
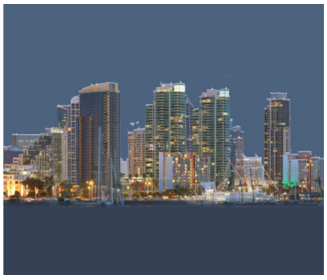

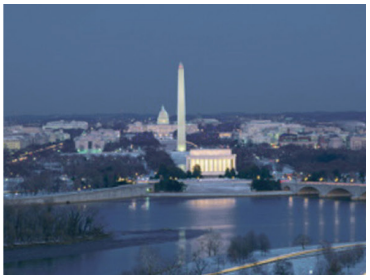

THE BROAD DIMENSION

the newsletter of tbd consultants - Spring/Summer 2024

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In this Edition:

Growth of Timber Buildings

Mass timber buildings have been increasing in number rapidly in recent years, but they still make up a small proportion of construction projects here in the US. In our newsletter for the fourth quarter of 2018 we ran an article, in conjunction with DCI Engineers, discussing the state of mass timber construction at that time, and its uses have grown substantially since then. Government and university construction was where you'd expect to find mass timber being used initially, but now its use in commercial, residential and healthcare projects is growing. Portland International Airport is a showcase for its use in airport terminals, and it is even being used for the supporting towers of wind turbines, one turbine being nearly five hundred feet to the tip of its fiberglass blade, and the tower itself being about 345 feet tall.

While mass timber construction has been common in Europe for decades, timber construction here has mostly been stick-built low-rise projects, so the expertise for design and construction of mass timber buildings has

been lacking. That shortfall is being remedied rapidly and is helped by having good communication between the onsite staff, the design team, and the manufacturers of the mass timber products. The main product that we think of when mass timber is mentioned, is CLT or cross-laminated timber, but it can also include LVL (laminated veneer lumber), LSL (laminated strand lumber), PSL (parallel strand lumber), and glulam (glue-laminated members).

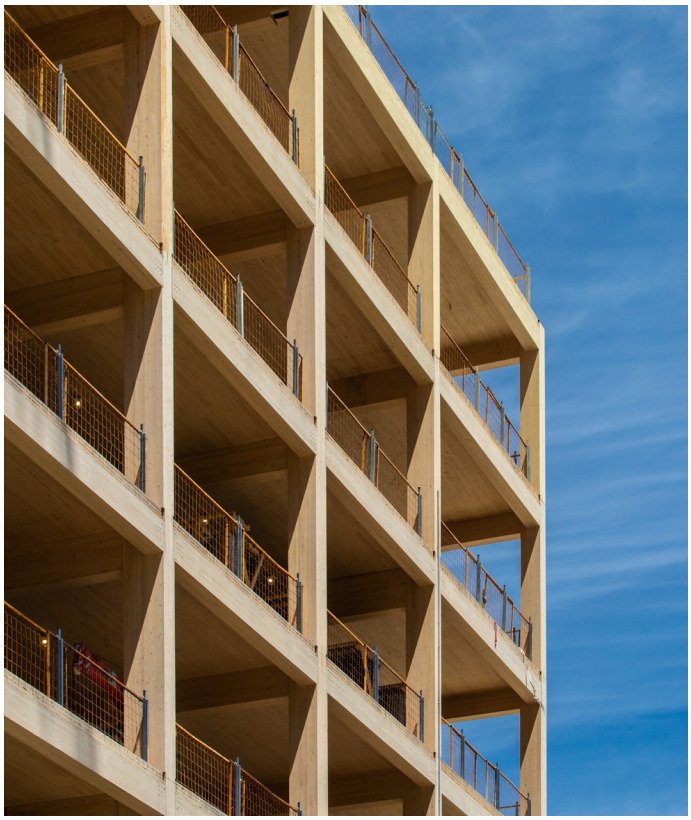
Building codes are having to play catchup with this construction method. The 2021 International Building Code (IBC) has now been largely incorporated into local building codes across the US, and the mass timber provisions in that allow for its use in three construction types that go up to 18 stories. The 2024 IBC increases the allowable proportion of exposed timber in the ceilings of buildings up to 12 stories to be 100%, whereas the 2021 IBC limited it to 20%.

Timber has the advantage of being an attractive material, so the ability to have it as a self-finished structural element can result in cost savings regarding finishes. It is also lighter than steel or concrete construction, so there is the potential for savings in regard to footings. On the negative side, if the structure is being used as the finish, it would also mean that services, that would otherwise be hidden behind a suspended ceiling or other finish (such as ductwork for the HVAC system), must now be designed to look attractive. That will add to the cost. Also on the negative side is the issue that there has been little experience with this type of construction, which can make it look like a higher risk factor for contractors.

The costs of the various materials used for structural purposes all vary over time, and the pandemic, with its related supply-chain issues, resulted in fairly dramatic cost variations, with timber showing some particularly large swings. But currently the cost of timber has settled down in a more advantageous position in regard to steel and concrete than it had before Covid-19 started affecting the supply chain. As more buildings begin incorporating mass timber in the design, there is also the economic driver of economy-of-scale coming into play and bringing costs down.

Mass timber, which usually has at least a reasonable amount of prefabrication involved, can shorten the onsite construction schedule and minimize the effects of adverse weather. But we are talking about a product that can be sensitive to moisture, so a good moisture management plan needs to be implemented.

Building owners benefit from being able to use the building early because of the shortened construction schedule, and the aesthetic appearance of timber, along with the fact that is ecologically friendly, attracts and retains tenants more



effectively than other structural systems. A full lifecycle cost analysis would be needed to try and quantify the value of these differentiators.

One of the main selling points for this type of construction is the fact that it uses a renewable resource that locks up carbon, and therefore helps us address the climate crisis. It is claimed to produce 30% less carbon dioxide emissions than concrete buildings and 50% less than steel. If carbon credits can be taken into account, that should make mass timber much more competitive on the basis of cost. Mass timber can certainly help with the LEED certification. That said, there can be reservations about how “green” it is. For mass timber construction to be really helping the climate and the environment, the timber needs to be sourced from an ecologically well-managed forest. The forest needs to be sustained and developed by ensuring that new trees are planted to replace those that are cut down, and care needs to be taken in selecting which trees are logged in order to maintain the ecosystem. What happens to the timber at the end of the building’s life is another consideration.

Mass timber construction has been seeing exponential growth in the US in recent years due to both its aesthetic appeal and its lighter onsite work demand - a welcome benefit in light of labor shortages.

Construction Goes Techy

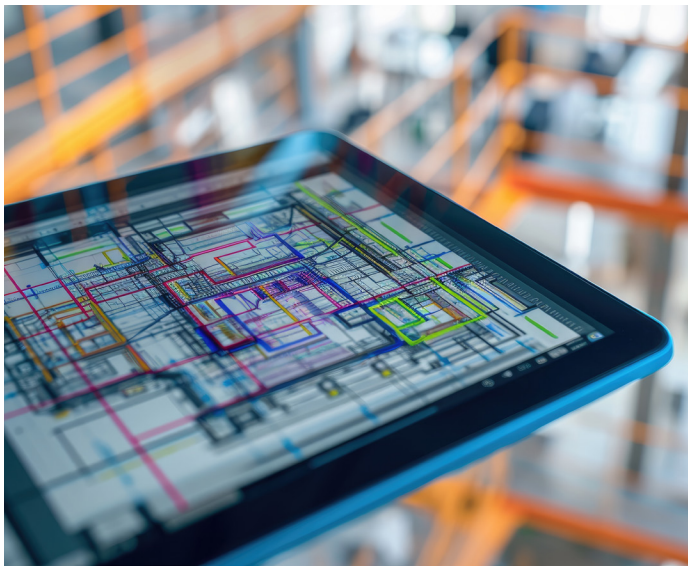
The construction industry is frequently faulted for sticking with methods that have been around for centuries, or even millennia, but to be fair, we have been seeing new methods and technologies being introduced into both design and construction processes in recent years. Nevertheless, there remains a need to make the industry more attractive to the younger generations joining the workforce. The baby-boomers are fading away and the newer generations are more used to handling and enjoying the tech challenges, rather than having to do manual labor. Construction is also one of many industries needing to improve its carbon footprint, and that will involve technological innovation.

BIM and associated design and engineering software has certainly revolutionized the design, planning, and engineering of new and renovation work, improved productivity and efficiency, and allowed designers to test alternates through digital 3-D modeling capabilities. Its 4-D and 5-D capabilities (bringing in scheduling and costing) enable the design team to show that the proposed design can meet the owner’s timeline and budgetary restraints. BIM is now incorporating 6-D (sustainability) and 7-D (facility management) information as well. With regulations, and even taxes, being enacted with regard to carbon emissions of buildings and the embodied carbon in the building materials, software enables owners, architects, and developers to have ready access to pertinent information about their buildings.

As the project moves into construction, there are innovative tools, materials, and processes that are improving the construction process, its ecological effects, and making the construction site a safer work environment. The adoption of modern software is helping to streamline the workflow, improve delivery time, and optimize the supply chain. These kinds of apps can also keep cashflow and financing organized, along with making and receiving digitized payments.

3-D printing has always been great for modeling a new construction project, but now the process has been adapted to enable it to build the finished product. Modularization and prefabrication are processes that have been around for decades, but the onsite workforce shortage and environmental concerns are bringing them to the fore again. They have the advantage of being less affected by weather and are less likely to involve onsite staff getting in each other's way and causing delays and claims.

There are always a lot of people, companies, and organizations involved in a construction project, so efficient communication is essential, and the pandemic made sure that we have those kinds of tools. The flexibility provided by modern project management apps is vital, since buildings tend to be one-offs, each with different design and construction teams. BIM and construction management software has been improving communication between parties, and has been leading to the standardizing of data, which is essential for providing the inputs that generative AI needs. Integration and communication between software solutions help everyone, and the ability to transfer data between apps has been improving. The newer mobile scanning techniques can produce a model of the building with similar accuracy to that obtained by using a traditional rod and tape but does it much faster. If you need finer detail, there's the terrestrial scanning (TLS) that has been around longer. Tracking progress, optimizing the schedule and resources, improving inventory management, and identifying problems, all in real time, has become possible. The advances in AI software will continue to improve the assessment of project risks and the identifying of potential alternates in designs, materials, delivery and supply chain options, etc.



The repetitive construction work, such as brick laying and the like, can be handled by autonomous construction equipment that can get their instructions from the BIM model, or at least the contractor's version of it (liability issues have to be considered here). Having AI monitoring site safety with image recognition of video data has the capability of identifying unsafe work practices and can lead to better training for site staff.

Automated electric vehicles can become robot assistants, moving materials, lifting heavy objects, and the like. Construction drones can provide digital/laser scanning (mapping job sites) leading to 3-D & 4-D models that identify conflicts and potential claims. Such drones also give remote monitoring in regard to safety issues, quality control, inspect dangerous places or damage from storms & natural disasters, etc. Better tracking should provide the data for better management that, in turn, should result in fewer cost and schedule overruns.

The advent of smart buildings and cities, with their IoT (Internet of Things) sensors, will be improving knowledge of maintenance issues and leading to preventive maintenance measures that keep buildings safer and functioning efficiently.

There are some stumbling blocks related to all this new technology, apart from it giving more things for Murphy's Law (anything that can go wrong, will) to work on. One problem is that generative AI needs lots of training data, which is probably more than any single building owner or construction company would have. We have to wonder if companies will be willing to share such information when the emphasis seems to be on securing the data. There is also the problem of overcoming the "We've always done it this way" attitude. Showing the return on investment for the new technology will hopefully assist there, and there's an app to do that.

Markets Seek Direction

The big question that the markets want answered is when will interest rates come down, and that depends on when the Fed will get the inflation rate it feels comfortable with, which in turn gets influenced by other world events and what happens in the political sphere. The strength of the general market makes it look as though there's not likely to be much, if any, reduction in interest rates this year, keeping the cost of investing in new projects high.

The jobs market has stayed strong with 275,000 new jobs reported for February, showing an increase over the revised total of 229,000 for January. Healthcare, hospitality and leisure, and government were the leaders in new job creation, but construction was also showing increases. The resulting low unemployment rate keeps the pressure on wage rates, and consequently on inflation. Pay increases to retain and attract construction workers seems to be running around 5% or more ahead of the general employment market. AI certainly doesn't seem to be taking away the jobs at present, and its main effect for construction is in the additional construction work required by companies trying to grab their share of the AI market.

Material costs have shown to be stabilizing, and, in some cases, coming down, but not fast enough for many. With construction materials, the ENR Materials Price Index was 3519 in January 2020 at the start of Covid and 6249.77 in January this year. That's an almost 75% increase, averaging out at 15% per annum. The index shows a 1.61% increase between January and March this year, so annual inflation of construction materials still seems to be running ahead of overall inflation.

Consumer spending is a major part of the US GDP, and retailers have been reporting a trend in consumers cutting back on discretionary spending. That is a result of food costs and the cost of housing continuing to increase. Consumer credit card debt has been reported as being high, but after taking inflation into account it's not a significant change, and most of that debt is paid off monthly, so consumers seem to be okay.

Of bigger concern might be the banks that are affected by the retail and commercial loans coming under pressure from the interest rates and as shops and offices adapt to the changes in people's habits following the pandemic. We've also been facing potential government shutdowns, with more of the same to come as the budget battles work their way through Congress.

Yet, for all that, the commercial, industrial, and investment markets have been holding up, confirming the strength of the economy, despite high interest rates. And high interest rates mean that the Fed has an easy way to boost the economy, if needed. That's all good news.

Geoff Canham, Editor, TBD San Francisco

Newsletter designed by Katie Levine