How Reality Capture and Reality Analysis are Changing the Construction Industry.

AVVIR®

A new level of analysts for the built world.

Glossary

In This eBook

What is Reality Capture?

Reality Capture technology is repidly changing the construction industry. The technology is being used in a wide variety of ways including progress tracking, risk and safety hazard identification, and to analyze quality control of installed elements in the field. Before we dig into these items in more detail, let's quickly review what Reality Capture means. In short, reality capture is the use of various technical devices; from 3D LIDAR scanners to 360 cameras and drones, to capture a digital 3D representation of real world conditions. This representation can be in the form of 360 images, videos, or point clouds.

3D scanning, which is the method of generating point cloud data, can be traced back to the 1960s. These laser scanners were developed for space and defense applications; in the late 80s, the technology was recognized to be valuable for industrial use as well. The technology has seen significant hardware and software improvements since then, and we now have easy to use 3D scanners that just about anyone can successfully deploy in the field.

Planning & Design Phase of Construction.

Reality capture has tremendous value in the planning and design phases of construction projects. It is useful in renovation projects to capture and document existing conditions to an extremely high level of detail. That data can then be used to generate 3D models of the existing conditions for design coordination. It is also very beneficial for new construction, as it can assist with site logistics, topo surveys, and other highly detailed content that only a laser scanner is capable of capturing.

360˚ cameras can capture high-quality images to clearly record existing conditions on-site. These images can be shared with the click of the button, allowing project teams to virtually walk the jobsite. Drones have also stormed the construction industry in the past few years and we are now able to capture high-quality data much quicker than it would typically take with a terrestrial scanner or 360 camera. The advancement of drone and photogrammetry technology allows us to now capture spaces that humans typically could not safely reach; like slab edges of super tall highrises, bridges, or other project environments that pose hazards.

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PLANNING & DESIGN

Adaptive Reuse & Renovation

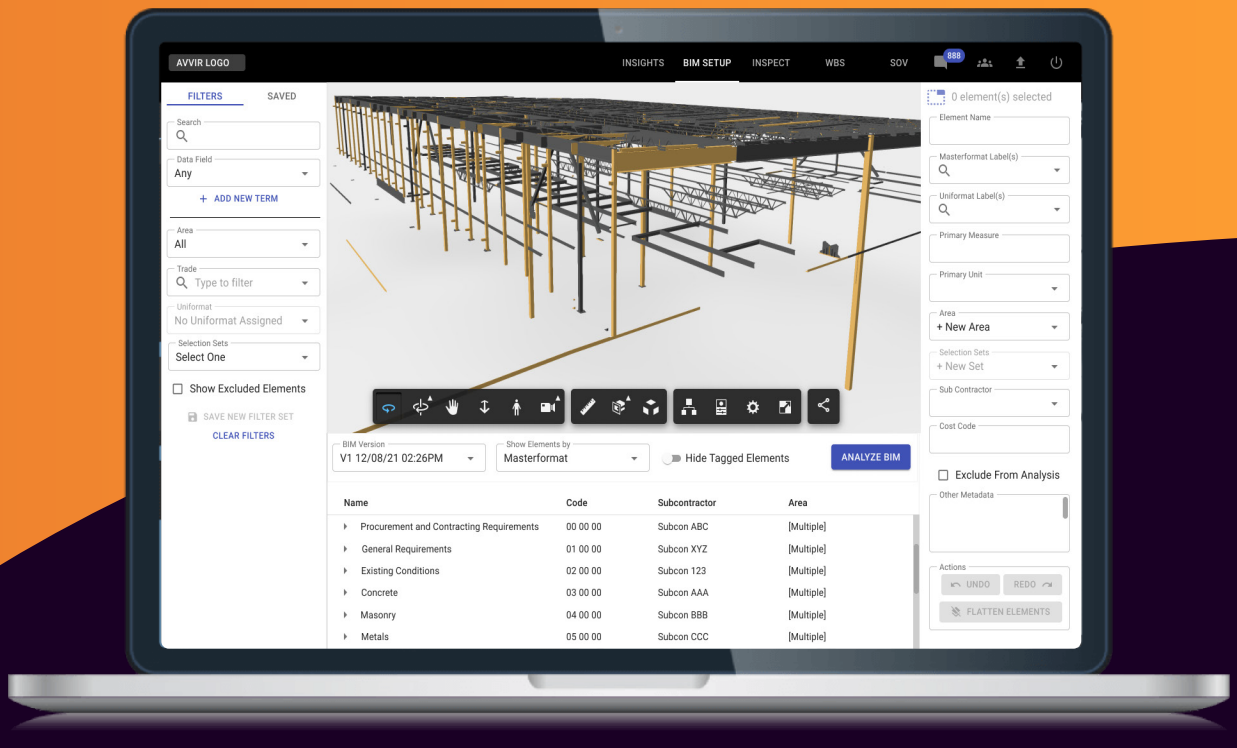
Adaptive reuse and renovation projects have always been challenging for design teams to coordinate around existing conditions. Oftentimes these teams rely on old inaccurate drawings in order to establish the existing conditions; however, those drawings are typically outdated and no longer represent the true existing conditions of the project site. When designs are largely based on those drawings, we often see errors that lead to costly rework and delays. Reality capture helps prevent this by capturing the true existing conditions of the site and incorporating this into the design process.

It starts by deploying a 3D laser scanner to the site and scanning the area of work. The type of scanner deployed largely depends on the accuracy needed and what each company prefers to work with. A terrestrial laser scanner like the Leica RTC360 is more than capable of capturing the necessary data for a Scan-to-BIM project. Once the job site is scanned and the point cloud is registered, this data can now be converted into a digital model for the design teams to leverage. Now we are able to reference the true existing conditions of the project site. The design teams no longer have to work off assumptions, or coordinate with outdated data, as they have a high fidelity 3D representation of the actual site conditions to coordinate around.

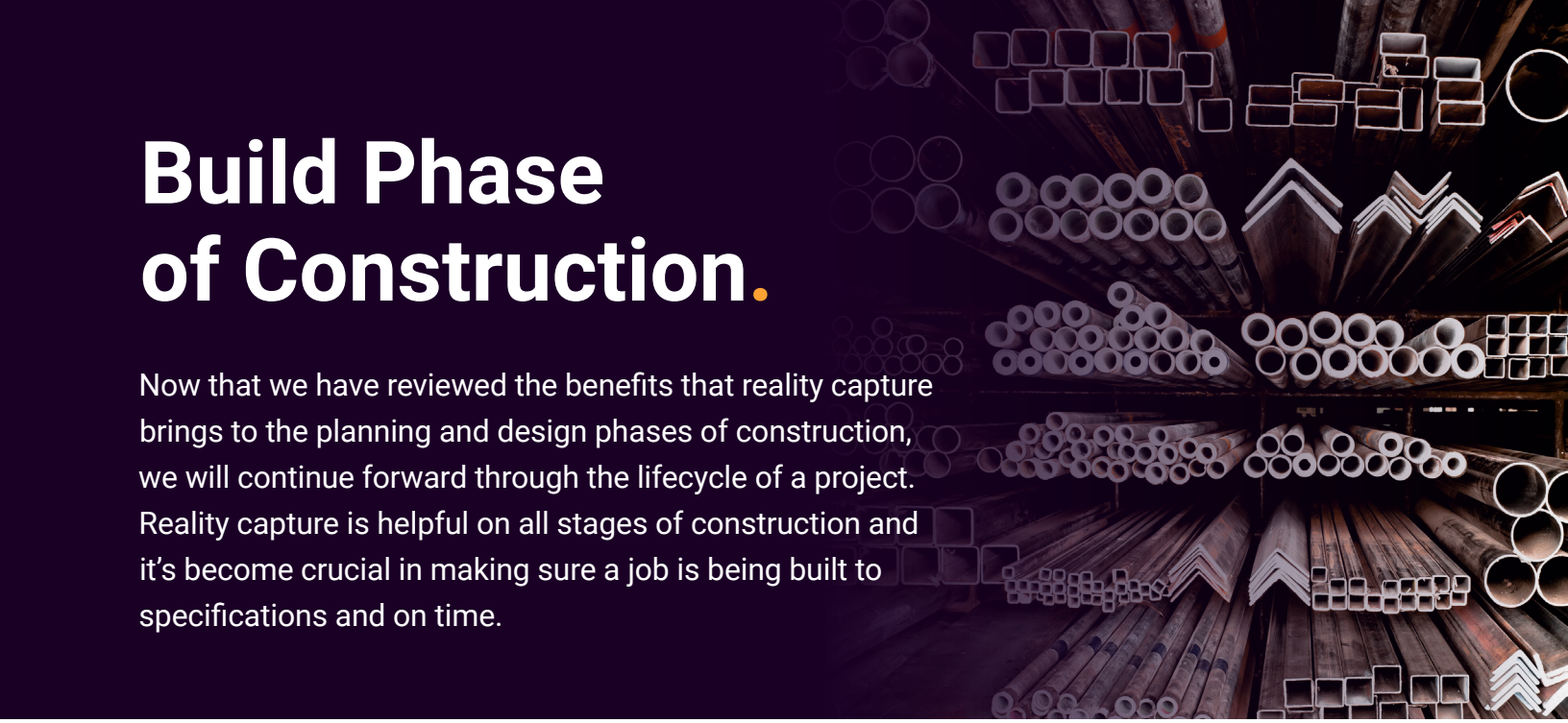
PLANNING & DESIGN

New Construction

Reality capture in new construction is also becomming more common and useful in those first few stages of work. This application of reality capture will allow you to better understand placement of curbs, light posts, manholes, or account for width of streets. 360˚ images help document what the job site looked like before construction even begins which giv es everyone the ab ility to keep track of what field conditions existed throughout the life of a project. Drone surveys are also becoming very common in the planning and design phases of construction as they are able to capture high-quality data in a very short time and can access areas not possible for humans. Drones can capture data high above the ground which helps better build a 3D representation of the jobsite. Drones have also made major advancements in the type of payloads they are capable of carrying. Drone mounted LiDAR sensors are starting to become more commonplace which will offer a dramatic change in the way and speed in which we can capture data.



Build Phase of Construction.



Now that we have reviewed the benefits that reality capture brings to the planning and design phases of construction, we will continue forward through the lifecycle of a project. Reality capture is helpful on all stages of construction and it's become crucial in making sure a job is being built to specifications and on time.

360° cameras are a great tool to capture the progress on the job as they are easy to use and see what is built on the site. Software, like Avvir Progress, enables a Project Manager or Supervisor to use 360° images for the progress of the job. Avvir Progress is also the only software on the market that compares the point cloud data with the BIM in order to determine what elements are built vs not built. In order to verify if elements are built on the correct location a terrestrial scanner is preferred due to accuracy. However, with the advancement in mobile LiDAR technology, this will quickly change and mobile LIDAR will take the lead. The Construction Industry has already seen significant improvements with mobile scanners, like the NavVis VLX, which has an accuracy close to that of a terrestrial scanner.

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BUILD PHASE

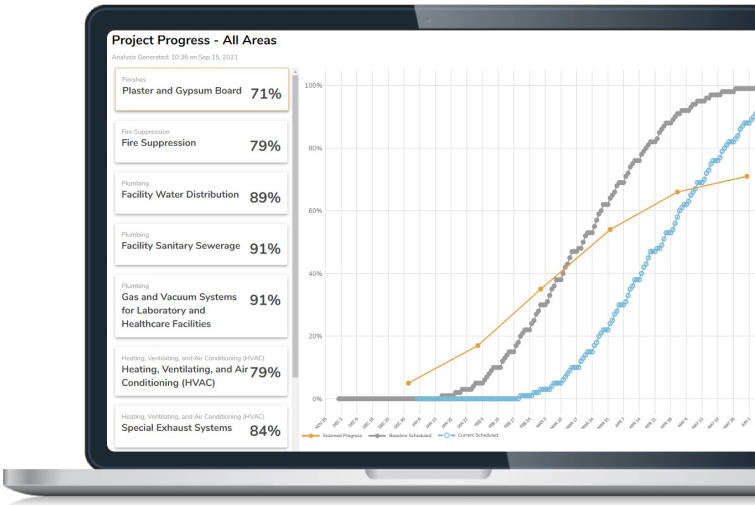
Actual Progress vs Schedule & Automating SOV reporting

Avvir's Progress software utilizes point cloud data and/or 360° images and video walkthroughs to analyze and automate reporting of up-to-date conditions and status of a construction project. The majority of the 360° cameras on the market will be sufficient to capture this data. A scanner like the NavVis VLX captures 3D point cloud data at a fraction of the time in comparison to a terrestrial scanner and the data can be used in the Avvir platform to track the progress of the job.

Once the reality capture data is uploaded, the Avvir algorithm statuses each and every BIM element as Built or Not-Built based on a sophisticated comparison of the point cloud data or 360° Mobile Ready 3D Viewer Photos to the BIM models. Taking this to the next level, Avvir Progress can ingest a construction project schedule in order to automate reporting for what's actually been installed on the job site vs what was scheduled to be installed on a trade-by-trade and area-by-area by area basis. This allows the construction project team to catch areas or trades that are behind schedule.

Avvir Progress analysis can also look forward and help you to anticipate when a critical path milestone is upcoming. Avvir Progress 4D data and analysis can be packaged and viewed in many ways – whether an S-Curve 4D dashboard, within PowerBI, or directly onto your project schedule so that you can view the data in an easily digestible gantt chart format, or in a custom report.

The world of construction is making a bigger jump into 5D applications and pay apps. Reality capture can help in this arena as well. Avvir Progress 5D tracks installed value against scheduled progress for each line item in your work breakdown structure (vs. schedule of value). Avvir Progress 5D helps validate and expedite subcontractor billings/pay apps with reality capture data.



BUILD PHASE

QA/QC

Understanding the accuracy of installed items (vs how they were planned in the BIM) is critical to keeping construction mistakes and project costs down. Today there are typically two ways to verify if a planned BIM element is built on the correct location on the job site, performing manual clash detection or automating it.

The manual clash detection process typically uses a point cloud, captured by a laser scanner, which is then converted into a BIM to accurately represent the current as-built conditions of the site. The design model and the as-built model are visually compared to see if there are any discrepancies between the two. Another method is to import the point cloud and BIM model into a platform like Navisworks and manually compare the two for any discrepancies. The problem with both of these methods is that they are extremely tedious, time-consuming, and the manual effort leaves significant room for error. By the time a deviation is identified it is often too late to take meaningful action.

The Avvir team identified this common problem in the construction industry and introduced Avvir Inspect. Avvir Inspect uses AI to automatically compare the design model to the point cloud and detect deviations between the two. Avvir Inspect identifies discrepancies between the design intent [BIM] and reality [Point Cloud] to uncover potential issues. Some discrepancies are more important than others, so Inspect helps parse through the list and highlight key issues that will clash with future unbuilt elements. This list is packaged into an Impact Analysis Report which can be easily shared with the field for follow-up onsite inspections. Avvir Inspect also helps the construction VDC and project teams understand the build quality of their project by identifying trends, trades, and areas that are common causes of issues.

For discrepancies that don't require fixing, Avvir Inspect updates the BIM during and after construction to produce an accurate as-built model that can be leveraged by owners during building operations and facility maintenance. Combined with Avvir 4D, impacts found during our analysis can be tied directly to the schedule, which allows Avvir to report whether a deviation may cause a project delay.

BUILD PHASE

Cross-Team Coordination & Communication

Cross-team coordination and communication is vital for any successful project. It goes without saying that if teams are not collaborating and coordinating with each other it could end up being very costly for everyone involved. By having a 360˚ walkthrough of the job, the project team can now access the jobsite from anywhere and work together to document deviations or discrepancies. Collaboration happens digitally and there is no need for all the teams to visit the job site to go over an error or issue that they are facing.

Point clouds also help with field coordination as they produce a real as-built representation of what has been installed to date. If something is built incorrectly and is causing issues for a certain trade, they can point that out by simply sharing the point cloud or a link to the 360˚ images displaying the issue. Reality capture brings highly accurate visual context to cross-team coordination which helps streamline communication across disciplines.

BUILD PHASE

Remote Site Access

At the beginning of the pandemic, a lot of the job sites closed down for months and were slow to come back to life as the fear of the virus was lingering worldwide. It was at that point not very common for project executives and owners reps to completely manage a job remotely and make key decisions without having to step foot on the job. This wasn't a technology problem as the technology to manage these projects remotely had been developed throughout the last decade, but it was more a change of practice adjustment. Many different types of technologies helped through this transition but reality capture in particular, was a big factor in this transition to fully remote management. With the use of reality capture technology, project teams can walk the jobsite daily without ever leaving their office. They can now view progress on the job, resolve issues and coordinate with other teams by simply utilizing reality capture data that was captured in the field.

Facilities Management.

Reality capture continues to prove useful even beyond the typical stages of active construction. The way we build is constantly changing, especially with the wide selection of disruptive technology entering the construction industry. With this wave of new technology entering the construction industry, the demands and requests of owners and developers are also becoming more sophisticated.

FACILITIES MANAGEMENT

As-Built Documentation

As-built models are now a commonplace request in RFP's as the industry strives to handover digital built records at project closeout. Reality capture technology can be extremely useful during this process to achieve high fidelity digital records of as-built conditions. When laser scanners are deployed throughout the course of construction, we are able to reference the scan data against our trades models and make real time changes to any scope that may have been altered or deviated in the field. By approaching as-built models with this systematic workflow, project teams are able to generate extremely accurate as-built models to meet the needs of even the most sophisticated clients.

FACILITIES MANAGEMENT

Documenting Maintenance Activities

Project closeout does not need to be the end of the road for as-built modeling. When leveraging reality capture to produce high fidelity as-built models, we should also consider the best workflow to keep those models updated so they remain valuable for future facilities management needs. Whether it be a small renovation, an additional valve for a water system, or an upgraded piece of HVAC equipment, keeping the model updated is crucial for long-term facilities management needs. Reality capture, when deployed during these renovations or upgrades, allows facilities teams to very accurately update the as-built models to ensure all modifications have been documented and updated accurately in the as-built model. When integrating reality capture technology into your facilities management workflows, you are able to ensure your as-built models are accurate and stay updated throughout the building's lifecycle.