



6 Tips for Choosing an Automated Layout Solution



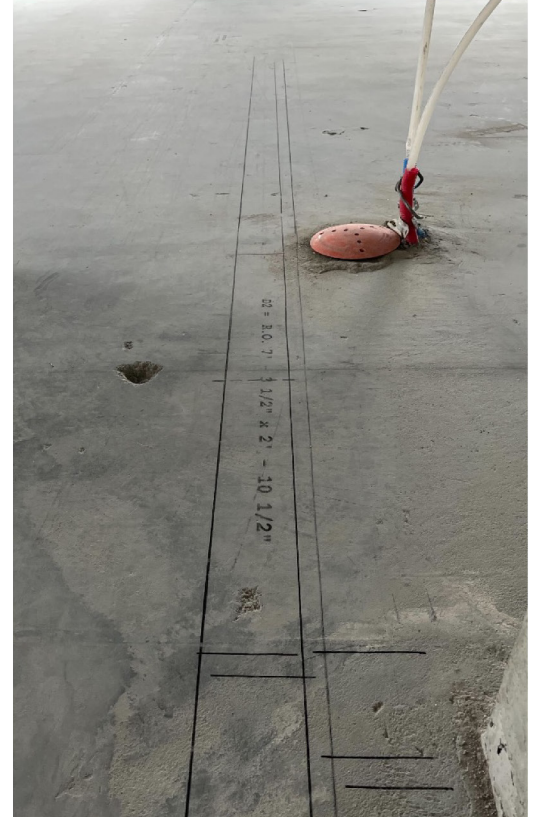
Automated layout is transforming the construction industry by reducing the financial, scheduling, and safety risks of traditional layout. As automated layout becomes increasingly prevalent and offers a significant return on investment, it is important to carefully consider key factors to ensure that the system you choose aligns with the specific needs of your team, budget, and timeline while delivering optimal accuracy and efficiency for the success of your project. Below are key factors to consider when selecting a robotic solution for automating the printing of construction layout.

CONSTRUCTION LAYOUT

Layout is a critical factor in construction, directly impacting the success of every project. However, traditional layout is a manual process leaving the project vulnerable to potential errors including inaccuracies, miscalculations, and miscommunications, all of which can result in costly delays and rework. Robotic automation for layout has emerged as one of construction's most innovative and valuable technologies. By removing the potential inconsistencies and errors of a manual process, automated layout provides a more accurate and reliable approach, offering teams greater precision and efficiency, resulting in lower costs, compressed schedules, and improved safety.

ROBOTIC LAYOUT AUTOMATION

Automated layout works by printing the exact digital model on the construction site surface, which decreases risk while simultaneously increasing efficiency and productivity. In fact, the most advanced robotic solutions are now printing multiple trades' layout in one pass, and doing it 10x faster than traditional methods with 100% accuracy.



FACTORS TO CONSIDER WHEN SELECTING AN AUTOMATED LAYOUT SOLUTION

1 Accuracy



Accuracy in layout ensures that the project stays on schedule and budget, making it a crucial factor in the installation process. Any inaccuracies can cause costly delays and rework. For automated layout systems to be effective, the coordinated coordinated digital model must be transferred to the site with unparalleled accuracy. Key considerations:

What is the rated accuracy of the system? Top automated layout systems guarantee that printed lines are within 1/16", relative to control points provided.

What positioning technology is used? Total stations and laser trackers are common instruments used to position layout. Total stations are generally only accurate to within 1/8" and are less accurate at measuring moving objects such as layout robots. Laser trackers, on the other hand, are accurate down to the micron and maintain that accuracy for moving targets.

Does the field accuracy match the rated accuracy? Print a wall system with known dimensions (e.g. a 3⁵/₈"-wide wall). Verify that the two sides of the wall are consistently 3⁵/₈" apart along the full length of the wall. If the system uses a laser-based positioning system like a total station or laser tracker, verify that the dimensions are correct both near the instrument as well as far away.

How consistent is the print? If you print a wall multiple times, do the lines stack on top of each other, or do they vary from print to print? Significant variance may impact some of the lines in the printed layout, meaning that some objects will not be drawn exactly where they are specified to be per the drawing.

Are the printed lines straight and true? Are parallel lines truly parallel or do they converge? Waviness or deviations in printed lines indicate that the system may not be accurately measuring its position in real time or may not compensate for minor variations in site conditions such as floor flatness or tilt. These deviations impact the accuracy of the system and may mean that objects are printed in the wrong place, resulting in costly rework.



2 Virtual Design and Construction (VDC)

Accurate and precise autonomous layout relies on the seamless conversion of Revit and AutoCAD models into robot-ready drawings, which highlights the critical role of an internal or external VDC expert. The quality of the robot-ready drawings determines the outcome you can expect from the automated layout process. Therefore, when assessing VDC efforts, it's important to consider the following key factors:

How are robot-ready drawings generated? Some automated layout vendors have certified VDC partners who can function as an extension to your in-house VDC team (or a wholly outsourced team), helping you to convert your models to robot-ready drawings.

Is VDC training included? Ensure that the automated layout vendor offers free training for your in-house VDC teams to teach them best practices for converting Revit/CAD models into robot-ready drawings.

Does the vendor understand your workflow? Make certain that the vendor functions as a true partner for your VDC team. Every project is modeled differently and variances in how buildings are modeled can impact how they show up in the printed layout. If your VDC team has trouble preparing the correct data for automated layout, ask how those challenges are resolved.

Does the layout system support your software program? Depending on your VDC workflow, your team may be working in Revit, AutoCAD, or a number of other software programs. Find out if the automated layout system supports the file formats your team already generates or if they need to do file conversion (which may result in loss of precision).



3 Speed and Productivity



In construction, where nearly all jobs function under tight schedules, the efficiency of automated layout can help meet or exceed deadlines and multiply the productivity of your layout crew. Combined with fewer errors and less rework, automated layout can enable builders to achieve significant schedule compression and turn over the building faster. Key considerations:

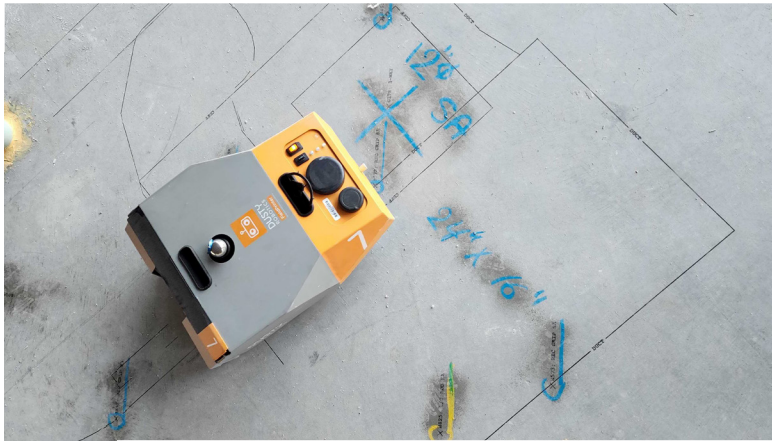
What types of layout does the robot perform?

Productivity rates can vary depending on a number of factors including the types of objects to be printed. Common object types include wall locations (e.g. lines), MEP hanger point locations (e.g. a crosshair plus associated text), and reflected ceiling plans (e.g. soffits, lighting fixtures, and cloud ceilings). To ensure success, determine if the automated layout solution is capable of printing the types of layout for the job.

Does the robot work in the environment? The efficiency of a layout robot can vary depending on the environment in which layout is needed. For example, in wide-open data centers, productivity rates as high as 1500 linear feet of printed line per hour are possible. But in congested environments such as multifamily residential, a skilled operator may only get a third of that productivity. Understanding a layout robot's typical productivity rates based on environmental factors will help set schedule expectations.

Who will be operating the system? Some automated layout solutions include operators, while others require you to provide your own labor. If an operator is not included, consider the training requirements and skill set of your operator(s) and their affinity for technology. Younger workers may be more excited about adopting new technologies, and may be more fluent in the tech skills that are fundamental to the operation of automated layout systems. Operators with a passion for technology will likely master the system faster and yield higher productivity. Also, operators with field experience will be more comfortable on job sites and have more credibility with other crews in the field.





4 Layout Completeness



The more complete the automated layout solution is, the less manual work is required to fill in missing portions of the layout. Make sure you select an automated layout system that meets the varied needs of your project—including printing near the edge of the slab, close to walls and pipes, and behind obstacles. Key considerations:

How does the system perform near obstacles such as existing columns, stub-ups, and leading edges? Some systems utilize a printer that is mounted in the center of the robot, making it difficult to print next to those obstacles. If completeness is important to your job, consider selecting a solution that can print near obstacles using printheads mounted near the outside edges of the robot.

Can the system print common objects such as hanger point locations, electrical symbols, text, dashed lines, and curved lines? Many field crews achieve increased efficiency and accuracy by having details and directions printed directly on the site floor. Consult with your field crew to understand what they want to see printed on the job and verify that your automated layout solution is capable of printing those objects.

5 Multi-Trade Layout

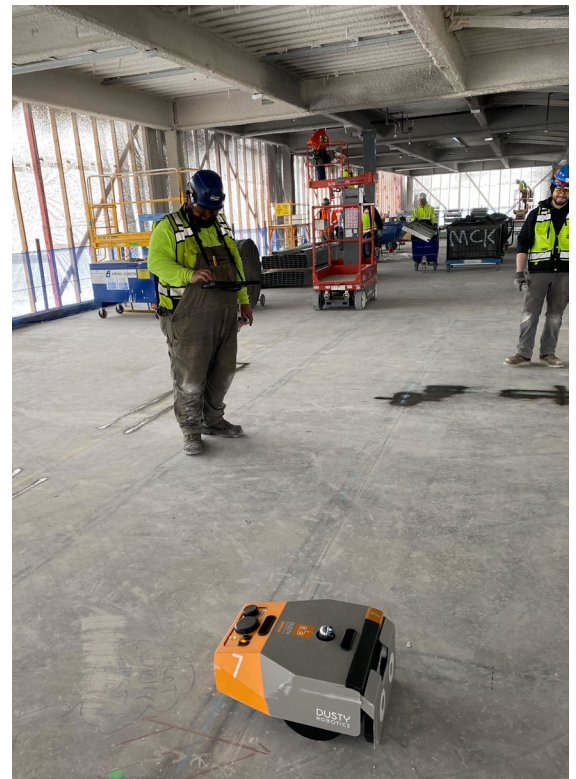


One of the biggest advantages of a robotic solution is the ability to print multiple trades' layout in a single pass, which compresses schedules, eliminates errors, and significantly improves communications between all teams. As automated layout becomes more prevalent, more and more GC's require their subcontractors to adopt [multi-trade layout](#). Key considerations:

Can the system print layout for multiple trades simultaneously? Is everyone building off the same coordinated model? Does the system print all trades' combined layout together in a single pass over the floor?

Does the vendor partner with you to bring all trades on board? It is important to ensure that all trades are aligned and working towards the same goals, and that the vendor has the necessary expertise to support this collaborative effort.

What are the other trade partners' experiences with automated layout? Getting all the trades on board is easier if they are already predisposed to wanting to use automated layout, or have already worked with one of the systems on the market.



6 Training and Support



Trusting that your automated layout system will operate efficiently and effectively is key to the success of any project. That's why evaluating the level of training, service, and support provided by the automated layout vendor is so critical. Insufficient training and support can reduce productivity and cause downstream impact to the schedule, putting the project at risk. Key considerations:

How easy is it to use the system? What level of operator skill is typically required to operate the system? How long does training take? Have other operators like your own crew been successfully trained?



Are there third parties that can also provide training? [Some unions](#) have started teaching their membership how to utilize automated layout. These union-led classes can augment the system vendors' training programs and provide more hands-on training time to ensure your operators get the maximum productivity.

What level of support is included? The best-in-class vendors provide 24/7 phone or email support to get you up and running should you need additional help on the job site, while others also include replacement hardware in the event of a hardware malfunction.

THE BOTTOM LINE

For the construction industry, automated layout continues to provide tremendous value in terms of time and cost savings. Now, as more systems enter the market, it pays to do the research and ask the hard questions to make sure the features, functionality, and productivity of the automated layout system is right for your project and your team.



ABOUT THE AUTHOR

Tessa Lau is the Founder and CEO at Dusty Robotics and inventor of the FieldPrinter, the first automated layout solution for the construction industry. Dusty's mission is to enable builders to do more with less through easy-to-use, innovative products that challenge the status quo. Dusty's flagship product, the FieldPrinter, simplifies one of the most inefficient processes in construction by bridging the gap between digital models and the field, giving builders the confidence to do their best work.

