



Prefab Preference Surging Among Specialty Trades: How Off-Site Became so On-Demand

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About a decade ago, just ahead of the 36th anniversary of the release of the summer blockbuster *Jaws*, director Steven Spielberg reflected in an [Entertainment Weekly](#) interview on the perennial post mortem debate over whether or not to film on location in the notoriously fickle North Atlantic near the island of Martha's Vineyard, Massachusetts, or to shoot off-site at a controlled location.

"I was naive about the ocean, basically," Spielberg said at the time. "I was pretty naive about Mother Nature and the hubris of a filmmaker who thinks he can conquer the elements was foolhardy, but I was too young to know I was being foolhardy when I demanded that we shoot the film in the Atlantic Ocean and not in a North Hollywood tank."

Although Spielberg remained adamant that if given the chance he'd do it all over again, the director's musings on the subject – off-site or on-location – resonate powerfully with today's architecture, engineering and construction industry. That's true, especially for mechanical, electrical and plumbing (MEP) contractors. They too, must grapple with the benefits and drawbacks of a burgeoning type of build; an assembly whose principle components, either as prefabricated parts or complete modular structures, are designed, developed, manufactured and evaluated for their accuracy and quality hundreds, sometimes thousands of miles away from their final on-site destination.

You're Gonna Need a Bigger Shop

While global performance and growth metrics tend to rope "modular prefab" into a single idea (when in fact, they are related but distinct topics) it's clear that in the last two decades off-site construction, which encompasses both modular and prefab, has expanded considerably for the AEC industry. According to [Allied Market Research](#), the global market research and business consulting wing of Allied Analytics LLP, the off-site construction market is expected to be valued at \$235.5 billion by 2030 up from \$130.4 billion in 2020, a 5.9% CAGR from 2021 to 2030.

"There are so many uncertainties when it comes to construction, material availability, cost, schedule, workforce shortages, the list goes on and on," said Josh Bone, Executive Director, ELECTRI International, the research and educational arm of the National Electrical Contractors Association (NECA). "Prefab allows contractors to better manage these variables. Trade contractors who have embraced off-site construction methods have a significant advantage when it comes to managing risk. The shift to prefab has entered a new chapter where we now we see owners and construction managers requiring prefab on jobs."

To be sure, the global pandemic has likely impacted these figures as manufacturing activities slowed, lockdowns halted business and construction projects were delayed, canceled or scaled back. Even now, as the global economy rebounds, a lingering labor shortage and supply chain disruptions have introduced additional stumbling blocks.

But there have also been a variety of unique benefits, benefits that are only beginning to be realized.

For starters, off-site ensures a controlled environment, both in terms of what Mother Nature can throw at a build site – snow, ice, rain, wind, scorching heat or sub-zero chill – and the amount of personnel required in coordinating a project’s final assembly. With the majority of work done off site, fewer people in the field means a reduced risk of viral transmission while at the same time improved safety with less people working with heavy equipment in the elements. There’s also a check plus for the environment with a reduced carbon footprint.

The shift to off-site prefab also means radically improved workflow efficiencies. Despite all of the effort spent pull-planning to determine the labor and time needed to install, often there is a delay to when site access is available because concrete won’t be finished curing or the structural steel won’t be in. By pre-fabricating off-site, delays to site access impact installation, but not necessarily fabrication.

All of sudden well-laid plans are laid to waste. And so with a tighter window to complete a task, the contractor doubles the estimated number of people required on-site to finish the build. With off-site construction, AEC professionals can start a project whenever they desire (sometimes months in advance) and can deliver it and have it installed by that specified date.

Another key prefab benefit is that this construction approach allows contractors to

scope work outside of their core territory. That’s because if it takes only six people on-site to complete a project, say 150 miles away, the cost savings in the field can be diverted to shop floor improvements, or the purchase or lease of additional space and equipment. The savings could also be used to train new staff on solely in-door prefab/modular projects – projects that are overseen by a consistent labor force, one that isn’t beholden to year-over-year jobsite location changes, leading to better quality.

Don’t Jump the Shark

Of course, there are good reasons why the prefab and especially modular construction industries haven’t gone gangbusters just yet. In some cases there are legitimate obstacles to overcome. And in other cases, some specialty trades like landscaping, for instance, or underground utilities, or road and parking lot paving, can’t be completed in an indoor environment.



For the former, though, the biggest challenges to off-site construction, or the adoption of it, is the above-mentioned paradigm shift. Specifically:

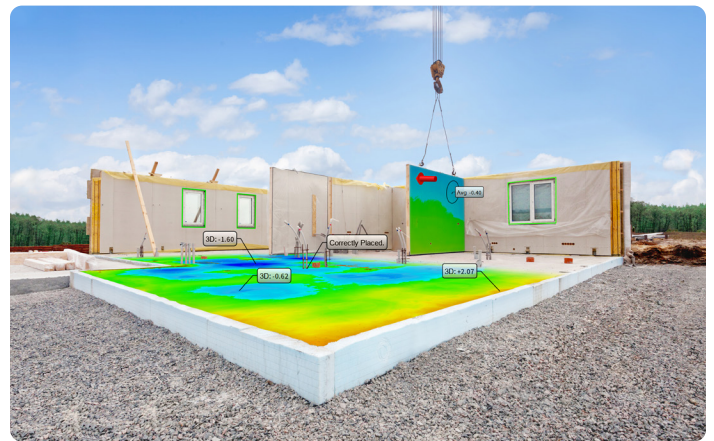
- **Lack of space** – This is critical. It is unrealistic to expect an MEP contractor, or anyone working in the AEC industry to immediately scale their business accordingly. Very often the indoor physical space needed to do the job is lacking.

This is also why prefab is easier to adopt piecemeal, with smaller projects coming online first – sheet metal work, mechanical piping (non-plumbing, non-water supply, non-wastewater) low voltage electrical, interior framing, etc. – than say, an entire modular project. Acquiring a new facility or expanding an existing one takes time and a lot of red tape cutting. For some, it's easier not to make the leap.

- **Lack of experienced personnel** – Just because you have fewer people on-site doesn't mean staffing is easier. Compared to on-site, off-site construction requires a process-oriented focus and finding someone with experience and skills to lead this change can be a challenge. Finding that Mr. or Mrs. Right might take time and dollars to recruit top talent.
- **Lack of equipment** – In addition to the physical space, there's also a required investment into the infrastructure that goes into the fabrication shop. Facility operators can't just unplug on-site and plug in off-site and say job well done. Because it isn't.
- **Lack of out-of-the-box thinking** – A lot of the hesitancy to adopt prefab early comes from a worry that the design will change and contractors will have to redo prefabricated work. It's this "what if there are changes" mentality that has to evolve. Especially as companies invest huge dollars and time into BIM and virtual design and construction (VDC) it makes all the more sense that these workflows and methodologies be used in prefabricating their coordinated design.

When it comes to modular construction, that is, a structure that is at least [70 percent](#) completed in the factory before shipment and is essentially made from building blocks, this has proven a tougher nut to crack. While it is predicted that modular construction will increase [6 percent](#) globally by 2022 (a prediction made in 2017) it has been harder for companies going that route to determine the secret sauce that best balances costs and revenues.

And although there are historical and contemporary [examples](#) of modular construction – Richard Buckminster Fuller's Dymaxion House of 1945, Montreal's Habitat 67 and Los Angeles' Star Apartments, a downtown homeless shelter that made one of Time Magazine's "25 Inventions of the Year" for 2015 – there's often a sense that modular construction, especially at scale, is still futuristic. Or, to borrow from a recent [Forbes article](#) on the topic, a form of contrarian thinking.



Giving 'Teeth' to your QA/QC Needs

From a third-party perspective, off-site construction prefabrication also has significant quality assurance and quality control potential, aspects of assembly that are easier to address indoors. Today that QA/QC increasingly comes in the form of a 3D laser scanner (which creates accurate, complete, 3D point clouds of an environment or object in only a few minutes) and to a lesser extent, in-process 3D laser projection, whereby lasers project original CAD schematics (or other model sources) directly onto building materials, ensuring quick and accurate positioning, assembly and verification.

Combined with sophisticated 3D modeling software that enables construction professionals to monitor their projects with real-time comparisons against CAD/BIM designs and regional standards using 3D scan data, contractors can reduce waste and costly delays and deliver higher-quality projects in time to accept new business at accelerated rates.

And despite its lower rung status relative to 3D laser scanning, laser projection, too, is a valuable QA/QC prefabrication tool that should not be overlooked. Too often, though, it's a technology siloed among the 3D Metrology set, when in fact, a prefab facility is really no different than a manufacturing shop. By using laser projectors, operators can visualize locations in a workspace of where work needs to be done. And instead of using a tape measure or other traditional manual measurement methods, the user is guided by a visible green laser projecting geometries and text onto the assembled part or surface. This way, users know instantly where (and how) parts align and connect.



The bottom line: if your goal as a contractor is to improve efficiency, reduce product time-to-market, as well as reduce total production costs, simplifying the manufacturing process and the assembly of those parts, then off-site prefabrication may be the right choice for your business.



In fact, it is this type of synergy, between parts, people and process, that's at the center of the Design for Manufacture and Assembly (DfMA) engineering methodology. Thus, as contractors move to prefabrication and off-site construction, it is imperative that this shift in process be considered in the design and engineering of buildings and components. Efficiencies in design and materials used might exist that would bring additional value to the contractor and ultimately the project and the owner.

While it's true the off-site/on-location debate is unlikely to be settled any time soon, what is likely, however, is that prefab's growth in the construction industry will only increase. Modular construction, too. New imaging and new measuring technologies will be brought to bear. New software will come online and artificial intelligence, already making impressive headway, will continue to mature.

In the end, contractors that adopt prefab construction might indeed need a bigger shop. And like a famous film that shot for 159 painstaking days and ran 300 percent over budget, cash reserves for a time might be tight. But the evidence strongly suggests that also like the 1975 hit *Jaws*, your contracting business will be on track to reap the rewards of blockbuster success.

Is Prefab/Modular Construction Right for you? Prefab Preplanning

Know

- That prefab construction is increasing in popularity and represents a growing proportion of new construction projects for a variety of cost-saving, labor-reducing (which is especially beneficial in a Covid-restricted market) and environmental reasons, namely that indoor environments are easier to oversee and can operate day or night in ideal climate-controlled facilities.
- That while modular construction has yet to fully hit its stride, it is not without its successes – nor is it lacking support. The company, the architect, the engineer who cracks this code, who figures out the “secret sauce” of labor, cost and project completion has the potential to revolutionize the construction industry and gain a critical foothold in areas as diverse low-income housing and homelessness, to military and space-based applications. Is that company yours?

Plan

- To adopt prefab construction by way of identifying the top 5 benefits you expect to gain, while also taking into account the top 5 pain points you must overcome. Conversion costs can be high purchasing or expanding an existing facility and the hiring and training of new staff, particularly those with a project management mindset, can take time.
- To investigate how modular construction could fit into your business practices – even on a limited, trial basis. Is this an area of construction you could begin experimentation with? Do you have the customer base to support such an endeavor and are you willing to attract, retain and engage more? The answer could be ‘no,’ and that’s OK.

Act

- With the understanding that competitors are already jumping on the prefab bandwagon and that traditional barriers between geographic markets are breaking down. While this fact opens the door to new business opportunities, it also means localized “turf” might be taken over by someone else. Awareness on how your regional market is changing is key.
- With intent and make this the year you decide on the prefab path that makes the most sense for you and your brand. Even with the Delta variant continuing to spread around the world, the latest economic forecasts remain upbeat that the global economic rebound will continue. In fact, the Organization for Economic Cooperation and Development only reduced worldwide 2021 growth forecasts by one-tenth of one percent, to 5.7% from 5.8% earlier in the year. Don’t let Covid-19 and its latest variants give you cold feet.

About the author:

Rob Miller is the Director of the AEC Segment for the Americas at FARO Technologies, Inc. A 20-year veteran of construction technology, Rob has been involved with the development and implementation of robotic total stations, laser scanners, drones and 3D machine control. Rob is credited as an inventor on multiple patents and holds a bachelor’s degree in Geomatics from the University of Florida.