PERSPECTIVE

Open BIM Standards: A Key to Digital Delivery for Bridge Design

Open BIM standards for bridges are a foundational shift toward transparent and efficient digital project delivery.

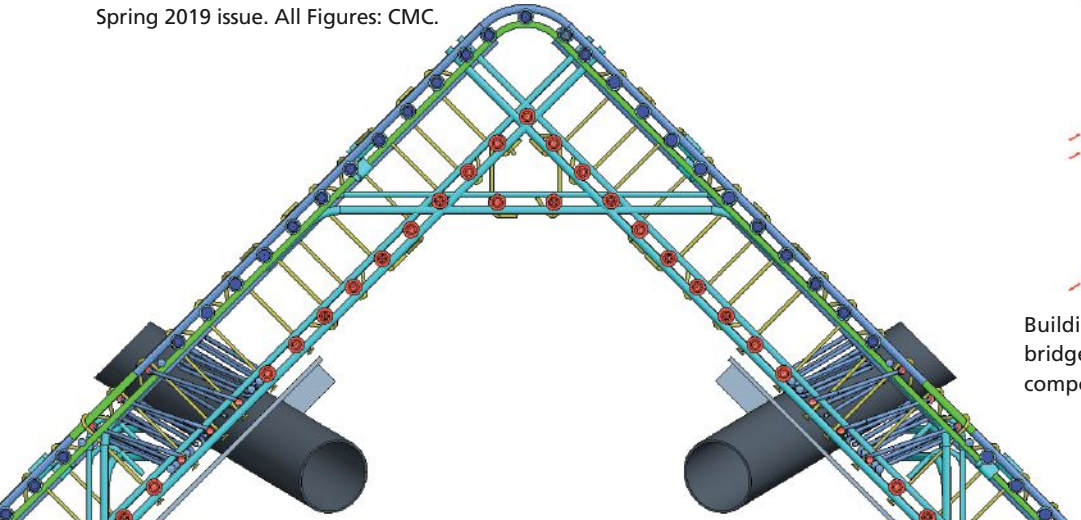
by Gregory Clauson, Concrete Reinforcing Steel Institute

Building information modeling (BIM) for bridges is reaching a pivotal moment. A pilot project in Pennsylvania is demonstrating that BIM models are no longer just references; they can also be contractual documents. This transformation is driven by open standards and promises to reshape the way that contractors, engineers, transportation agency officials, fabricators, and owners approach bridge delivery.

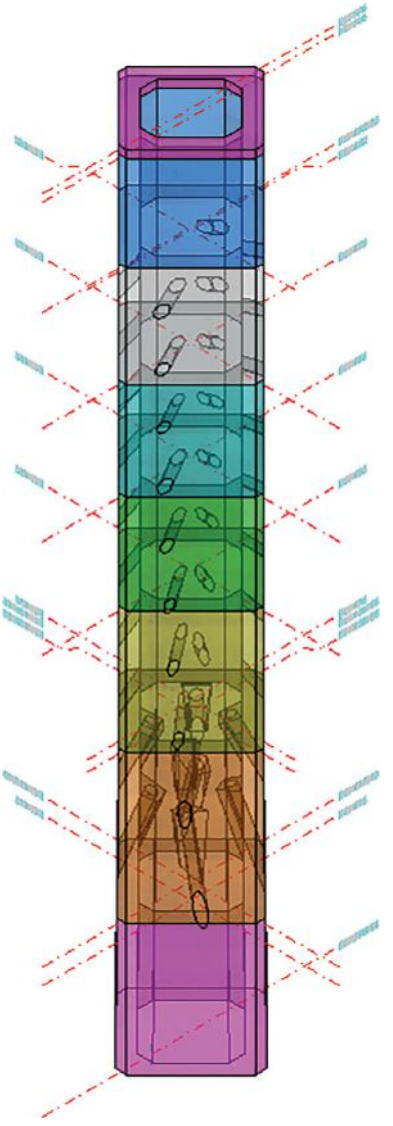
Open BIM Standards in Action: The Pennsylvania Department of Transportation Pilot

The Pennsylvania Department of Transportation's (PennDOT's) U.S. Route 6 (U.S. 6) French Creek Parkway Bridge #3 project made history by including an Industry Foundation Classes (IFC) model of reinforcing bar as a legal contract deliverable. This bridge replacement project is notable because a three-dimensional (3-D) model, and not just two-dimensional (2-D) drawings, is a contractual requirement. IFC is an open, standardized BIM format that ensures compatibility across all software platforms.[1] This shift to BIM allows project participants to use the tools they prefer while maintaining consistent, transparent, and accessible data.

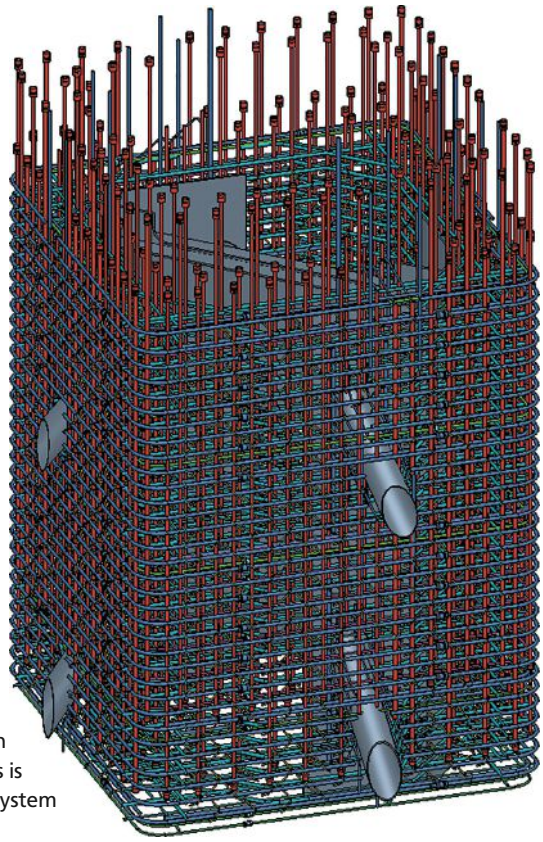
Of interest to the Concrete Reinforcing Steel Institute is that the project's BIM model incorporates not only the 3-D geometry of the reinforcement but also metadata such as reinforcing bar sizes, grades, spatial relationships, material properties, and pay-item information. This comprehensive dataset empowers contractors to automate material takeoffs, generate reinforcing bar lists, and perform accurate planning.



Corner detail of the Long Beach International Gateway–Gerald Desmond Bridge project is generated by building information modeling for bridges. The Gerald Desmond Bridge is discussed in the Spring 2021 issue of *ASPIRE*® and is the subject of a Project article in the Spring 2019 issue. All Figures: CMC.



Building information modeling for bridges can be used for assembly of components during construction.



Building information modeling for bridges is used to show cable system interaction.

Fabricators benefit from seamless translation of BIM model data into shop production, and field teams can integrate BIM models with digital layout tools.

While 2-D plan sheets are part of the project deliverables, the reinforcing bar detailing, coordination, and related communication in this pilot project are all entirely model based. This arrangement is a leap toward a digital-first future that reduces interpretation errors, shortens shop drawing cycles, and enhances project coordination.

Why Open BIM Standards Matter

The strategic use of open BIM standards in bridge projects ensures interoperability across all phases of a project. When models are shared using IFC, the same dataset can move into detailing platforms, cost estimation software, scheduling tools, robotic layout systems, and facility management platforms with far less information degradation than traditional file-conversion workflows. In practice, "translation loss" happens when BIM model geometry and metadata (objects, properties, classifications, and IDs) must be remapped during repeated exports and imports between platforms or proprietary formats, which can cause data to be dropped, simplified, or reinterpreted. IFC reduces that risk by providing a consistent, standardized structure for exchanging model content.

The use of open BIM standards enables automation at every stage of the project, from estimating and procurement to fabrication and field installation. It also reduces the risk of a phenomenon known as vendor lock-in, where it is difficult and expensive to switch from one software vendor to another. Furthermore, the use of open standards allows small and midsize firms to participate in digital delivery without the burden of purchasing proprietary software.

From a life-cycle perspective, IFC models serve as enduring digital assets. Bridges often exceed a 75-year lifespan, and their data must remain accessible and usable across decades of inspections, maintenance, and retrofits. An open-standard model assists in ensuring that asset information remains transferable and reliable across different systems and owners.

Policy Momentum: AASHTO and Federal Support

This shift in delivery methods aligns with national and federal policy movements. In 2019, the American Association of State Highway and Transportation Officials (AASHTO) adopted Administrative Resolution AR-1-19,[2] designating IFC as the national standard for exchanging electronic engineering data. AASHTO also established the Joint Subcommittee on Data Standardization (J-STAN) to coordinate BIM-related activities across all state transportation agencies.

Meanwhile, the Federal Highway Administration launched the Accelerated Implementation and Deployment of Advanced Digital Construction Management Systems (ADCMS) initiative. With $100 million in funding through the Infrastructure Investment and Jobs Act, ADCMS supports states adopting digital tools such as BIM. PennDOT's pilot project is part of this program.

Preparing for the Shift

The following are five actionable steps that stakeholders can take now to prepare for the digital future of bridge delivery:

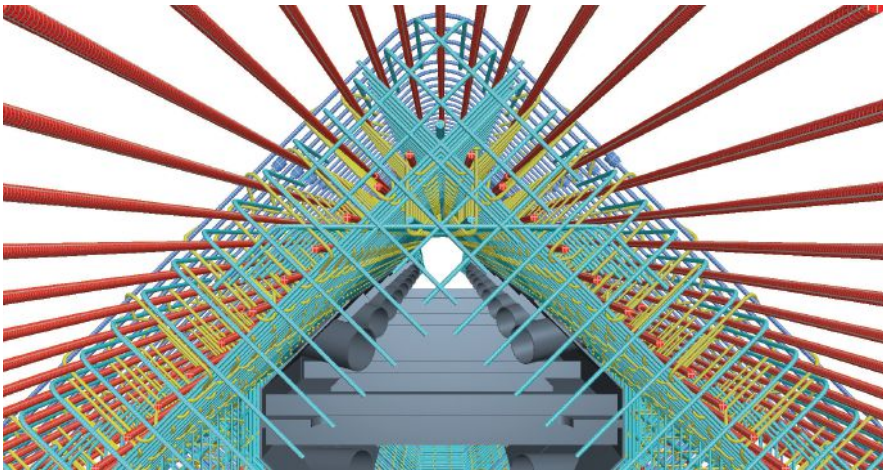
Adopt Industry Foundation Classes (IFC)–compatible tools: Evaluate software tools for compliance with IFC standards. Upgrade or integrate solutions that support open data exchange.

Participate in standards development: Engage with the American Concrete Institute, Concrete Reinforcing Steel Institute, Precast/Prestressed Concrete Institute, Post-Tensioning Institute, and National Concrete Bridge Council to influence emerging model content standards and implementation guides.

Collaborate early: Clarify expectations around model use, level of detail, and responsibilities at project kickoff. Effective collaboration facilitates smooth workflows and reduces downstream rework.

Monitor incentives and pilots: Keep track of Advanced Digital Construction Management Systems funding and agency-led pilot opportunities. Demonstrate your firm's readiness to participate in digital delivery projects.

Update contracts and training: Work with legal advisors to develop model-based contract templates. Train staff in digital modeling workflows, collaboration practices, and quality control.



This image produced by building information modeling for bridges shows the interaction of components in the Long Beach International Gateway–Gerald Desmond Bridge.

As more agencies pursue ADCMS grants, experience with digital delivery will become a competitive advantage. Contractors and suppliers that demonstrate proficiency in model-based delivery may be eligible for incentives, bonuses, or even preference in bidding.

Industry organizations such as the Association of General Contractors of America, American Council of Engineering Companies, and American Road and Transportation Builders Association have publicly endorsed digital delivery. This unified front suggests that model-as-legal-document practices will become increasingly common in public infrastructure contracts.

Stakeholder Benefits Across the Board

The application of open BIM standards in bridge delivery provides advantages for all stakeholders:

- Designers and engineers benefit because detailed models improve clarity of design, reduce the number of requests for information, and speed up the review process. Conflict (clash) detection and quantity verification can be automated directly from the model early in design, reducing rework before 2-D sheets are generated or finalized.
- Contractors benefit because model-based estimating, scheduling, and site layout tools simplify planning and execution. Enhanced accuracy in takeoffs helps reduce risk and increases competitiveness.
- Fabricators benefit because reinforcing bar detailers and precast concrete producers can extract fabrication data directly from the design model, ensuring that their products align with project requirements. Automated fabrication equipment can be driven from digital inputs, improving consistency and quality.
- Owners and transportation agencies benefit because accurate, comprehensive as-built models support asset management and long-term maintenance. Open standards also help protect data integrity throughout the life of the structure.
- Legal and procurement teams benefit because contracts tied to BIM models require clear definitions of scope, liability, and model ownership. While these requirements present new challenges, they ultimately enhance transparency and dispute resolution.

Embracing the Future of Bridge Construction

U.S. 6 French Creek Parkway Bridge #3 is more than a pilot project. It's a signal that the transformation to digital delivery in bridge construction is accelerating. Open BIM standards, supported by policy and funding, are redefining what it means to collaborate on infrastructure.

By investing in open standards, participating in development efforts, and preparing internal systems and teams, stakeholders across the bridge industry—from reinforcing steel fabricators to precast concrete producers—can ensure that they are ready to lead in this new era.

BIM based in open standards isn't just a technology; it's a strategic choice. Now is the time to build bridges that are not only strong and durable but also digitally connected for decades to come.

References

1. International Organization for Standardization (ISO). 2024. *Industry Foundation Classes (IFC) for Data Sharing in the Construction and Facility Management Industries—Part 1: Data Schema*. ISO 16739-1:2024. Geneva, Switzerland: ISO.
2. American Association of State Highway and Transportation Officials (AASHTO). 2019. *Adoption of Industry Foundation Classes (IFC) Schema as the Standard Data Schema for the Exchange of Electronic Engineering Data*. Administrative Resolution AR-1-19. Washington, DC: AASHTO. https://transportation.org/data/wp-content/uploads/sites/45/2023/12/AR-1-19-IFC-Schema-Resolution-Board-Adopted-FINAL.pdf.

EDITOR'S NOTE

Building information modeling (BIM) is transforming how bridge engineers design, deliver, and manage infrastructure, and this issue of* ASPIRE *offers two perspectives that together illuminate both the conceptual foundation and the legal contract deliverable.

The Perspective article by Richard Brice on page 11 provides essential context for readers who are still defining what BIM means for their practices. His article situates bridge BIM within the full asset life cycle—from design and construction through decades of operations and maintenance—and introduces the standards frameworks and national roadmap shaping how transportation agencies are approaching this transformation.

This Perspective article provides a real-world example to putting BIM into practice: a transportation project that incorporates BIM model as a legal contract deliverable. It examines what open BIM standards mean in practice for designers, contractors, fabricators, and owners, and offers concrete steps for stakeholders preparing to compete in an increasingly digital delivery environment.