

Bridge Information Modeling

Are We There Yet?

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Bridge information modeling (BrIM) has become an important industry tool since it was first introduced to the transportation sector. BrIM is an innovative approach to bridge design, construction, operations, and project delivery. It allows for the creation of an information-rich data model that can be used during the life of the bridge, connecting design, construction, operations, and maintenance.

More than ever, bridge professionals are seeking methods to:

- reduce construction costs with more economical designs,
- improve quantity take-offs,
- model the step-by-step construction process in 4D, and
- realistically visualize projects with imagery and virtual drive-throughs.

The Federal Highway Administration MAP-21 compliance requirements, and the growing popularity of design-build and Public-Private Partnership projects, have set the stage for greater owner expectations for faster and more-efficient methods of constructing our transportation assets. Bridge designers need to be prepared for this shift in workflows.



Information modeling allows more time for evaluating different alternatives, simulating different scenarios, and optimizing your eventual design. All images: Bentley Systems Inc.

The BrIM design environment has been a headlining discussion at conferences and committee meetings, in articles, and on social media. These discussions are an opportunity for research results and best practices to meet new contractual requirements to select the best solution to design, build, maintain, and operate these assets. While the infrastructure needs increase, new methods to expedite projects, manage funds more wisely, and meet the demands of the public—who want minimal disruption to their traffic patterns—are needed. Current trends indicate that the transportation industry is slow to adopt BrIM workflows and methods. It is unclear whether the industry is waiting for industry standards, if it is uncomfortable with change, or both.

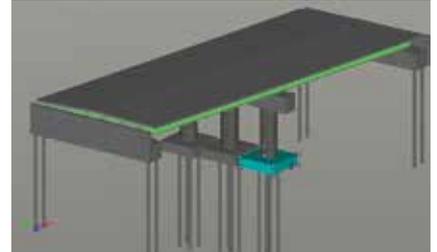
The perceived challenges associated with implementing a BrIM approach are:

- a change in workflow would detract from billable design time, and
- whether it is worth it.

Considering the benefits versus the risks, a traditional workflow can be best described as a fragmented flow of information and it is likely approached from a 'data ownership' perspective. Those responsible for their component of the project own their information and minimal data are sometimes shared.

For example, the highway engineer designs the alignment, profile, and superelevation of the structure based on a typical bridge section. The bridge engineer takes that information and re-enters these data into the structural design software to design

Interactive inspections allow for collection and reporting of condition data at the component level.



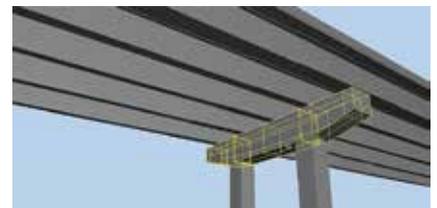
Fully augmented models transfer structural component data directly to field inspection technology.

the bridge. Following completion of the design, the work is turned over to the detailers who draw the structural sections and reinforcement details based on the engineer's preliminary drawings or even paper sketches.

In this non-automated workflow, any changes or updates to the design are left to the engineers to inform their peers of modifications made. The documented effects of this current workflow translate into project risks, including errors introduced with data re-entry and scattered data across an organization or organizations. Each person only knows where their piece of the workflow is—and the same data may be held in different locations.

BrIM Environment

Working in a BrIM environment eliminates these gaps in shared data. A lot of the information generated during a typical design workflow can easily be adapted into a BrIM workflow with increased productivity and efficiencies. The key components



Data re-use and mobility are a necessity.

are already in place; transferring to a BrIM workflow is likely a matter of assessing data mobility and adjusting the gaps. BrIM is a collaborative way of doing business and can be a key component for success in firms of all sizes.

Data re-use and mobility are a necessity for any type of well-designed, constructed, and maintained asset. Having the right version of data, the right format, and the required level of precision available to the right people at the right time is a clear differentiator in this workflow.

Data model standards commonly used for building structures include CIS/2 (CIMSteel Integration Standards), IFC (Industry Foundation Classes), and Bentley's ISM (Integrated Structural Modeling). However, there isn't one currently available for bridges. There are efforts underway at

buildingSMART to extend the IFC standard to bridges. A recent research study at the State University of New York at Buffalo found that Bentley's ISM can be used to create data models for the most common concrete and steel bridges. Additional work is necessary in ISM to extend its applicability to complex bridge types and roadway information.

A typical BrIM workflow would involve all stakeholders, from all relevant disciplines, to be involved in developing a fully intelligent, living, cradle-to-grave model. Data sources can include information from the geotechnical, survey, civil, and bridge disciplines. In the design of the bridge, these same data are used to create a global-intelligent, three-dimensional, as-designed physical model. This global model can then be augmented with miscellaneous components such as lighting or signage, thereby becoming the single source of data for the asset.

Publishing this vital as-designed information is more than a plan set.

One of the advantages of publishing a BrIM model is the effective and efficient sharing and distribution of information, which can reduce errors, compress the project schedule, and reduce project costs. BrIM models are widely reusable, enabling teams to reference, repurpose, and republish content, including business properties, geometry, graphics, and the respective component relationships. The asset information can be queried or the components linked to construction documents and 2D plan sets. These design data also can be fully utilized by inspection software and seamlessly accessed in the field for collection and reporting of the asset via mobile technology.

In many ways, the bridge industry is ready to embrace BrIM. The potential is there for state-of-the-art deliverables with assurance of accurate results. This year could be the one that BrIM gains traction and places the bridge industry in a position to meet our infrastructure needs, quicker, less expensively, and confidently. 

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