Once construction starts, changes happen to every bridge project. As-built digital models capture critical information needed for management in the weeks, months and years after construction.

INNOVATION SOLUTIONS

Rolling "as-built" data into three-dimensional building information models

lowa DOT leads the nation in using three-dimensional building information modeling (BIM) to design and manage the state's bridges and structures. When these models are built, however, unplanned changes often occur with the building, materials, or site conditions, which must be documented as "as-built" information. After the agency completed a bridge in the I-380/I-80 interchange, a design model provided the opportunity to develop an as-built model, with a record of the modifications that were made to assist bridge managers going forward. A software issues and needs assessment will also help the agency achieve its vision for digital delivery.

THE NEED

Designing and maintaining a bridge is a complex process that includes numerous considerations such as load requirements, topography, and environmental factors. Iowa DOT was one of the first transportation agencies in the nation to use three-dimensional virtual models for designing bridges. The agency also leads a national pooled fund study that helps states work together to advance BIM-related research and implementation.

Recently, Iowa DOT used BIM software to build a three-span, steelplate bridge as part of its I-380/I-80 interchange reconstruction effort. As often happens during construction, changes made during the building process resulted in a completed structure that's different from its original design. By creating a new virtual model of the bridge in its final form, Iowa DOT saw an opportunity to compare the BIM and as-built models and better understand the possibilities and limitations of the modeling software. Capturing



(continued)



"Bridge designs normally undergo changes during construction, and data documenting the changes can be hard to access. Now we have a method to gather all the as-built information in a central location, which will be very helpful for inspecting and managing the bridge in the future."

- JAMES HAUBER,

Iowa DOT Chief Structural Engineer

construction modifications and incorporating other relevant data would also greatly enhance ongoing bridge management and future maintenance.

PROJECT APPROACH

To update the model with as-built data and other information relevant to ongoing asset management, the project team first ensured the electronic file format could be modified and would be compatible with Iowa DOT's asset management system.

The proprietary software that was used to create the original BIM model has since been updated and no longer works with newer versions. Investigators used the older version of the software to add the as-built information, drawing from data provided by lowa DOT, construction contractors, and users of traditional two-dimensional as-built plans such as inspectors and maintenance managers.

After incorporating the as-built information, attachments, and links to other data sources into the BIM model, the team republished the files to the current software format.

WHAT IOWA LEARNED

The updated model captures information on the bridge as it was built. Recorded changes from the original design that occurred during construction included:

- Revised footing and pedestal elevations.
- Increased reinforcement between the girder and roadway slab.
- Updated the geometry of disc bearings, which carry any bridge movement load.
- Added survey pin locations and anchor bolt wells.

Additionally, links to construction information such as photos, materials certifications, and shop drawings provided additional value to the model.

Lastly, an exploration of non-proprietary open-file formats revealed a promising future option to convert and export older BIM models into a format that could be read by other modeling software. While not yet a viable option, transitioning to this format eventually could ensure a model will remain accessible to other modeling software and compatible with current or future asset management systems.

PUTTING IT TO WORK

Building information models are a crucial component of Iowa DOT's digital delivery vision, as these can help facilitate construction, support maintenance activities, and coordinate asset management. Integrating database systems across the agency will ultimately result in "smart" models, creating workflow efficiencies and wide information accessibility for bureaus, managers, and contractors. This research project will help make these outcomes possible.

The agency is developing a digital delivery roadmap for future BIM efforts. As further software advancements are made, and as the non-proprietary file format is refined, more desired uses of the model may be possible.

ABOUT THIS PROJECT

PROJECT NAME: Development of Digital As-Built Model for I-80/I-380 Design 420 BIM Technical Brief

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