

Intelligent data for efficient design and construction

Assessing the future value and current limitations of bridge information modeling (BrIM) programs

By Jerry Pfuntner, P.E.

Bridge information modeling (BrIM) represents a major leap forward for the bridge design and construction industry. Like its close cousin, building information modeling (BIM), BrIM synthesizes and infuses 2D and 3D CAD drawings with “intelligent” data that allows designers, contractors, and owners to access and manipulate a structure’s components more quickly and efficiently through all phases of the bridge’s life cycle.

Information modeling systems for civil engineering projects, including bridges, have lagged those of the building trades. However, BrIM is rapidly developing and catching up to its predecessors, offering vast promise for the future.

Currently, Finley Engineering Group is using Bentley Systems’ BrIM solutions on several complex bridge projects. The primary benefit at this stage is its ability to integrate design and CAD programs being utilized on a project as a way to share common project information, such as bridge geometry and post-tensioning layouts, while often enhancing this collective data as engineers and technicians progress through the design and plans production processes. In other words, as with BIM, if you act upon one data point, the BrIM model reflects the effect of that action upon all other data points.

Bentley’s BrIM works in varying degrees with many of the company’s CAD and bridge project design and management programs, including highway design, geotechnical data management/reporting, rebar detailing, plans production, and project data management.

This coordination among programs,



A rendered image shows the planned Palmetto Section 5 interchange.

combined with the added value of synergistic and reusable information embedded within the BrIM programs, helps rectify many of the inefficiencies that previously existed in the bridge design and drawing production process.

Nonetheless, current BrIM programs have limitations. In particular, as is the case with BIM, BrIM programs have yet to solve completely the issue of interoperability. While many of the software programs being used on bridge projects are able to communicate with each other within the BrIM framework, others still cannot. This is particularly true for programs outside one technology provider’s family of products (for example, Autodesk programs not cooperating with Bentley programs). Software companies are working together to create a common standard, but until this interoperability problem is resolved, project teams will not be able to tap into the full value of BrIM.

Despite these limitations, Finley and its project team members have realized significant benefits from using BrIM on its projects.

One project for which the Finley team is successfully using BrIM is Palmetto Section 5 in Miami-Dade County, Fla. This \$558 million design-build-finance project involves construction of an interchange between

state route (SR) 826 and SR 836 (two limited-access facilities) and reconstruction of the SR 826 at Flagler Street and SR 836 at NW 72nd Avenue interchanges. It is the state’s largest project funded through the American Recovery and Reinvestment Act of 2009.

Total capacity improvements include reconstruction and widening along both SR 826 and SR 836 and construction of 46 bridges. The project will provide new direct-connector ramps for major improvements and collector-distributor ramps to eliminate existing geometric and operational deficiencies.

Finley is designing and providing construction engineering on four high-level segmental bridge ramps (Bridge Nos. 9, 11, 15, and 19) that travel the core of the interchange.

The segmental bridge ramps will be precast, balanced cantilever and erected with a launching gantry. The 47-foot-wide bridge lengths vary from 1,100 feet to 2,450 feet with a maximum span length of 266 feet. The curved segmental bridge ramps are the third level of the interchange, with radii as short as 590 feet, and have a proposed maximum superstructure deck height of 95 feet above ground. All of the bridges are supported on 24-inch pile foundations and reinforced concrete piers and caps.

The design offered unique challenges integrating underlying roadways, canals, and traffic maintenance requirements into the layout of these segmental bridge ramps.

The design team used Bentley’s RM V8i program (RM Bridge) to generate segment and tendon geometries. When incorporated into other BrIM solutions, the additional functionality allowed for easier and more efficient

checking of web intersection conflicts with the internal tendons, sizing of diabolos, checking of tendon stressing jack conflicts, and routing of internal tendon ducts. For example, the BrIM functionality provides the project team with a tool it can use to more easily and efficiently ensure that there is sufficient clearance to the webs within each section (see Figure 1).

Prior to the BrIM initiative, the team would have had to draw the critical sections of the bridge in 3D and check each of these drawings for conflicts. If conflicts were found, the drawing would be returned to the engineer to redo the geometry and rerun the design. Then the drawing would need to be checked again.

The use of this powerful BrIM feature allowed the tendon geometry for four segmental bridges to be evaluated

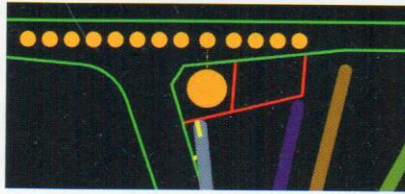


Figure 1: Microstation drawing of a bridge section at minimum web clearance.

within weeks, and the segment dimensions for the project were able to be established early in the design stages, saving valuable time on this design-build project. Thus, the use of BrIM technology offers bridge design and construction professionals dramatic efficiency improvements in this area and many others.

As BrIM's capabilities advance, its value as a process improvement tool will grow. "The cornerstone of BrIM

is data reuse, with an emphasis on purpose-ready information delivery," according to Bentley. "With more flexible access to information about the bridge, organizations can begin to optimize business processes that cross the bridge life cycle."

Because the technology is relatively new, the post-construction value of BrIM to the bridge industry remains to be determined. However, as with BIM, the potential exists for BrIM models to help bridge owners/operators, maintenance crews, and inspectors significantly increase operational efficiency and safety. ▼

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