BIM for Bridges and Structures Pooled-Fund Program

The journey toward open 3-D data exchanges

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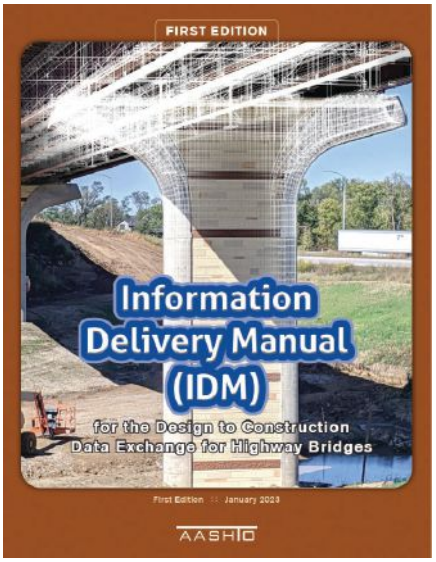
The use of building information modeling (BIM) for bridges is increasing in popularity. However, in the past decade, various studies and pilot projects have concluded that the United States lacks a unified file format for exchanging three-dimensional (3-D) models and other digital data. As a result, designers, contractors, and owners who want to use BIM workflows face interoperability issues if they do not use the same software.

More than 20 state transportation agencies, the Federal Highway Administration, and the American Association of State Highway and Transportation Officials (AASHTO) Committee on Bridges and Structures (COBS) have come together to change that. In collaboration with the lead agency, the Iowa Department of Transportation, the stakeholders pooled funds to create national open standards for data based on the industry foundation classes (IFC) format or, more accurately, data schema. The early work of the BIM for Bridges and Structures effort influenced the creation of the 2019 AASHTO resolution, "Adoption of Industry Foundation Classes (IFC) Schema as the Standard Data Schema for the Exchange of Electronic Engineering Data," which established IFC as the preferred schema across all disciplines, not just for bridges and structures.[1] Some describe IFC as the "PDF of BIM."

Information Delivery Manual (IDM) for the Design to Construction Data Exchange for Highway Bridges **is a guide specification for the model-based information to be exchanged between owners and contractors within the context of the design-bid-build method. It is an outcome of the pooled-fund study TPF-5(372) BIM for Bridges and Structures. Figure: American Association of State Highway and Transportation Officials.**

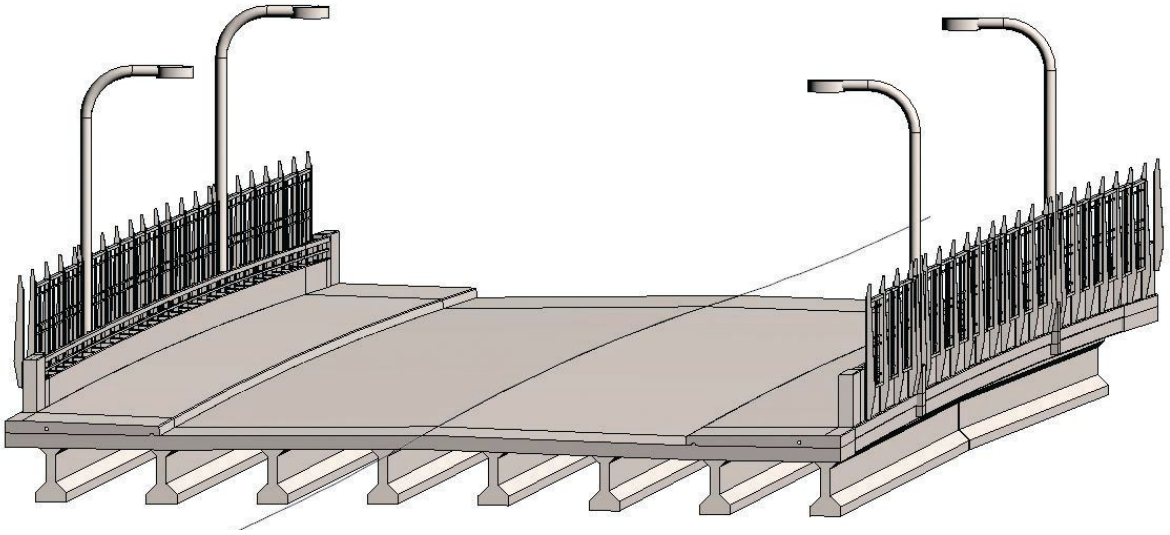


In 2017, the AASHTO COBS Technical Committee T-19 on Software and Technology (now the Technology Committee) organized a pooled-fund study known as TPF-5(372) BIM for Bridges and Structures.[2] This five-year effort focused on developing an open data standard and related technical solutions for the design-to-construction data exchange. A key component of this standard is a guide specification, which was balloted and adopted by AASHTO COBS in June 2022 and formally published by AASHTO in January 2023. That publication, *Information Delivery Manual (IDM) for the Design to Construction Data Exchange for Highway Bridges*,[3] is available for purchase from the AASHTO store (store.transportation.org).

The IDM provides a human-readable set of information requirements, rather than machine-readable format or binary data, for the exchange of model-based information to execute construction in the United States. Subtasks that the IDM supports include preparation of a bid package and initiation of the fabrication phase. The IDM outlines the required data to be exchanged between the owner and bridge construction contractor for conventional bridges within the context of the design-bid-build delivery method in the United States. These conventional bridge types include pretensioned and post-tensioned concrete structures and precast concrete culverts. While bridge and linear infrastructure definitions are relatively new to the IFC schema, details related to reinforcement have been well defined in the IFC schema for many years due to the more widespread use of IFC in the building industry. The IDM is an essential part of the IFC development work, providing a plain-language description of the scope of the exchange and a listing of information required to satisfy the exchange.

The IDM by itself is not the full solution. Additional products were developed under TPF-5(372) BIM for Bridges and Structures, including an information delivery specification (IDS), a bridge data dictionary, and a unit test suite. These products, along with the alignment-based model view definition developed by buildingSMART International, provide the means for software vendors and developers to implement IFC-based exchanges within their software products for the benefit of the bridge industry.

While the focus of TPF-5(372) BIM for Bridges and Structures was one single data exchange, the ultimate vision is to enable more widespread use of BIM throughout the life cycle of a structure. To this end, a second pooled fund, TPF-5(523) BIM for Bridges and Structures – Phase II, was created in 2023, and work will be conducted from 2024 to 2029.
The Phase II objective is to develop additional technical solutions for



This three-dimensional model of a conventional bridge superstructure with precast, prestressed concrete girders is an example of a bridge type that is supported by the outcomes of the TPF-5(372) BIM for Bridges and Structures project.[2] Figure: HDR Inc. and Iowa Department of Transportation.

delivering 3-D bridge models and other digital data in an open, nonproprietary format. The Phase II effort will expand upon the Phase I work and undertake additional exchanges in the bridge life cycle beyond the design-to-construction data exchange. Prioritization of the next data exchanges is currently underway (as of summer 2024), and data exchanges of high interest include those related to fabrication (such as fabrication of precast concrete components) and as-built information. In general, each data exchange requires its own unique IDM, IDS, and data dictionary content—collectively referred to as a set of technical solutions.

At the end of this process, software will include a standard export, similar to the way that a two-dimensional document can be exported to a PDF. This export will allow each stakeholder to work in its chosen BIM program but still efficiently share the same data. It will set the stage for more automation during construction and fabrication, and open the door to better asset management.

Successful completion of a project of this complexity requires industry-leading expertise in bridge design as well as extensive knowledge of construction, fabrication, asset management, IFC development, and technology deployment. A team of experts from HDR and its partners is working closely with the pooled-fund sponsors to navigate the complex journey of creating these national standards. Standards established through this effort will transform how bridge designs are developed and managed for decades to come.

Another critical success factor is building consensus for adopting BIM and U.S. data standards. This effort requires collaboration with many stakeholders, including transportation agencies, bridge owners, contractors, fabricators, and consultants. An industry advisory group is being established under the Phase II pooled fund to provide a mechanism for getting critical technical input from key stakeholders, especially those that are most relevant to the selected data exchanges that will be developed. Concrete bridge industry groups are targeted to participate in the industry advisory group, and such organizations are also eligible to formally join the pooled fund as funding partners. Close coordination with technology providers is ongoing to ensure that they can and will include the standards in future versions of their software products and meet the needs of the various stakeholders in the U.S. bridge industry.

The technical solutions developed under the first BIM for Bridges and Structures[2] pooled fund are being deployed and piloted by some state transportation agencies. For example, Iowa Department of Transportation and Pennsylvania Department of Transportation are carrying out proof-of-concept type pilot projects with support from the Federal Highway Administration's Advanced Digital Construction Management Systems grant program. Much like bridge design specifications, software applications are continually updated. Technical solutions that enable IFC-based data exchanges will continue to improve and to be enhanced after they are put to use and adopted nationally.

To learn more about the BIM for Bridges and Structures pooled fund initiative or to become a funding partner, visit https://www.bimforbridgesus.com/ or https://pooledfund.org/Details/Study/755.

References

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