

How 3D Printing And Prefab Are Changing Construction

By **Josephine Bahn and Jeffery Mullen** (April 26, 2024)

Regardless of whether artificial intelligence programs possess all the information capabilities required of project teams in 2024, having and understanding the right technology and project data will most certainly be beneficial.

One of the new ways the construction industry is changing is through the advent of 3D printing on project sites. 3D printing, also called additive manufacturing, is a process whereby a three-dimensional object is created using a digitally created file as its source. The newly created object is printed by using additive processes that include laying down successive layers of material generating a physical, 3D object.

The layers are actually thinly sliced cross-sections of the object being generated. This type of printing is on the rise and becoming increasingly popular — migrating from objects on a teenager's bedroom shelf to objects now helping facilitate multimillion-dollar construction industry projects. Clearly, 3D printing is becoming more accessible to more people than ever before.

3D Printing for Construction Products

3D printing starts with a digital or virtual design of an object to be made. The digital design is created by using a computer-aided design software that can create precise drawings and technical illustrations. The digital design serves as a blueprint for the 3D printer to read.

Once the creator develops the digital design, the virtual model is generated. From there, the virtual model is digitally sliced into hundreds or thousands of thin, horizontal layers. The slices then go to the 3D printer to be uploaded, where the 3D printer then prints the physical object layer by layer.

While sectors like aerospace and automotive have pursued 3D printing as a way to drive change and innovation, the construction industry has only recently begun to harness this change. Construction projects have seen a notable rise in 3D printing whereby a project starts with a smaller mock-up or structured 3D digital figure or model such as a building, bridge, house, etc.

From there, the model serves as a starting point for those thin virtual slices and layering pieces. Once physically created, the construction continues from there, reassembling the slices into the fully realized product.

In this way, 3D printing is finding ever-increasing use in the fabrication and construction of various components and projects, from prefabricated panels to full on-site assembly. Most interesting to the construction industry, these components can be created using any number of materials including concrete, metals or construction polymers.

Presently, the most common 3D printing substrate used in the construction industry is concrete. Specifically, concrete contractors are utilizing a robotic arm that squeezes out



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concrete while moving back and forth. Like squeezing toothpaste from a tube, the robotic arm is able to squeeze and stack the concrete to build a vertical, 3D object quickly and efficiently — especially significant for a material like concrete with a limited shelf or air life.

Other facets of the construction industry utilize 3D printing through powder binding and additive welding. Through powder binding, a 3D printer can solidify powder layers to create a 3D object, whereas additive welding has been employed successfully to even create a full-scale metal bridge.

3D printing also allows particular parts and components to be tailored to a specific project or contractor's needs, to enhance design flexibility and even improve functionality of the materials themselves.

This, in turn, is likely to reduce waste remaining from a construction project because 3D printing uses only the precise amount of material needed to create a structure. Through the aforementioned layering technique, these precise measures can yield significant cost savings and increased sustainability.

These new objects and structures can be made quickly, which could also have a positive project impact regarding the project's schedule. Further, as 3D printing continues to develop, current dangerous project tasks could be performed by a 3D printer — reducing the number of tasks performed by personnel in the field, and therefore improving the safety on a project site.

Prefabrication's Impact on the Industry

Another area where significant improvements in the industry can be confidently forecast is prefabrication. Prefabrication of an object typically occurs where an element or an entire structure is manufactured and constructed using materials and building components at an off-site, secure facility and transporting the materials and units for assembly on a project site.

As a result of a particular part or form being duplicated so often, contractors are finding it easier and more cost-effective to manufacture these repeated items in a warehouse or trade shop off the project site rather than in the middle of the active construction zone.

The individual trade contractors assemble the materials and have a turn-key product on a faster scale. The process largely has eliminated the need for so-called stick-building construction. Prefabrication has allowed for contractors to reduce waste, while substantially reducing the cost of labor, time and materials on projects.

This cost-effective and secure method of prefabrication allows contractors to work on expedited timetables without interruptions by other trades — minimizing the need for resequencing when project schedules get turned on their heads because of a delay.

In fact, prefabrication allows for contractors to disassemble and relocate materials to different project sites, while general contractors and owners are seeing the prefabrication trend as a way to increase productivity and project timelines in favorable ways.

Prefabrication is here to stay. In fact, UA Builders Group anticipated in 2022 that modular construction will increase by 6.1% globally by 2028. Trending components of construction projects where this is occurring include prefabricated timber elements for residential buildings and repeating steel elements and glass panes for commercial buildings and

skyscrapers, warehouses and apartment buildings.

More and more trades utilize the off-site option to perform these tasks, creating an opportunity for faster production, less waste and an ability to hold to project delivery schedules.

What's Next for the Construction Industry

The past few years have brought about evolving changes in the industry aimed at building projects safer and more efficiently under difficult circumstances that implicate and require the use of changing technology.

But with those technology trends come challenges and opportunities that have affected the industry and forced a historically reticent industry to be thrust into change and development.

Developing a plan for navigating the new wave of technology, including 3D printing and prefabrication among other growing trends, with a coordinated business and legal strategy will benefit owners, contractors and other stakeholders involved on project teams and help them prepare for these challenges and opportunities in the years to come.

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