect and its deviation analysis, LIDAR scanning is a must. Consider tolerance, which is related to the hardware and method used for reality capture. A terrestrial LIDAR scanner is typically accurate to +/– 0.3 cm, whereas a mobile LIDAR scanner is generally accurate to +/– 2 cm.

And photos? Whether taken by a robot, drone, or person carrying a camera on a stick, there's a much greater range of accuracy. Although photos taken by drone or a robot typically use VSLAM (visual simultaneous localization and mapping) technology, issues still exist, including the inability of drone photos to estimate pose and the challenges robots have in scanning visually distinct areas.

Then there's photogrammetry, which is the process of extracting 3D information based on 2D photos or videos. When it comes to photogrammetry, there are multiple types of SLAM, depending which sensors are used in data collection. The two main (non-LIDAR) types are VSLAM (visual simultaneous localization and mapping) and VISLAM (visual-inertial simultaneous localization and mapping). As the V in VSLAM stands for visual, usually the only sensors are cameras, which are unable to estimate scale.

The I in VISLAM indicates it uses inertial sensors in addition to photos. In practice, this often includes accelerators (literal inertial sensors) and GPS sensors (not inertial). When VISLAM is conducted via robot, the robot's odometry sensors (for example, wheel sensors) can negatively impact accuracy.

Scanning best practices

Clearly, LIDAR is superior. To get the best out of LIDAR, let's review the best practices for effective scanning.

Use the ideal laser-scanning hardware:
Know how the end-user will use the captured data to determine from among the different types of laser-scanning hardware.

Understand the project environment:
Familiarize yourselfwith the project environment before scanning so you can determine the ideal scan path and strategy for the project space.

Plan for registration:
Have a registration strategy before you begin. Whether you're scanning with a mobile or a terrestrial laser scanner, a preparatory job walk is critical for scanning with target registration.

Understand your deliverables:
Know the end use of the project point cloud to determine the details such as scan resolution, field coverage needed, areas to be captured, and if color is necessary. These details impact both scanning and processing times.

Continually back up your data:
Data capture is expensive and time-consuming, so back up data post scanning, before leaving the project site, and after importing data into your registration software. Also back up your working files, and export deliverables into multiple universal file formats. Archive your project with these backups.

Modeling best practices

Avvir Inspect is tied to BIM. Therefore, it's important to implement BIM best practices to maximize Inspect.

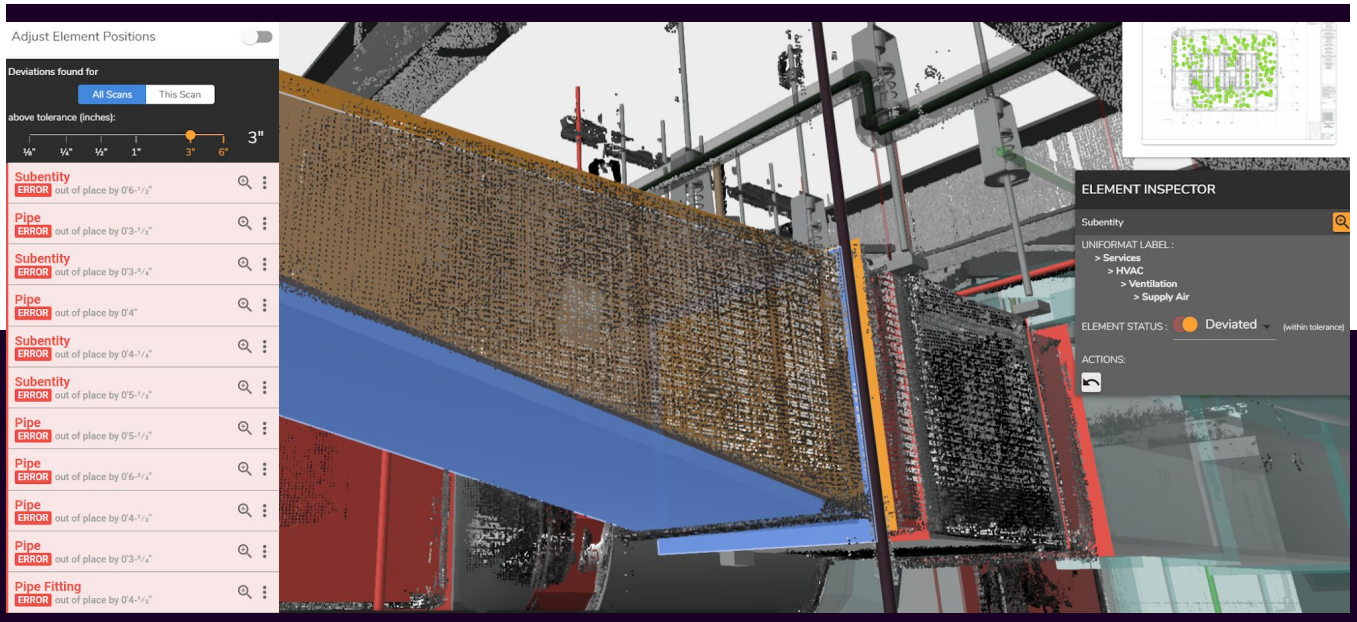
Align on a standard classification system:
Whether in Uniformat or Masterformat, ensure that project execution plans standardize how these codes can be applied across models, schedules, and schedules of values.

Standardize units of measurement:
Model components should align with how the object will be physically constructed and billed, so there is consistency between the model, schedule, and schedule of values

Avoid the temptation to start from scratch:
Save time by building on the information provided by the previous team. In addition, this helps preserve metadata that may be important to the design team/owner.

Prioritize quality of information over precise geometric accuracy:
Know the end use of the project point cloud to determine the details such as scan resolution, field coverage needed, areas to be captured, and if color is necessary. These details impact both scanning and processing times.

Communicate regularly:
Keep the various project stakeholders up to date to help ensure the data strategy will be aligned with ultimate goals.



Real-life Examples: How Avvir Can Be Deployed on Your Project

Now, that you know how to use Avvir Inspect, it will be helpful to understand and see how companies have benefitted from using it in the field.

The primary benefit of using Inspect is its ability to find critical quality issues that require attention. While we all want the ideal scenario (construction going exactly as laid out on the BIM), the ideal rarely, if ever, happens on large complex construction projects.

So, the question is not what if issues arise, but how will they be handled when they do occur? Inspect enables the discovery of issues more quickly, so they don't fester and make a repair more expensive and time-consuming.

Inspect does this by enabling teams to automatically review installation quality issues and find discrepancies between design intent (BIM) and reality (point cloud).

With near real-time project monitoring and quality control, issues are identified much faster than they would be with traditional methods. For example, a sub installs a pipe a few inches off from the model. This might seem insignificant, but in fact could impact other work that has to be done in the area.

Accurate installation the first time prevents future rework. By the time the issue is discovered, other work may have been done in the area that would need to be dismantled and ultimately redone.

We all crave certainty. However, constructing a complex structure with complex plans is a recipe for uncertainty. When teams are not confident about the plans, they'll question themselves and work slower than they are capable of. Inspect provides teams with as-built verification. This can help the team feel more confident about their work, allowing them to progress more quickly.

Inspect is useful to a team from design to conclusion. What happens when elements have to be redesigned due to unexpected field conditions? Progress stops while the design team literally goes back to the drawing board. By turning to Inspect and incorporating the reality on the ground, the design team can make the necessary changes more quickly. The construction team can minimize delays and get back to work faster.

Finally, Inspect helps a team improve communication among all parties. An RFI (request for information) from a subcontractor regarding as-built conditions compared to plans is easily produced and shared. Information regarding changes, clashes, etc., is easy to identify.

Because Inspect requires BIM, which serves as a single source of truth, the entire team can see progress, changes to the design, and future work. Each team member is clear about their responsibility and how their work will impact others. Lastly, management can verify that contractors are adhering to design intent. If something is off, the culprit can be held accountable.

Real World Uses

Teams using Inspect have been getting meaningful results.

DPR Construction, one of the top general contractors in the U.S., used Inspect when they experienced a bottleneck scanning construction progress due to a lack of skilled technical professionals. The team was constructing a data center campus with five separate data centers. Inspect enabled the team to "save time and money on finding the problems and instead focus on resolving issues," notes Tim Conroy, Northeast Field Technology Group manager with DPR.

DPR's client wanted the entire building scanned for as-built verification and then validated to ensure they were getting a high-quality end deliverable. The customer requested installation tolerances within one inch of the model. Accurate scans were critical to ensure that construction progress was captured correctly. "If things changed at any point, we had to make sure the model we turned over represented that. The Avvir software made this possible," Conroy says.

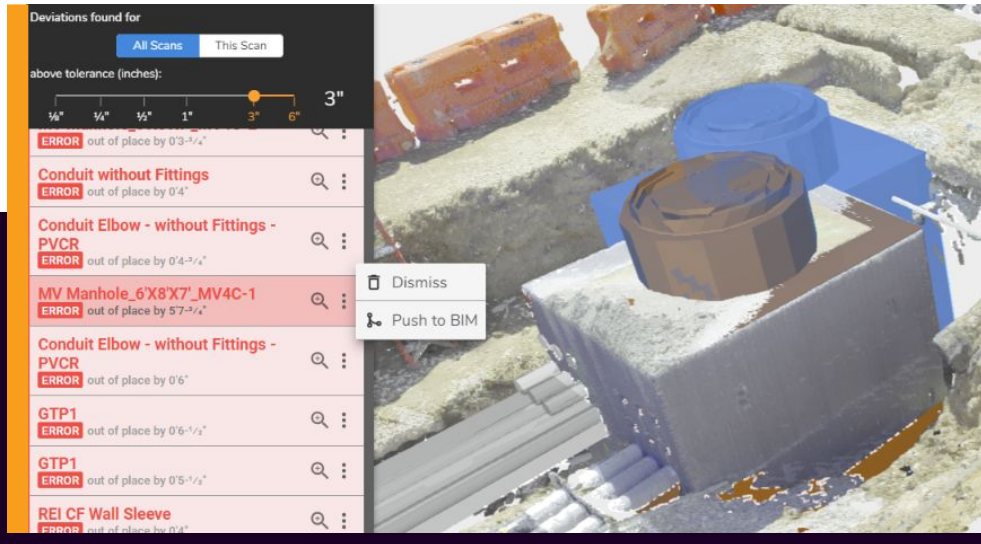
Columbia, a construction management company, used Inspect while constructing life science buildings, which required working with very sophisticated model-driven and detail-oriented subcontractors. Inspect and Avvir Progress helped them maintain accountability for subcontractor productivity during installation.

Using Inspect enabled Columbia to save time (no more site walk-thru inspections, analyzing the data, and creating reports), identify deviations, increase visibility and confidence, and produce final as-built models. "We needed to change our sophistication to track installation progress properly, answer our owner's questions, and feel comfortable with what we're reporting. And that's what Avvir allowed us to do," explains Jennifer Wooles, a project coordinator at Columbia.

AECOM Tishman, a fully owned subsidiary of AECOM, was working on a massive mixed-use development project that included seven mechanical floors and 236,966 square feet. They turned to Avvir to manage reality capture data sets. "Managing reality capture data sets can be daunting, and we needed a solution to do the heavy lifting of processing and visualizing data in objective ways," says Christian Peña, AECOM project manager – Virtual Design and Construction.

Inspect enhanced client communication, with the BIM manager, project managers, and superintendents better positioned to quickly adapt to changes in the project. "I could move faster, giving updates to the project team on a weekly basis so they could proactively get ahead of predicted clashes that had to be addressed in the field," says AECOM Superintendent Kevin Marren. The Avvir platform identified 112 critical forward-looking clashes within two months.

> "I was able to track construction progress on a really granular level, so it's more meaningful to the building owner."
>
> **Christian Peña**



Future Potential for Avvir Inspect

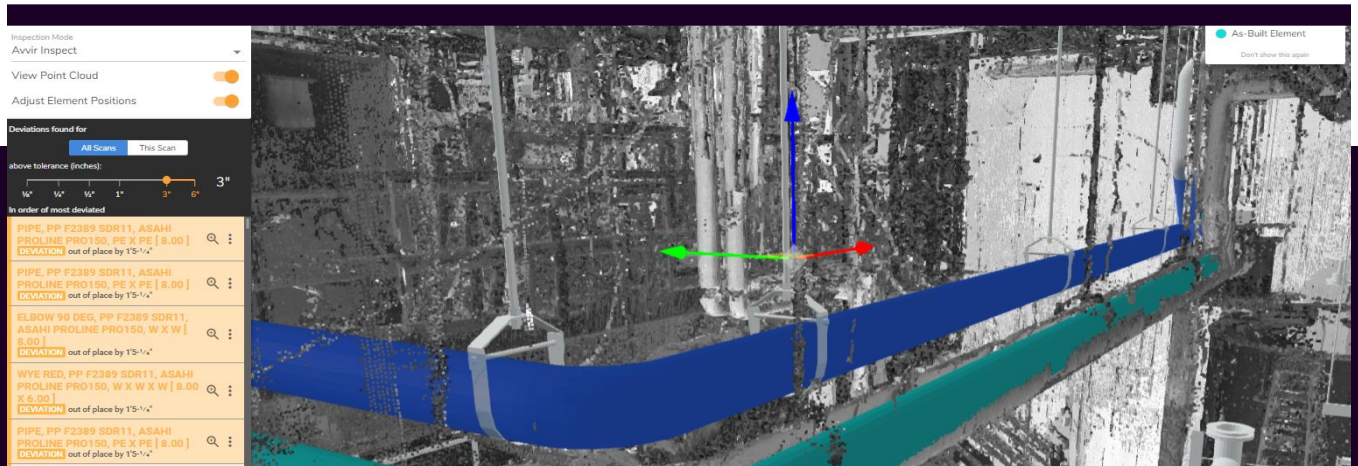
Like any software technology, Inspect is regularly adapted and updated in response to user feedback to make it more helpful for the ever-changing AEC world.

The AEC industry is also implementing virtual reality (VR) and augmented reality (AR) into its work routines. What if Avvir Inspect included a live onsite data overlay that's compatible with AR technology? One could be guided to the location of the issues found in analysis and save time in solving the problems eliminating the time it takes to find them on site. Then imagine that same overlay could be generated in reverse where the real environment is reproduced in VR and through reality capture and allow a person to experientially review content in the same way they would be reviewing in the world on site in the AR version, Field conditions will be replicated in ways never before conceived as this AR/ VR — ultimately XR — spectrum of experiences as it is developed out further.

Then, there's NeRF (Neural Radiance Field), which uses a few photographs and AI to re-create real places in 3D. By leveraging advancements in computer vision and NeRF, implementing Inspect could be even easier and faster. NeRF is not limited to the same scene processing restrictions of traditional photogrammetry. Being able to be produced from photos and videos without such rigid restrictions puts realistic 3d reconstruction back into the ubiquitous form factor of the phone or tablets which proliferate on job sites already.

Robots are becoming a regular feature on construction sites. Collaboration between Inspect and construction robotics will accelerate the time between reality capture and analysis. Among the robotics being infused into construction are ground based and aerial drones with autonomous reality capture capabilities. Reality capture will be even more effective when hard-to-see places are no longer elusive and capture can be automated and even more precise in the 3D reconstruction. Continuous reality reconstruction will unlock efficiencies enabling real time feedback loops with capture and analysis cycle.

Deviation detection, as-built verification, review of installation quality, progress tracking, validation of the BIM model, and real time project monitoring: Avvir Inspect will help your project in many ways. Ultimately, using Avvir Inspect will keep your BIM up-to-date with as-built conditions, help your team fix mistakes, and minimize rework. Save money and save time. Avvir Inspect is a technology helpful to every project.



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