

THE BROAD DIMENSION

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Prefabrication

Prefabrication has been the up-and-coming technology for decades, but perhaps its time really has come now. Prefabrication has been around for a long time, in some respects one could say for millennia, but it has had a reputation of being the cheap alternative, and ‘cheap’ and ‘nasty’ tend to be linked in people’s minds. In the past, prefabrication has come into its own in times of dire need, such as providing housing for those displaced by warfare or natural disasters. But this resulted in the image of prefabrication being very much on the lines of the old Pete Seeger song “Little boxes on the hillside ... and they all look just the same.”

People like to stand out in some way, and like their buildings to do the same, and technology is enabling prefabrication



to break its 'one size fits all' image. BIM technology is the driver here. Using the Building Information Model to directly control the fabrication of construction units can facilitate the prefabrication of unique designs and have them constructed in controlled conditions which can increase the quality, save construction time, and hopefully save cost.



Ways of reducing construction cost are always being sought, but prefabrication might not generate as much in the way of savings as one might hope. A fabricator may be able to purchase materials cheaper through long-term contracts, but a unique design could require different materials, lessening that savings. The assembly-line assembly method is more efficient than on-site construction, but then you have the transportation costs for units that may be large, adding more cost. If there are initial cost savings (and they are reported on many projects, sometimes up to about 20%), you would really want to avoid change orders because it can become a lot costlier to incorporate changes into the design once fabrication is underway. If a building needs to be reconfigured regularly (as happens in many research environments, for instance), the use of prefabricated components that can be disassembled and reconfigured can lead to substantial life-cycle cost savings.

Building in a remote location might seem like an ideal situation for prefabrication, but if the fabricator is far away and roads and other transportation infrastructure isn't up to handling wide and heavy loads, it will probably be more effective to go the traditional construction route. Projects need to be evaluated for their suitability for prefabrication.

What is now considered traditional construction will almost certainly include some element of prefabrication in it, such as windows and doors, and steel frame members that arrive on site fabricated and ready to be bolted and/or welded together. Large portions of MEP work can also

be fabricated off-site, and more subcontractors in different trades are recognizing the competitive advantage that off-site fabrication can give. This has become an increasingly attractive option, especially given the growing scarcity of qualified site staff, and we are seeing subcontractors collaborating to fabricate multi-trade components.

One reason often quoted for not using prefabrication is that it had not been considered in the original design. Designers frequently view prefabrication as being a 'means-and-methods' option that is open to subcontractors, rather than something to design specifically for. This might be attested to by fact that prefabrication is more likely to be used in design-build projects, where the contractor is more directly involved in the design.

Site safety is sometimes quoted as a benefit of prefabrication, because the site is less congested, resulting in less opportunity for injury. On the other hand, prefabrication does mean that large and heavy pieces of construction are being hoisted and maneuvered around the site, with a potential for some serious accidents. That said, the controlled environment of a factory producing the prefabricated units should be a lot safer than the hustle and bustle of a site.



The main benefit of prefabrication has been shown to be schedule reduction, and in this age of needing everything yesterday, that is certainly important. The savings is not just in on-site construction time, although the main benefit is felt there, but in overall delivery as well because the offsite fabrication becomes better organized and can be started while site clearance and substructure work is being carried out. If the building can utilize standard premanufactured parts, then the schedule savings can be substantial, and the use of such parts doesn't mean they can't be put together in original ways.

Reducing waste is part of the 'green building' revolution, and it is far easier to control, and thus reduce, waste

factors in factory conditions than it is on site. The energy resources can also be controlled better.

Fabricating whole sections of a building is also known as modular construction. We have seen modular classrooms and the like for a long time, but modern modular construction can be used for constructing multistory buildings, especially where there is a large amount of repetition within the building. Hospitals, hotels, and apartment buildings are among the types of construction that fit well into the modular construction model.

In a climate where change is constant, construction schedules are tight, and site staff is hard to find, prefabrication and modular construction provides a good solution. Provided the change we mentioned doesn't come while the building is being fabricated.

Thanks to Brad Hartnagle of ManufactOn for the images.

Value Capture Funding

The latest generation to enter the workforce, Gen-Z, is likely to spurn the use of cars, and rely more on bikes and public transit. With traffic snarl-ups becoming more common, members of other generations often agree with them. That means that housing and commercial space (such as offices or retail) that are near a transportation facility will experience higher demand and consequently a higher property value.

When a new light rail or rapid bus service (for instance) is being developed, the authority knows that property values (or more specifically, land values) in the area around the station or bus stop will increase. Value capture funding (or Land Value Capture) includes a number of different methods that authorities have used to capture at least some of that increased value to fund the development of such a service. These methods include:

- **Special Assessment Districts:** Where a special property tax is imposed on a district deemed to be benefitting from an infrastructure development. These are of limited duration, and frequently require a majority vote of affected property owners before they are implemented.

- **Tax Increment Financing:** With this method, the total assessed value of properties within the district before the infrastructure development are noted, and then the additional property taxes resulting from any increase in property assessments are used as financing for the infrastructure. This assumes that all increased assessments are a direct result of the infrastructure development, which is probably not true.

Some other financing methods, that can be argued are not strictly Value Capture, include:



- **Impact Fees or Negotiated Extractions:** These might be charged where a new development necessitates new infrastructure, and ideally would be negotiated with the developer.
- **Joint Development:** Often some form of public-private partnership.
- **Land Value Taxation:** Taxing the value of the land, rather than the value of the land and property; this is seen as having benefits as to what developments will end up going on the land.
- **Naming Rights:** As commonly used for stadiums.
- **Parking Fees:** Can be used to fund infrastructure, and might provide an on-going revenue.
- **Sales Tax Districts:** Here, an increase in sales tax within the affected area is used to help finance the infrastructure development. Once again, this may be voted on by residents of the area.

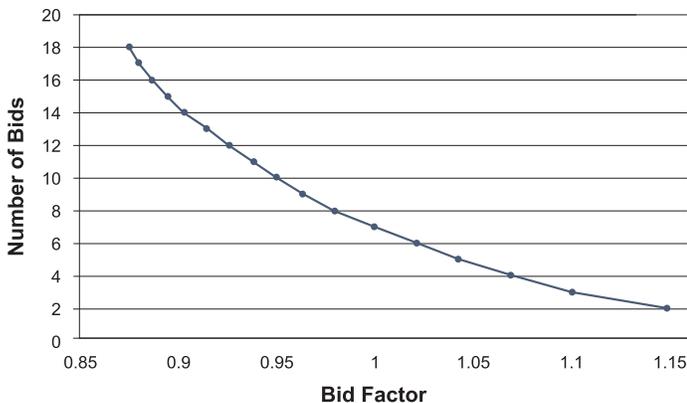
The above methods are mainly only useful for financing the capital cost of such a development (which might really be any form of infrastructure improvement, not just transportation), but they do not supply on-going funding for

running costs. However, the increased property values will lead to an increase in property taxes, so there is some on-going increased income-stream.

Mixed Markets

It is looking as though the tariffs and trade wars are back on the table (writing around the end of May), and the issues with Iran are again raising global tensions and pushing oil prices higher. National inflation levels remain under control for now, but construction prices have been rising rapidly over the past few years. Here we take a look at some of the drivers for these increases.

There has been shown to be a relationship between the number of bidders and the level of the bid prices. Taking seven bids as a norm for a fairly competitive market, studies have shown that if more bids are received, the price comes down, and fewer bids leads to higher prices. Only getting two bids on a project might result in the low bid being about 15% higher than would be expected in a 'normal' market.



The relationship between number of bids and bid prices is not causal, but both are driven by the market conditions. The construction industry has been suffering from a shortage of qualified staff for some time now, while businesses have been booming and providing a high demand for construction services. Consequently, contractors generally have as much work as they can handle, and if they are going to bid on a job they will make sure that they cover any risks well.

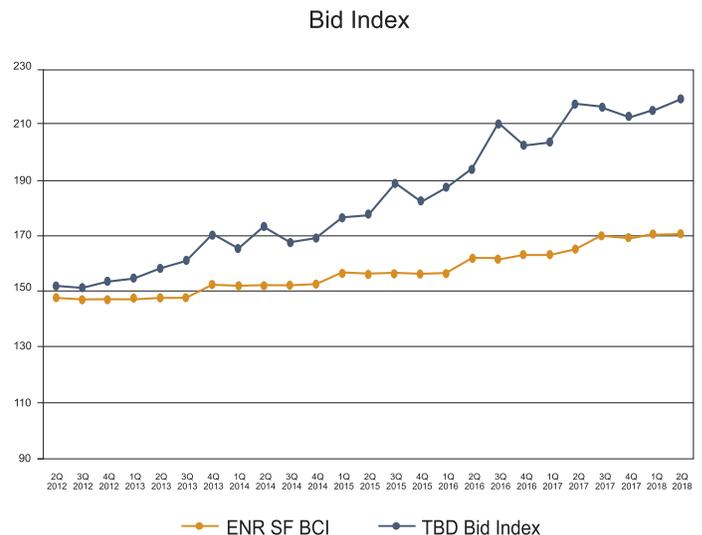
The staff shortages will add to the contractor's costs in a number of ways, which can include providing incentive

packages to obtain and keep staff, providing additional training, and maybe suffering lower productivity where newer staff is involved. These kinds of additional costs will further push up bid prices.

Full work-books will also mean that contractors can be picky about what projects they bid on. A new-build project on a green-field site will not carry the same kind of risk as an alteration project. So, the alteration project will have greater problems attracting bidders, and those who do bid will be making sure they cover any risks well. Projects with difficult access, restrictions on work or delivery hours, or heavy oversight are also jobs that will be less attractive to bidders, even if they are new-build.

To summarize the above factors affecting bids, we have the following range of effects:

	Low Range	High Range
Lack of bidders	0%	15%
Hot market conditions	5%	30%
Attractiveness markup	0%	50%
Total effect	5%	95%



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