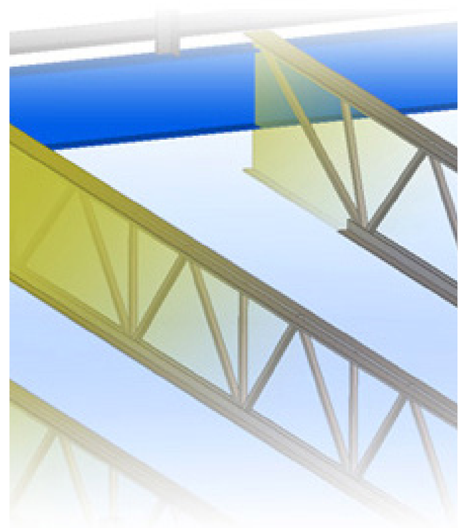
NEW MILLENNIUM
BUILDING SYSTEMS
**Building a better steel experience.**

CASE STUDY #7

# Adopting Digital Design at the Supplier End

While much has been published in support of the top-down merits of building information modeling (BIM), the lack of digital design adoption at the supplier end will remain an impediment to the approach. The digital capability investments made by others to participate in the digital planning process may be underutilized and go unrewarded, and the full value of a totally digital design may not be achievable, so long as key supplier disciplines are absent from the process.

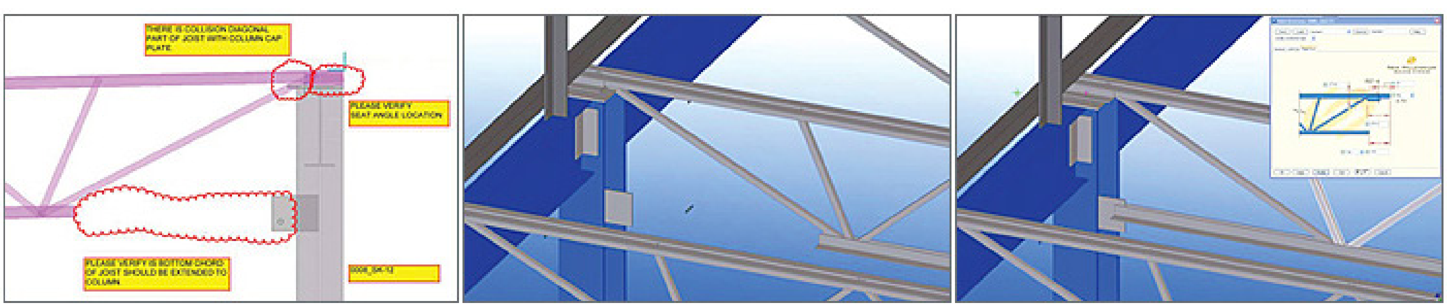


Until now, steel joist and metal decking supply has been one of the core disciplines yet to participate in BIM-based digital plan development. In April at the NASCC steel conference in Orlando, Fla., New Millennium Building Systems announced the company's completion of a two-year process of BIM evaluation, software development, testing, and real-world digital project deployment.

## Getting digital joists off the ground

A holdup for the inclusion of steel joists within the digital BIM movement has been the need for joist software that interfaces with leading digital structural steel software.

The steel joist has been the missing link in the use of BIM for structural design and detailing applications. Until now, the objects that represent steel joists in the building model have been modified beam shapes or non-representative trusses that are difficult to model and have few joist similarities. Development of a steel joist digital design component gives architects, engineers, and fabricators the ability to produce a joist object that can be used for estimating, detailing, design, and fabrication.




These images depict error detection in the digital realm: A question regarding apparent missing joist information is shown (left), the area was located in the model (middle), and determined that the section information for that joist was incorrect. The problem was quickly and easily corrected and visually confirmed (right).

## Going to school on steel joist design

Possibly the first example of a digital steel joist design in the United States, the Joint School of Nanoscience and Nanoengineering project in Greensboro, N.C., provides an early validation of the BIM approach for commercial steel construction.

"BIM was a requirement set down by the owner and architect for this school project," said Ed Jumper, steel detailing project manager at Prodraft, the structural steel detailing firm on the project.

According to Jumper, Prodraft was called in by the steel fabricator, Lyndon Steel Company, in part because Prodraft had been providing BIM-based digital design for many years. However, Jumper said that the requirement for specific digital steel joist design, requested more and more frequently, has presented a new challenge, since Prodraft had yet to come across a means for efficiently integrating a digital steel joist design.

"Until recently we had not encountered too many general contractors requiring the model to accurately depict the specific joist properties for BIM purposes," Jumper explained. "Typically, in our model we show generic forms of joists to indicate they are there, but on this project they wanted a more clear representation of what will actually be built in terms of joist members."

Jumper said the digital joist design solution became apparent when he learned that New Millennium had been chosen by the fabricator to provide the steel joists for the project. "We work with a Tekla structural steel component," Jumper noted. "And it turns out New Millennium had developed a steel joist component as a Tekla add-on."

## Fabricating higher expectations

According to Shaun Plybon, P.E., engineering manager at Lyndon Steel, the use of digital planning with the inclusion of steel bar joists was also a first for this steel fabricator, but the process has already demonstrated a range of clash prevention for the project.

"The information from the joist manufacturer was electronic, and that was innovative, it's never been done before," Plybon said. "But this project pushes BIM across several disciplines. Even the rebar in the concrete was digitally planned and they have caught some foundation issues where anchor bolts and rebar were colliding. Had this gone into construction, there could have been a cost impact, including project delay. So the process is working. Everyone is going through a learning curve, but we can see that it's preventing added costs."

Plybon said the benefactor and driving force for the BIM-based project is the general contractor, who has fewer headaches to deal with. However, everyone involved stands to benefit by the more collaborative approach.

"We want to be that type of fabricator that takes care of the customer," Plybon asserted. "So we're glad that Prodraft and New Millennium are staying up on this technology, taking some risk to be involved. At the end of the day, it benefits the general contractor. More contractors are going to ask for digital planning and that's why it's smart for us to be ready, moving forward."

## Seeing the devil in the details

As though to illustrate a key advantage of BIM-based design, the collaboration between the structural steel engineering and steel joist participants during the joist design phase prevented a costly oversight on the project.

Having imported the joist requirements into its design component, the joist manufacturer e-mailed the file back to the steel detailer for approval. Upon review the next day, the steel detailer replied with a question regarding one of the joists in the model, pointing out a possible problem with the bearing and a missing bottom chord extension. By simply locating the joist in the digital model, the joist manufacturer could immediately see a dimensional discrepancy and make the adjustment within seconds.

In this case, participants were collaboratively able to quickly see and fix a problem that may likely have been missed in a traditional 2D plan review. The numerical discrepancy found was in regard to a joist that had different dimensions at its ends, but should have been the same. The correct information was entered into the digital plan and with a click the fix was made. The updated model was e-mailed back to the steel detailer. In retrospect, the wrong joist dimension would probably not have been detected, following the traditional 2D drawing review process.

Jumper agreed that had it not been for the digital plan review, the project would have experienced disruption and cost consequences.

"For this specific instance, the joist chord member actually interfered with the cap plates on the columns," Jumper said. "You're probably talking thousands of dollars for field labor and field fixes for what is one of the more costly phases on a project."

### Opening up the digital future

There is an industry-wide endeavor to apply technology in service of a simplified, accurate, and productive process. It is every proactive supplier's goal to reduce costs to the project by way of a more efficient and thorough planning process. Typically, suppliers are not paid until they produce, and by introducing compatible digital design tools, we can collectively bring new value to a project by accelerating timelines and reducing costs for everyone involved.

## Three phases of digital plan review

New Millennium's new digital steel joist design component contains configurations, specifications, material, and design requirements that can be used from the planning room to the job site. The software gives the user the ability to cut a joist schedule by significantly reducing the time it takes to coordinate the information the joist supplier needs for fabrication. A digital steel joist design component was developed to support three phases of project flow for joist design.

**First phase** – A "generic" joist object gives the user the ability to model joists in a digital building model for required length, joist specifications, and load requirements. Generic joist configurations are based on manufacturer standards and material sizes are representative, not actual. All generic joist objects can be identified, quantified, and used as the "project joist profile" for budgeting and pricing.

**Second phase** – The generic joists information is used within New Millennium's detailing and design process. The information can be exported and converted into a bill of materials (BOM) used in the design of a "prefabricated" joist object. The prefabricated joist object can be imported back into the model for review and coordination. This can be done at different stages of the project or as building changes dictate. If the user prefers to work with 2D drawings, the information contained in the digital joist detailing system can be exported; joist objects can be designed and imported into the 3D building model.

**Third phase** – The plan provides the "as-built" actual joist configurations, end conditions, and member sizes. Once the building is finalized and joists are released for fabrication, any "as-built" joist object can be imported back into the "construction model" and used as the final fabricated joist component. Currently, the joist component is only available as a Tekla add-on. Add-ons for other BIM platforms are expected to soon follow.

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