TEACHING INFRASTRUCTURE TO DO MORE, BETTER, WITH LESS

AN INDUSTRY IN TRANSITION

The world is changing. Today's infrastructure is not only aging—the approach to planning, design, and constructing it is rapidly becoming out-of-date as well. What's more, population growth, urbanization, and economic expansion are set to push demand for infrastructure to unprecedented levels over the next 20 years.

So, how can infrastructure account for a future that accommodates not just demographic pressures, but the uncertainty of a changing climate and the increasing need to reduce environmental impact and stretch increasingly scarce raw materials? In other words, how can we do more, better, with less?

A NEW WAY FORWARD

It begins with a new kind of technology-enabled process that takes into account the interdependencies across adjacent infrastructure systems and considers the costs over their lifecycle, not just the initial construction costs. It embodies a spirit of data-intensive modeling to assess inherent capability of new and old systems to adapt and respond to changing needs.

It's all made possible by the rise of reality cloud computing coupled with hardware and software advances that have the ability to quickly and cost-effectively capture information about the physical world and make it digital.

This information will soon be used to support and inform decision-making during planning, design, construction, and eventually operations—minimizing environmental disruption and benefitting project design firms, contractors, and infrastructure owners.

With the power of BIM, big data, cloud computing, and analytics, we can now better tackle and answer the questions that need to be answered to solve our world's $57 trillion infrastructure challenge.

Building our infrastructure the right way is no longer good enough. In this impending connected era, we now must answer the more important question: "Are you building the right infrastructure in the first place?"

TRACKING THE DIGITAL DISRUPTION

Most of the infrastructure industry's current techniques and technology hail from a time when there were fewer people, less urgency, and lower demands. Today, larger project sizes, increased complexity, and aging infrastructure are driving the need to better simulate alternatives, reduce delivery schedules, maintain high quality, minimize cost, and ensure safety. These are needs that technology can help meet. Full-scale digitalization – the development and deployment of digital technologies and processes such as Building Information Modeling (BIM) –could lead to annual global cost savings of 10 to 25 percent in the engineering and construction phases, and 8 to 13 percent in the operations phase.

Full-scale digitalization will include:

Autonomous Vehicles

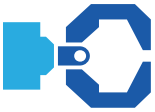
These vehicles could substantially increase road capacity as vehicle-to-vehicle communication enables tighter vehicle spacing.

Integrated Transportation Systems

As people move incorporate multiple modes of travel—walking, biking, mass transit, rail and autonomous vehicles—for a single trip, new solutions will be needed for effective transportation designs.

Unmanned Aerial Vehicles (UAVs)

UAVs or drones are already beginning to be used in planning, design, construction, and operations to digitally capture existing conditions, track construction progress, and provide as-builts once an infrastructure project is complete.



Manufacturing Innovations

Additive manufacturing, 3D printing, new materials, and advanced automation are already opening up new possibilities for building resilient, adaptive infrastructure onsite, lowering costs and increasing options.

Alternative Resources

As communities struggle to adapt to climate change and diminished availability of traditional materials, BIM enable the development and use of advanced materials and renewable or unconventional energy.

How will we get there? With connected BIM, especially BIM blended with GIS (geographic information science). BIM + GIS blends a layer of geospatial context into the BIM model, making it possible to draw information about climate-related variables, like the likelihood of floods, into decisions about a structure's location, orientation, and even construction materials.

Tools in a connected era will be flexible and focused on providing functionality tailored the needs of each infrastructure professional discipline. For example, cloud computing will enable new levels of generative design by crunching population demographics, economic forecasts, and user preferences to optimize outcomes for complex infrastructure projects. All of those projects can also be explored much more deeply than in the past—long before construction begins. That's because augmented and virtual reality are creating immersive experiences that allow teams and stakeholders to interact with buildings before they're built.

LEARNING TO DO MORE, BETTER, WITH LESS

Taken together, these and other innovations are making it possible to do **more**: create infrastructure for a growing population; do it **better**: improve living standards and adapt to changing demographics and climates; and do it all with much, much **less**: using fewer resources and having a lower environmental impact.

That future is here, and it's taking the shape of:

- SMART CITIES: Use technology like BIM+GIS, augmented reality and virtual reality to connect people to places and information while also optimizing the long-term sustainable operation of their infrastructure assets.
- SMART RISK: Use big data to help industry better identify, quantify, and mitigate project risks or perhaps even turn risks into vehicles that increase profits and make margins more predictable.
- SMART OPERATIONS: Deploy digital technologies and processes such as BIM to deliver better predictability of project outcomes.

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