

PROFESSIONAL ISSUES

issues affecting the structural engineering profession

The Future of Making Structural Things in the Construction Industry

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There is a disturbance in the Force. Can you feel it?" This quote can be applied to many different subjects in the universe, including what is going on in the construction industry here on earth. We do not have floating cars and diplomatic robots fluent in six million languages yet, but the construction industry is being transformed like never before. While there are sure to be growing pains along the way, it is also an exciting time to be in the industry.

There are so many changes happening in the construction industry, as a whole, that it would be remiss not to stop and consider what the impact is to structural engineering, fabrication, and construction. Three key factors are shaping the future of designing and making structural systems in the global construction industry. These include:

- Global adoption of Building Information Modeling (BIM)
- Changing project delivery methods
- Dawn of the "Era of Connection"

BIM

The most significant trend to impact the discipline of structural engineering since the advent of personal computing is the adoption of BIM. Beginning in the early

2000s, it established a way for project teams to improve collaboration by working within a common, multi-discipline, three-dimensional environment. Structural engineering firms initially adopted BIM to meet client contract provisions, but now see the return-on-investment as a result of better-coordinated designs that are easier to communicate to their clients. Additionally, the benefits of BIM have also been recognized by owners who – along with government agencies across the world – are now driving BIM mandates for their projects.

The benefits of BIM are real, and engineering and fabrication firms are seeing them every day. However, BIM is not the only trend impacting the industry. There are other challenges beyond new technology that are driving change and disrupting the structural industry we know.

Changing Project Delivery Methods

Despite the proven benefits of BIM in engineering and the use of model-driven processes in fabrication, structural engineers still feel the competitive pressures from increasing project complexity, globally dispersed teams and accelerated project schedules – compounded by a lack of skilled labor entering the workforce. To overcome these challenges, project teams are reshaping how they design and collaborate so



New technology and processes are rapidly changing the way that structural engineers, detailers, and fabricators deliver projects.

they can generate new value streams for their firms and remain competitive.

For example, if engineers, fabricators, and builders can contractually work together with shared risk and reward, the benefits are significantly greater. Because of this, we see firms change how they deliver projects in a number of ways:

- *Engineering firms and construction firms are merging to provide combined, integrated design-through-construction services.*
- *Engineering firms are forming business partnerships (like informal partnering and joint ventures) with detailing or fabrication companies to offer integrated services that allow them to extend their design-assist offerings further upstream.*
- *Firms are delivering projects with more innovative contractual models like Design-Assist, Design-Build, or Integrated Project Delivery.*

Have these delivery models already been used in the past? Yes, they have. What is different now, and likely to continue into the future, is that technology is transforming the actual process of designing, building, and connecting teams in a way that is magnifying the benefits of using these more collaborative delivery models.

Dawn of the Era of Connection

We are now on the cusp of a new era of connected design, manufacturing, construction, and building operation that is driven by the digitization of information and connectivity between people, places, and things, also referred to as the Internet of Things. Here are a few of the trends that we see growing from this era of connectivity that will surely impact how structures are designed and built over the next decade:

- *New structural materials and systems will emerge that are smart, connected, adaptive, and sustainable. Examples of this are self-healing concrete, 3D printed nanostructures, and structural systems that dynamically adapt to changes in their environment.*
- *Computational methods using machine-learning will automate simple engineering tasks while assisting engineers to perform*

more complex engineering tasks. This will empower engineers to offer more high-value services.

- Global work sharing will become commonplace as the world scales its cloud infrastructure and services, making engineering and detailing services more accessible and competitive.
- An engineering education will focus on high-value, problem-solving skill sets. Craft and labor training will require new technology skill sets that are more manufacturing-centric.
- Manufacturing processes will be hyper-connected with the buildings that enclose them to optimize and minimize energy consumption and minimize their carbon footprint.
- Manufacturing-driven innovations like machine learning, lean manufacturing, and modular construction will transform the construction site in response to a growing shortage of skilled domestic labor.
- The sharing economy will disrupt how construction projects are funded, designed, built, and operated. This will be enabled through the connectivity of teams, manufacturing and job site processes, and building operations.

The common theme that will emerge is a hyper-connectedness between people and things that will allow the production of ideas and building products in a much more effective and sustainable way. So how seriously should you consider these trends? Are others in the industry already preparing for these changes?

An excellent view of the road ahead can be had by looking at the British Government. Beginning in 2016, they require all government projects to use BIM. This mandate is a part of Britain's 'Construction 2025' joint strategy which sets out how industry and government will work together to put Britain at the forefront of global construction over the coming years. Britain believes that using digital design with smart construction methods will give them a competitive advantage over other world economies. In other words, if they can reduce the costs to build and operate their infrastructure, they will be more competitive than other economies that do not. Their success will put pressure on other economies to follow suit with digitally connected infrastructure to compete in a global economy.

New materials, better-connected project teams, the sharing economy – it is a lot to digest. One thing is certain – the future of making structural things promises to be an exciting ride. ■



BIM was used by Odeh Engineers to successfully deliver the complicated MassArt Residential Hall, Boston, MA. Courtesy of Odeh Engineers.

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