

# FHWA Supports Advanced Modeling with Bridge Information



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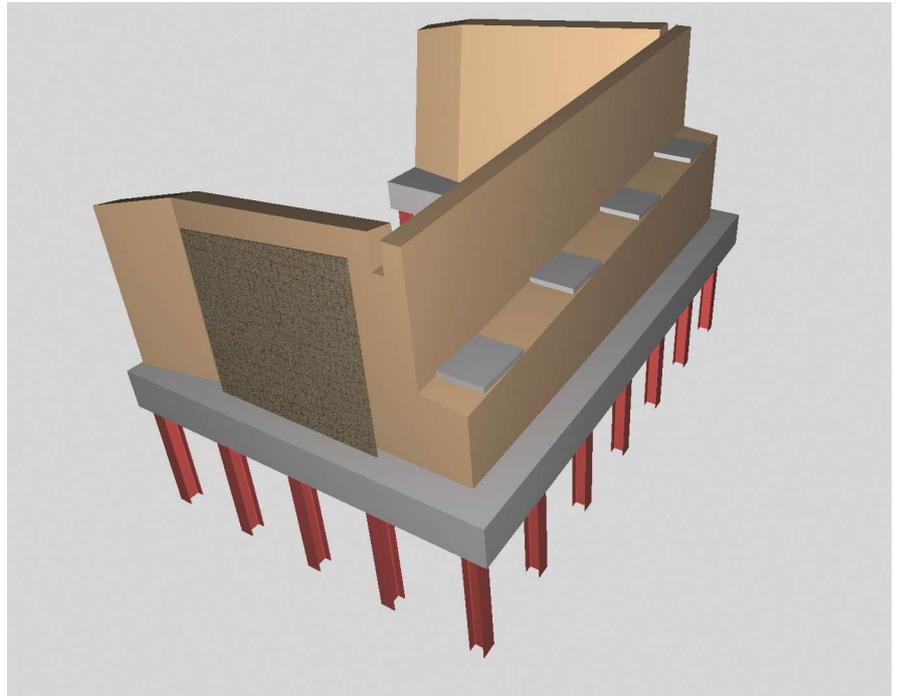
*Information modeling* refers to an advanced modeling approach that is based on generalized definition of the “objects” that make up a system. It is a holistic digital representation of physical and functional characteristics of a facility, which provides a shared knowledge resource for information to support a reliable basis for decisions during its life cycle. Information modeling is relatively mature and commonly applied in the building industry, but much less so in the bridge industry.

Some form of computer modeling and analysis has been done for most of our nation’s bridges, from conception to design to fabrication to construction to inspection to management to demolition. Bridge information modeling (BrIM) offers the opportunity to use digital project delivery, multi-dimensional analysis, visualization, virtual assembly, automated machine control, fast routing and permitting, network-level study, and more, to integrate project development, construction, and asset management.

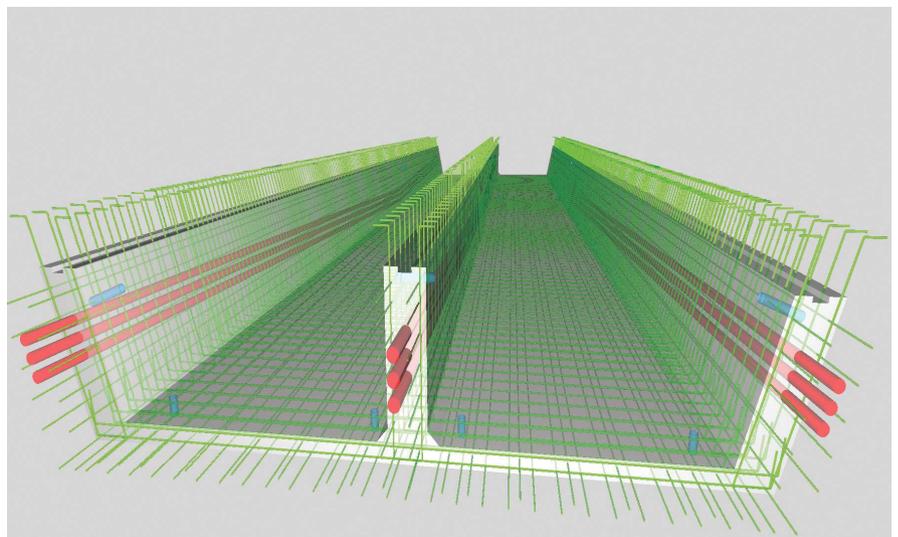
Broad implementation of BrIM would provide a transformative change in the way that engineers and owners execute workflows. It would provide a framework to move the engineering community beyond the outdated practice of communicating information via two-dimensional plans that require multiple manual data reentries downstream. It would allow engineers to discover conflicts and problems with fabrication and construction earlier in the design development and mitigate them in the office instead of in the field. It would move engineering away from “bookkeeping” activities such as quantity takeoffs and plans and shop drawing development/approval and move toward creation of a shared resource that is more useful to others downstream.

## Need

Current bridge modeling practice is limited in sophistication, level of detail, compatibility, exchangeability, and downstream value. BrIM-based engineering tools are available in some commercial software, but they are mostly



*Bridge abutment model. All Figures: Federal Highway Administration.*



*Concrete post-tensioned box-girder model.*

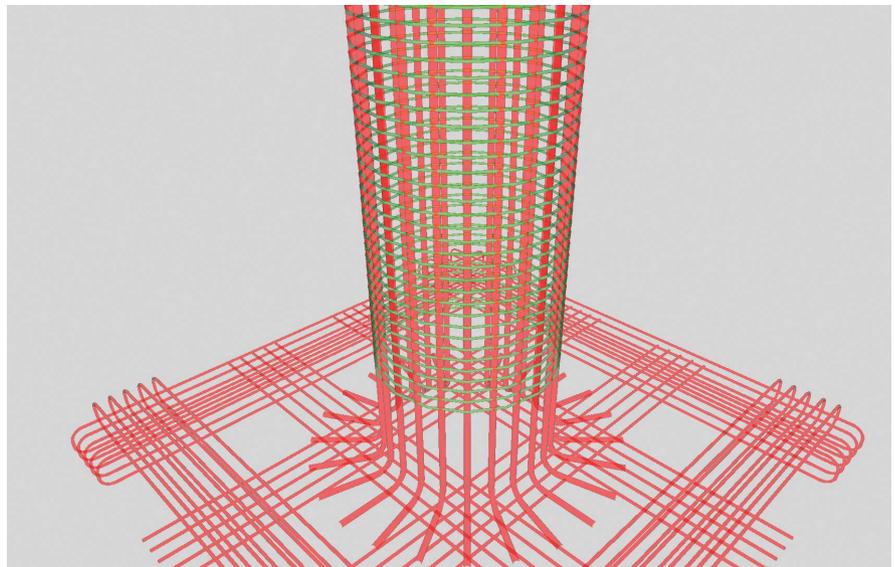
marketed as a special feature to sell a proprietary product. What is needed is national leadership by governing bodies to develop and promote an open, industry-consensus approach to BrIM modeling that can be implemented without dependence on specific software.

Every bridge in the United States must have a file that includes a load rating and its National Bridge Inventory data. If this could be done using an open, robust BrIM model, errors and omissions could be reduced. Conflicts and associated delays could be mitigated. Conditions and impacts could be better tracked. Efficiencies could be gained. Designs and evaluations could be enhanced. Costs could be reduced. Ultimately, safety of bridges and mobility of their users could be improved.

### FHWA Accomplishments

With the help of the University at Buffalo, State University of New York (SUNY), CH2M Hill Inc. (CH2M), and the National Institute of Building Sciences (NIBS), FHWA has been studying and developing ways to standardize the implementation of BrIM in bridge engineering. Work has progressed on two parallel paths in recent years. SUNY and CH2M have been developing new BrIM objects with powerful parametric definitions in an open format that could be freely shared among users—ideally via some kind of national library or online community. This approach has been given the name “openBrIM” and can be applied using freeware developed by Red Equation Corp. (available online at <https://openbrim.org/www/brim/>). The FHWA work related to openBrIM is documented in published reports that can be found at [www.fhwa.dot.gov/bridge/protocols/](http://www.fhwa.dot.gov/bridge/protocols/) and [www.fhwa.dot.gov/bridge/pubs/hif16010.pdf](http://www.fhwa.dot.gov/bridge/pubs/hif16010.pdf).

NIBS has been evaluating the use of an existing standard called Industry Foundation Classes (IFC), which has a well-established and active stewardship body and general acceptance by the software community. This standard has been developed and used primarily for buildings, but there is ongoing development that will add the definitions necessary to effectively model bridges and other infrastructure. One such item is roadway alignments and placement of objects related to these alignments. NIBS was able to develop an IFC model of two common girder bridges to the level of detail necessary to communicate the information found in the design plans. NIBS also developed a Model View Definition (MVD) documentation, which provides the necessary specifications for software implementation. The FHWA work related to BrIM with IFC is documented in published reports that can be found at [www.fhwa.dot.gov/bridge/protocols/](http://www.fhwa.dot.gov/bridge/protocols/) and [www.fhwa.dot.gov/bridge/pubs/hif16011/](http://www.fhwa.dot.gov/bridge/pubs/hif16011/).



*Bridge column and footing reinforcement model.*

### Looking Ahead

The Federal Highway Administration (FHWA) will continue to develop and demonstrate open, software-neutral standards for BrIM modeling through research, committee support, and case studies. FHWA is working with the American Association of State Highway and Transportation Officials to lead the industry towards consensus

and implementation of credible, robust digital standards that will allow software providers to develop translators to facilitate transfer of data among different software applications in a common schema/format. FHWA communication and stakeholder outreach will continue through webinars and workshops. Stay tuned! 



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