

# Model Exchange and Review – Live

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## A practical approach to complete integrated project development.

**BIM AND IPD** should no longer be “buzzwords.” The technology, education and worker skill sets are present for both building information modeling and integrated project delivery. The question is how should we use these systems in a practical application? First off, we know that steel structures are the ideal material for model exchange and ultimately IPD projects.

There are many answers and approaches related to “how do we...” A proven practical approach is to start with understanding your firm’s analytical and BIM documentation tools and their respective limitations. Do not allow yourself to hit a ceiling due to a perceived limitation; rather, develop a work around and embrace the opportunity.

There are many combinations of tools and programs that engineers throughout the country use with various levels of success. Many programs have external tools to allow the two platforms to transfer information. Our focus on these engineering tools will be limited to Revit Structure and Bentley RAM.

The key to the success of any integration process is understanding what the programs are capable of doing. To start, our system relies on the KISS method—Keep It Simple Silly.

Start with a Revit file with a linked architectural model. Then copy/monitor the grids and levels. Our next steps have been tested, and proved to be time-efficient. There are other approaches; however, this matches our comfort level for both accuracy and time management.

Export the file to Bentley’s RAM Structural System. The RAM model is populated with only levels and grids. The immediate benefit is that the columns will be locked into the same position in both programs, minimizing errors related to rounding tolerances. Now we are off to build the analytical model.

Model the columns and beams. Insert slab edges and design loads. Input all design criteria into the analytical model. Basically use the analytical model as you historically have. Run your analysis; design all of your beams and columns.

Now we are ready to transfer the information into Revit. After importing the analytical model information, quickly glance at the information to verify the reactions, camber and sizes have come across. Your framing plans and columns are now in place.

The next steps are the time-savers and efficiencies. Use the beam annotation tool to populate the beam sizes, reactions and cambers. Your framing plans are now pretty much set.

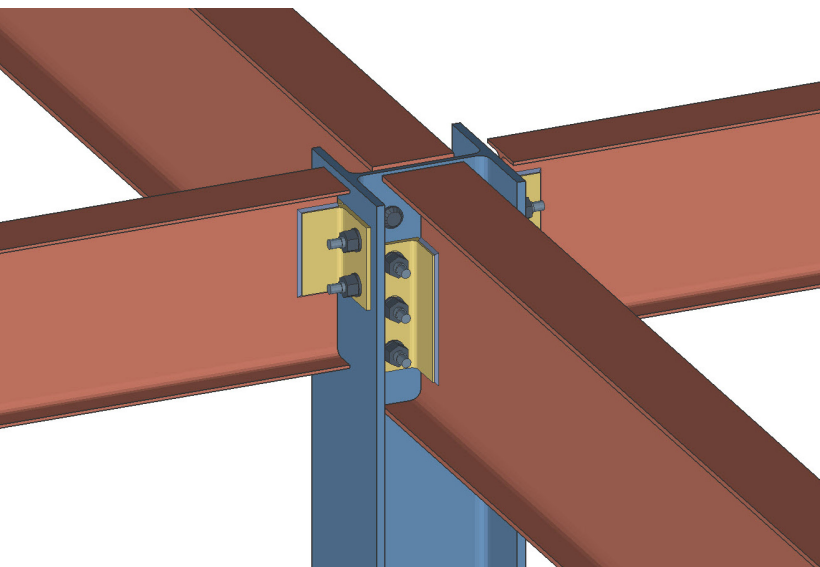
There is a need for a “clean up” process. Manually input additional framing information for foundations, moment frames, collectors, drags and braces as required. Adjust column heights for sloping roofs, splice locations and base plates. At this time, update the model for all structural elements that were not modeled analytically.

Typically we do not model structural loads in Revit. Rather, we input structural loading criteria only into RAM. This eliminates redundancy, and the industry standard today has only the engineer using the information.

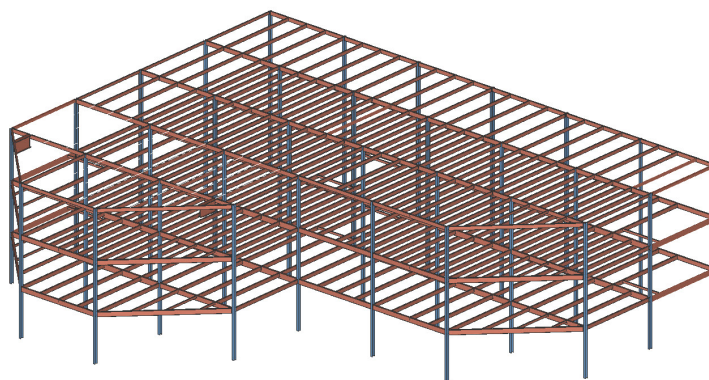
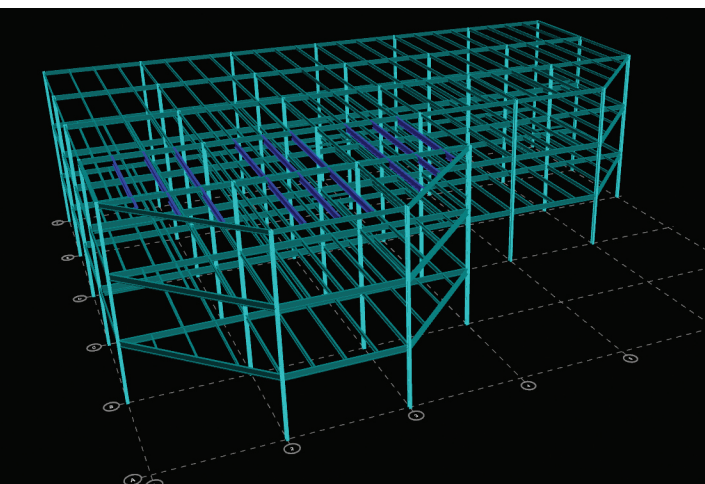
On a typical three-story, 100,000-sq.-ft building, we will spend less than a half day going from the analytical model to fully populated framing plans. Place a few BIM-generated schedules on the plans, and you have a great start to a complete set of documents.

A quick side note: Our template houses hundreds of standard details, legends, symbols, and sheet notes. This type of information does not affect the interoperable communication between the BIM and analytical programs. Coupling the template base and with the bidirectional linking, our documents are well defined compared to the time invested.

One common question is, “What is your quality control process for the electronic information transfer?” My answer is simple: It is the same as before, when you had an engineer and a drafter. The engineer will use a highlighter to back check and review the drawings between the final documents and the engineer design. The process is much more efficient than the traditional red mark days. We also can eliminate the human error—no more 23 kips instead of 32 kips.



▲ Importing the engineer’s CIS/2-compliant model into its structural steel detailing program, the fabricator adds the connections.



◀ ▲ Grids and levels from the Revit file and linked architectural model, left, are exported as the basis for the structural analytical model, above, locking in the column locations.

Now it is time to share the model with the steel fabricator. Communication is key during the model exchange. When transferring models, the EOR must communicate any known inaccuracies (edge of slabs, beam locations at rooftop equipment, sloping or curved members to name a few). Modeling issues will exist, but as long as the issues are open and disclosed everyone can address them and move forward. The situation can be complicated by mill order projects versus core and shell projects versus design-bid build projects. But for all, communication is key to project success.

### The Fabricators Turn

There are many reasons receiving a model from the engineer is beneficial to the fabricator and to the project as a whole. Being able to place a timely mill order and staying consistent with the contract drawings are at the top of the list.

Once we receive the model from the engineer we open the RAM model with Bentley RAM and export a CIS/2-compliant model highlighting the information we require to be brought over, including loads and column splice locations. We then import this CIS/2 model using the "Design Link" module in SDS/2, our structural steel detailing software. Once imported, we can process the job and review it against the contract documents and any of the known inaccuracies provided to us by the EOR. After this process, which typically takes less than a day, we have SDS/2 create an advance bill of material for purchasing which generally includes all wide-flange, channel and HSS beams, columns and braces.

At this point we are able to hit the ground running with beginning our 3D modeling. Because SDS/2 has extensive connection design capabilities, we typically expect upwards of 80% of the connections to be designed by the software with calculations provided at the click of a mouse. We then review the connections not designed by the soft-

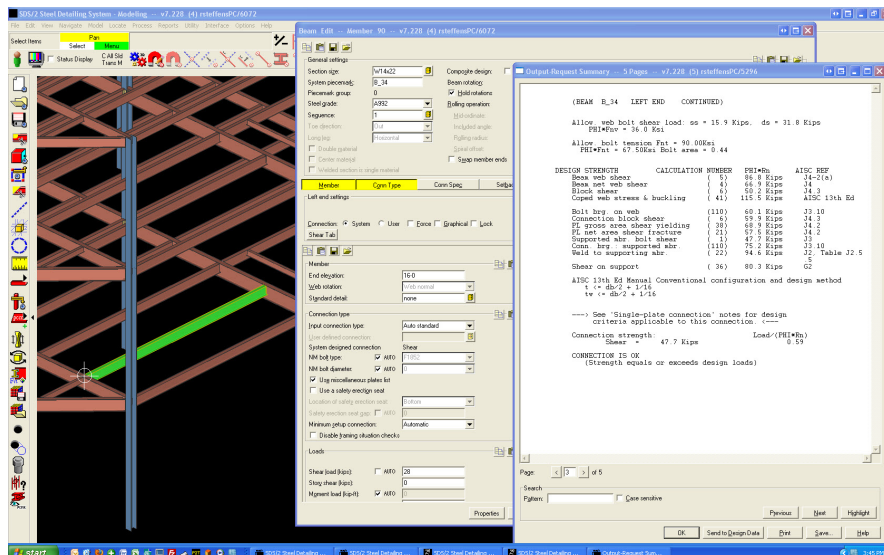
ware and have our detailers put together connections and calculations with assistance from our in-house engineer. At the same time, detailers begin further 3D modeling of such items as pour stop, embedded items, fascia items and other miscellaneous framing. In keeping with the BIM structure, everything is kept current and up-to-date in the model.

During this process we can expect numerous changes and additional information to be provided. In breaking from the typical process of receiving bulletins every few weeks, the lines of communication are open and there is coordination taking place virtually every day between the EOR and the fabricator. The information exchanged is always shared with the contractor to keep them in the loop with any and all changes and updates. Keeping these lines of communication open between all parties in this manner can save considerable time and money for all involved, including the owner, because changes and updates can be implemented on the fly and typically are made before fabrication of the affected members.

Once significant progress is made in the model we start putting together 2D details for review. Detail sheets are then created and the corresponding members have their status updated in the 3D model for approval. The status options used for approval allow both the fabricator and engineer to have a visual aide as to what is being sent for approval and what has been reviewed. There are many other statuses we as a fabricator use that the engineer can also make use of, such as pieces released for fabrication, pieces held, and galvanized pieces. This allows the engineer to obtain valuable information from within the model.

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➤ A portion of the connection design calculation generated from SDS/2, showing the results of each of the limit states checked and confirming the end connection meets or exceeds the required loading provided by the engineer.

The shop drawing models are reviewed graphically and by traditional piece mark. Additionally, the connection calculations are reviewed. Any comments are placed electronically in the model. Each piece mark is reviewed and approved (or not approved).

Along with the electronic model, the reviewed pieces are printed to a PDF and returned. Why a PDF, when we are talking about electronic model transfer? The owner needs a copy, the site needs a copy and not everyone will have the required software to review the information. Additionally, when we execute the project closeout documentation we ensure future access.

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*This article is the basis of a presentation the authors will make at NASCC: The Steel Conference, May 11-14 in Pittsburgh. Learn more about The Steel Conference at [www.aisc.org/nascc](http://www.aisc.org/nascc).*

Once the approval status has been set, the model is then zipped up and placed on an FTP site, along with a transmittal, for the engineer to review. The contractor is also notified of this submittal and provided the drawing transmittal. And as is the case with most BIM projects, we provide a model to the BIM coordinator in their format of choice for importing into their coordination/clash-detection software program.

Now for the last step in the final leg of the complete structural IPD process. We will receive and review the shop drawings electronically. To be clear, we are speaking of model review and not PDF review. Like our approach to the BIM design upfront, there are many software programs on the market, but we will focus our process on Design Data's SDS/2 Reviewer Station.