# Building Information Manufacturing: Optimizing Your Design with SDS/2 Connect

Michelle McCarthy, Design Data
Doug Evans, Design Data

**FB2172** With the adoption of Building Information Modeling (BIM), projects have benefited from model collaboration and improved communication. These intelligent models solve one problem by providing a conduit for earlier coordination, while fostering another, because the purpose of structural design and manufacturing models differ. The difference in the purpose behind each model—design versus manufacturing—can create limitations in how they can be used. The idea of Building Information Manufacturing (BIMfg) is to enhance the design-centric intelligent model with manufacturing information, improving structural design and benefiting structural manufacturing. We will demonstrate how the SDS/2 Connect Add-in for Autodesk® Revit® Structure software improves structural design by incorporating manufacturing considerations. In this class, you will discover how to approve and review connections inside the Revit Structure model in accordance with codes of standard practice. Finally, you will learn how manufacturing information, such as computer numerical control (CNC), robotics, and construction, impacts the project and how to optimize design.

## Learning Objectives

At the end of this class, you will be able to:

- Understand key principles of Building Information Manufacturing and its impact on BIMs

- Improve structural design by incorporating manufacturing considerations

- Analyze connection scenarios with SDS/2 Connect to improve design choices in the model

- See how other companies are implementing SDS/2 Connect into their Revit workflows

## About the Speaker

Michelle McCarthy is strategic sales manager for Design Data, developers of SDS/2 software solutions for fabrication, detailing and engineering. McCarthy presents and sells SDS/2 software products that provide 3D models with automatic detailing, engineering information, fabrication data and much more. Additionally, she has spoken at several national industry conferences and influenced the rebranding of SDS/2 and the addition of four new SDS/2 products. McCarthy earned a bachelor's degree from the University of Nebraska-Lincoln, and a masters in management from Doane College.

Doug Evans is vice president of sales for Design Data and has been with the company over 20 years. Throughout his two decades in the steel fabrication industry, Evans has been a part of many technology initiatives and panels. He was involved with the design and delivery of some of the first CNC interfaces between CAD systems and fabrication equipment in the early 1990s. Evans also has served on the Intergraph Structural Committee and continues to serve on many AISC advisory boards that are involved in maintaining industry file transfer standards and presenting industry awards. He has helped concept many products for Design Data over the years, with the latest being the rebranding efforts you see today from Design Data. Before joining Design Data, Evans spent five years as director of marketing for the Gallup organization. He has a bachelor of arts in business administration from Nebraska Wesleyan University, with a minor in computer science.

## Building Information Manufacturing and BIMs

With all the construction acronyms out there, why coin another term? Why Building Information Manufacturing? Mainly, we want to get your attention. As construction goes deeper into the world of Building Information Modeling (BIM), additional information in the model becomes necessary—manufacturing information in particular. Construction has seen its first wave of BIM projects through completion, and people have learned what works and what doesn't work. As a result, we've learned that basic model information is nice, but performances can be improved through the availability of more information in the model. Level of Detail (LOD) qualifications set out by the AIA are direct proof of this growing demand.

### What IS Building Information Manufacturing?

For our purposes, we'll define Building Information Manufacturing (BIMfg) as the BIM model that manufacturers *need*. It is a design-centric BIM model that can be accurate enough for downstream use, comply with certain manufacturing needs, consider constructability in the manufacturing process, and facilitate the downstream flow of information. We know, that's asking a lot! But as BIM continues to evolve to what proponents believe it can be, these things won't just be nice to have, they'll be requirements.

Some positive side effects of information existing that way in a BIM model is that structural design will be improved from a constructability standpoint, discarding of information will be reduced and LOD 300 and 400 classifications are easier to achieve.

### Design vs. Manufacturing

There is a natural conflict between design models and fabrication models, simply due to the intent of each type of model. Engineers build a model to analyze and create a structurally sound building while optimizing section size of the structural members. Manufacturing models focus on creating a model that represents the engineer's structure on a more detailed level to include information like plate, weld and bolt sizes for the purpose of fabricating these materials. Engineers focus on the overall structure, while manufacturers will focus on the minor details— this naturally creates a divergence in the level of detail in the models built by each discipline.

The biggest roadblock in the transition of a model from design to manufacturing is precision. For design models, a work point off by 1/2" can still produce accurate results, while a manufacturing model off by 1/2" can wreak havoc on a project.

A detailer using a BIM model from an engineer as the basis of their manufacturing model must be absolutely certain of its accuracy. Once an inaccuracy is found, it casts doubt on the whole model, and the amount of time spent verifying everything can take longer than it would to just re-input the model. A design model created with the intent (accuracy) to be used downstream by manufacturers can be worth much more than one that is input very quickly.

What we are learning through the BIM work process is that BIM construction is not a competition. It's a cooperative act, and in order to do it right, you need to do it together. Our goal is to help bring this divergence of information back together.

## Incorporating Manufacturing Considerations

Already many companies are beginning to build their Revit models with increased data for manufacturing and construction. This is evidenced by the proliferation of Revit add-ins available to improve workflow and data stored in the Revit BIM model. Take, for example, IDAT for precast concrete design, CSC Fastrak Building Designer for analysis, Get the Point for point cloud technology, and SDS/2 Connect for connection design. All these products in some way enhance the Revit model with an additional level of detail that improves the work process for various Revit users.

### Level of Development

Level of Development (LOD), also called Level of Detail, is a description of the steps through which a BIM element can logically progress, from the lowest level of conceptual approximation to the highest level of representational



precision. http://www.aia.org/groups/aia/documents/pdf/aiab078868.pdf
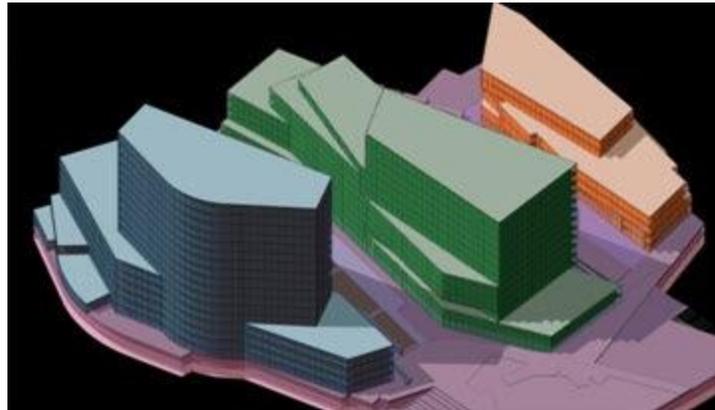
### *LOD 100*

LOD 100 is the basic visualization of a structure or model that's primary function is to provide information of overall mass of the building. Downstream users are authorized to perform whole building types of analysis (volume, building orientation, cost per square foot, etc.) Essentially, it is the model at its broadest level. Think of it as a representation of the space that the structure occupies. http://www.allthingsbim.com/2008/12/aia-bim-protocol-e202.html

### *LOD 200*

LOD 200 models consist of generalized systems or assemblies with approximate quantities, size, shape, locations and orientation. A model built with generic model elements like walls, windows, floors, etc. The LOD 200 model is more concerned with telling that an object is a wall, rather than what the wall is made from.  Think of this as the architect's model.

### *LOD 300*

In an LOD 300 model, the elements making it up are suitable for creating general arrangement or construction documents. At this level, the model is detailed enough to be analyzed for structural performance. Precise material information begins to be important now. Sizes,

materials, and shapes are scrutinized at this point to ensure that the makeup of the building have been chosen correctly. Consider this the engineer's model.

Some may consider shop drawing generation a part of LOD 300, and there is a movement to create an LOD 350 that is specific to shop drawing generation, as the shop drawings have an added level of accuracy over general arrangement drawings.

*LOD 400*
When a model reaches LOD 400, it is expected to contain information suitable for fabrication and assembly. This includes information such as shop drawings, assembly drawings, site layouts, etc. The models used to generate shop drawings contain information more fitting for LOD 400 than LOD 300 and lower. LOD 400 models are more likely to be generated by subcontractors, such as detailers and fabricators.

*LOD 500*
LOD 500 is the final level of development that represents the project as it has been constructed, also known as the as-built model. Containing information from duct locations down to equipment model numbers, this is ideal for maintenance and operations of the final structure.
http://www.allthingsbim.com/2008/12/aia-bim-protocol-e202.html

**Increasing LOD of Your Revit Model**
There are many ways to increase the LOD of your Revit model, depending on where your concerns lie. Revit users can invest the time to create and customize their own families to increase LOD, or they can take advantage of add-ins that are readily available to the market. It all depends on how much time the Revit user has to spend on customization versus building the models. There are so many disciplines in which users can increase LOD in the Revit model, it all depends on your discipline and the end information needed. Some existing add-ins that can help you increase the LOD on your next Revit model:

- IDAT for precast concrete design
- CSC Fastrak Building Designer for engineering analysis
- Get the Point for incorporating Total Station site layout information
- SDS/2 Connect for connection design and model transfers for fabrication

## Revit, SDS/2 Connect, and Building Information Manufacturing
The focus of this class is to educate attendees about increasing the model LOD in terms of structural steel and connection design, in turn driving your Revit model downstream to fabrication. This section will address how SDS/2 Connect fits in various workflows, teach users how to implement connection design in their Revit model and explain how the engineer's model may be transferred downstream for better BIM communication.

**How Does SDS/2 Connect Fit?**
In dealing with structural steel in Revit, engineers can utilize SDS/2 Connect to bridge the gaps between the designer's model and the manufacturer's model. There are a couple of ways that

SDS/2 Connect fits into the user's work flow, depending on the desired LOD. The two primary functions of SDS/2 Connect are model transfers and connection design. The level at which users utilize these functions depends on what's required for the project. In explaining the various options for implementing SDS/2 Connect on a project, the next few sections will transition from its simplest uses to the more complex uses of the add-in.

### One-Time Model Transfers
SDS/2 Connect includes the ability to import and export major structural members and their connection information between Autodesk Revit Structure and SDS/2 Detailing or SDS/2 Engineering. Since the two products are "speaking" directly through an API rather than a standard, more information can be retained in the  model, as opposed to transfers of standard files where nuances of the models might be lost because there is "no space" for the information to be stored. Through API development with Autodesk and SDS/2, the models transferred through this add-in will contain better information than a file-type standard like IFC or CIS/2.

As a one-time transfer of information, the model may only be 90% finished coming from the engineer, but it allows the detailer/fabricator to get a better start on the project. Often in these situations, the engineer has not used SDS/2 Connect for connection design at all, but solely as an export tool. Knowing this, the detailer will expect to get additional information, but time has already been saved from having to rebuild a model that already exists.

This is the simplest application of SDS/2 Connect that is currently being utilized by engineering firms such as Martin/Martin Consulting Engineers.

### Acquiring Design Calculations
The simplest application from a connection standpoint is using SDS/2 Connect to simply verify the strength of a connection. This is done by inputting the framing (columns, beams, etc.) that is to be checked, applying the desired connection and then running the report for the design calculations. SDS/2 Connect will "show its work" for the results of the design calculations. The calculations performed are code-based design calculations. Currently U.S. codes, Canadian codes and Australian codes are all supported.

Consider how long it might take to generate all the calculations if the engineer were to do this manually, and it is clear that the time savings here are great. Additionally, through the interface in Revit Structure, SDS/2 Connect provides visual feedback when connections are detected to have a constructibility issue, such as clashing, bolts or other materials.

### Creating Connection Sketches
Furthermore, once the engineer has evaluated and approved the connection's strength, connection sketches are quickly generated. Engineers who've compared the time it takes to manually input all the materials needed to create a sketch for a connection in Revit Structure with versus without SDS/2 Connect have seen a savings of 15 minutes per connection.

With SDS/2 Connect, the materials for the connection are automatically added, users can add desired notations and tagging has been enabled for bolts and connection materials. While welds are not present in the model and cannot be tagged, the information does exist and is editable by the engineer, if so desired.

Again, the previous two applications of SDS/2 Connect are the most simple aspects in terms of using SDS/2 Connect for connection design purposes.

*Connection Schedules*
Because of BIM, much information is now transferred through the models. Why, then, wouldn't the natural step be to include information like connection schedules with the BIM model?

Connection schedules are still generally handled in a traditional fashion: they are created by an engineer and delivered with the 2D general arrangement drawings that indicate typical connections to utilize on the project. SDS/2 Connect approaches connection schedules in a method that better fits with today's BIM project workflow. The detailers do not have to interpret the information and can immediately start, automatically including the engineer's schedule in the manufacturing model.

Through the setup options, engineers can simply set their schedule and export the model without connections. The detailer or fabricator can import that file into SDS/2 Detailing, at which point the file will insert the engineer's connection schedule into the detailing model's settings, automating the design of steel connections to meet the engineer's standards.

This is a higher-level concept for the use of SDS/2 Connect. However, since it only requires some modifications in setup, this is still relatively simple to accomplish with a one-time transfer of the model. Having the connection schedule embedded in the model is already used by detailers all the time, but instead of  importing this information directly, they have to look at general arrangement drawings and input this information to setup manually.

*Multiple Model Transfers*
Moving on to higher-level applications of SDS/2, multiple model transfers should be discussed next, as this will impact the next few items as well. It is not difficult to transfer models more than once between Revit Structure and SDS/2 Detailing in a process that would be considered round-tripping.

In a common version of this process, a model would be created by the engineer in Revit Structure, and sent to SDS/2 for the detailer to begin working. Changes or additions that the engineer makes can then be sent out again to the detailer, who can then use the export from Revit to update his manufacturing model. Only the updated members or newly added steel will be imported and adjusted. The same process applies when the detailer wants to send an update of the model to the engineer. This is highly valuable for maintaining as-manufactured or as-built models, and it reduces duplication of work needed to maintain these types of models.

In this process, changes can either be accepted or rejected, allowing the user to maintain full control of what information is adjusted in their model. This type of round-tripping and updating is only possible through the direct API development that exists between SDS/2 Connect and Revit Structure. This process cannot be achieved through IFC or CIS/2 file exchanges.

As mentioned earlier, this is a higher level of use for the SDS/2 Connect add-in. As engineers grow more comfortable with this process, this workflow will become more common as the benefits will prove to be huge time-savers.

*Connection Design for Full Models*
There are four main reasons that engineers may want to design connections in their own models:

- Clash prevention
- Level of detail
- As-built requirements
- Projects using early steel detailing

Whatever reason users might have to want connections shown in the Revit Structure model, SDS/2 Connect will help design and apply connection material automatically. With SDS/2 Connect, it is possible to identify the exact connection at each joint down to the bolt, hole, and weld information.

The different reasons for designing connections in the Revit Structure model are more important in determining how many of the connections need to be designed in the Revit Structure model. Here is more information on how each of the above listed reasons affects connection design.

- Clash prevention - Possibly only 10-20% of connections get designed. Mainly concerned with bracing connections and associated gusset plates.
- Level of detail - Working on LOD 400, 80%-100% of the connections will be designed. Lower LODs will require a lower percentage of designed connections.
- As-built requirements - This depends mostly on the stringency of the requirements. Most likely requiring 75% or more of the connections to be represented.
- Projects using early steel detailing - The percentage of connections designed in Revit is up to the engineer and detailer that are working together.

One major thing to understand is that none of these items specifically require engineers to design the connections in Revit. Just have the understanding that *it is possible*. Even for high LOD projects or as-built models, the engineer can simply export the un-connected model and let the detailer work on the connections (or a percentage of them) and simply import the connections back into their Revit Structure model using SDS/2 Connect. For example, 10% of connections could be designed in Revit, with the other 90% in SDS/2 . It only depends on whether the engineer and detailer are round-tripping their information and keeping both models updated. This leads us to the final workflow involving connections in the Revit Structure model.

*Receive and Approve Connections from the Steel Fabricator*

For engineers who are not necessarily interested in designing their own connections, but do want an easy way to approve the manufacturer's steel connections in their own familiar work environment, SDS/2 Connect can be the solution. As long as the models are associated via the round-tripping tools, the engineer can see the connections designed by the detailer/fabricator, check the calculations provided, and verify that the connections meet their standards. There are two ways to implement this workflow.

One way is to keep the models completely linked, exporting the original Revit model, working on the connections in SDS/2 Detailing and then exporting an update back to Revit Structure. The other way would be to use the first steps from above and then import the updated file created by SDS/2 Detailing into a new Revit Structure project. Keep it as separate "approval" model, preserving the original design model. Once imported and the Design All command is invoked, the detailer-designed connections will come into the model and be accessible for approval. This separate model can still be linked to the detailing model.

This process is probably the most complex, in terms of sharing the model and developing your system of approval. However, it can streamline and improve the approval process.

## Applying Building Information Manufacturing

To this point, we've covered how SDS/2 Connect fits in BIMfg and the various workflows that SDS/2 Connect can facilitate. So, how can users apply what we've learned about BIMfg to the design model with SDS/2 Connect?

### Model Better for a Better Model

The key to bridging the gap from your design model to the manufacturing model begins with model quality. Accurate design models are models that can (and will) be used downstream. Here are some beginner's tips on how to input a model that will be useful to the manufacturer:

- Modeling to the top of steel, in particular for beams and bracing.
- Columns should break at the correct splice elevations.
- Beams should be modeled point to point (detailing software can adjust the setbacks, add copes, etc.)

Connection design, should you choose to do it in Revit using SDS/2 Connect, can also be optimized by considering a few items. This is important because various connections can impact the project—connections that are cheaper/easier to fabricate yet still meet load requirements can result in significant cost savings. Here are a few things to consider when designing connections:

- What type of shop equipment does the fabricator have?
- Are they a bolted or a welded shop?
- Is there certain equipment requirements? (i.e., TC bolt guns)
- Can I adjust section sizes to avoid large amounts of welds in connections?

These are just a few things that, when considered during design, can improve the results on the rest of the project.

**Noticeable Impact on the Project**

There are a few ways that implementing some of these modeling tips, combined with the ability to design connections and round-trip the design model with the manufacturing model, will result in noticeable impact on your projects.

*Time Savings*

With the Revit model now able to contain more information pertinent to the manufacturer, like member-end loads for connections, manufacturers can begin to use that information because it is accessible in a usable format. SDS/2 Connect can read member end loads that are stored in Revit Structure, or that have been imported from add-ins like CSC Fastrak Building Designer, RAM, RISA or even Revit Composite Beam Designer.

With the correct settings activated in SDS/2 Connect, member end loads can be used to apply connections or can simply be exported out with the Revit model to automatically populate the manufacturer's model. This can eliminate RFIs for member end loading information and save time by reducing the need to search through multiple sets of drawings.

More important to engineers themselves, is the ability to quickly perform cost analysis on connections and member sizes. This will enable users to compare and study their proposed connections, as the analysis can more quickly be evaluated than in the past. Time is saved for the engineer as well as the manufacturer downstream, and leads to the natural participation in Target Value Design (TVD).

*Improved Structural Efficiency*

With the ability to compare and analyze various connection options in the design model, it becomes easier for engineers to perform TVD on more projects. The goal of TVD is to design the most sound structure possible at the lowest cost possible. Many engineers believe they are working toward that on every project, but certain considerations, such as a lighter column, may seem cheaper from a design point of view, but end up incurring larger costs when connections come into play.

An excellent example of that would be a situation where the load on a moment connection requires web doublers and stiffeners. At first impression, choosing a stronger column while maintaining the same depth, i.e. changing a W14x43 to a W14x99, may cost more for the column itself, but the reduced need for web doublers, stiffeners and expensive welds will more than make up for the cost—particularly if this situation is a common one in the project. With SDS/2 Connect, these options can be seen in the design model and quickly adjusted for.

Many other fabrication-based options can be worked into the design model through SDS/2 Connect. Incorporating the shop's standards into the setup will improve the efficiency of the model in regards to the way materials are chosen for design, and in terms of bolt diameters,

plate thicknesses, etc. Because clash detection is an inherent part of the connection design process, most clashing will be avoided or have design considerations in place, making for fewer misfits in the field.

*As-Manufactured and As-Built Models*
Having the as-built model for lifecycle management has become a major benefit of BIM. The expectation for manufacturers (who are not also GCs or erectors) to provide an as-built model are often beyond what the manufacturer can easily provide. Part of these expectations are due to people not understanding the difference between these types of models. The difference between the as-built model and the as-manufactured model is while that the manufacturer can send the model and drawings as instruction for how the building should be put together, they cannot guarantee that the erector will follow those instructions explicitly. Anything that gets adjusted or changed in the field, creates a difference between as-manufactured and the as-built model. Once those changes happen, they must be communicated exactly back to the manufacturer and changes must be made to the model for it to be an as-built model.

Once those changes are made to the manufacturer's model, the next step is to communicate them further upstream to the Revit model. SDS/2 Connect can facilitate some of this. Currently, only structural and connection information is transferred through SDS/2 Connect, but for those changes, the updates are easily accomplished. Until miscellaneous materials are added in the file transfer, DWG reference drawings of miscellaneous materials can be exported from SDS/2 and brought into the Revit Structure model.

## Real-Life Uses of SDS/2 Connect

Think back to the days when companies were just changing from using only 2D drawing tools to creating a 3D model as a means of generating drawings. Surely you've heard those who would say, "Why should I bother with going through a 3D model when I can just make the 2D drawings?" Those who invested early on in the 3D technology had a vision for their future and were well ahead of the curve when 3D became the norm.

With SDS/2 Connect, Design Data has offered a solution to the problems that engineers don't yet know they have. Those with a vision for improving the work process, meeting the LOD 400 standards, and smoothly transitioning their design model to a fabrication model can see the benefits that SDS/2 Connect can offer. As BIM technology advances, more of this type of information will be available; eventually, it will be an expected or required deliverable. These engineers have a vision of where technology is going in the future, and when the industry catches up, they will be ahead of the curve.

**Martin/Martin, Inc.**
Based in Colorado, Martin/Martin, Inc. has been using SDS/2 Connect to facilitate the transfer of their Revit Structure model to SDS/2 Detailing for use by one of their primary fabricators, Puma Steel Fabricators in Cheyenne, Wyoming. Their current work process is to use it as a one-time model transfer of information.

Similar to the transfer of an IFC or CIS/2 file, SDS/2 Connect's API model transfer offers some improvements over the standard file formats. Performing the file transfer using SDS/2 Connect, Martin/Martin can send a model that is immediately ready for use by the detailer. More detailed information can be passed to the detailer, like connection schedules, through the model.

As an added benefit, if for any reason they did want information sent back to the Revit Structure model, it is possible to do so using SDS/2 Connect. If an IFC or CIS/2 file were sent back to Revit Structure, it would either duplicate or overwrite the member(s) in question. On the other hand, using SDS/2 Connect, the unique IDs of the various members are maintained and linked to the original transfer between the two products. This results in an update of material rather than an overwrite.

**KC Engineering**
KC Engineering Co. located in Sioux City, Iowa, has both an engineering and detailing department in-house. Already long-time users of SDS/2 Detailing, SDS/2 Connect was a natural addition to allow KC Engineering to utilize in a transferring their Revit Structure models to their detailing staff. They are using SDS/2 Connect in two ways: as a one-time transfer of the model; and to create contract documents with a higher level of detail.

In their one-time model transfer procedures, KC Engineering applies all of their "standard" connections inside Revit Structure before sending the model to SDS/2 Detailing for finishing by their detailing staff. Information like connection schedules and design codes are also included in this model transfer, minimizing the time spent dealing with RFIs. With this information already in the model, it gives the detailers at least a week's head start from where they would be if they were using today's traditional work process. Though the engineers and detailers are all "under one roof" at KC Engineering, these capabilities enhance communication within the models and between departments.

Utilizing SDS/2 Connect as a part of contract drawing creation has also been an important addition to KC Engineering's capabilities as a company. The level of detail that KC Engineering can provide is heightened by the automatic design of connections in the Revit Structure model. Images for traditional connection schedules can more quickly be created in Revit Structure than in the past, making the generation of contract drawings a much more efficient process.

KC Engineering has worked on integrating many available software solutions to provide the best package for their customers. On one of their first pilot projects, a 180-foot tower structure, KC Engineering successfully used RISA-3D, Revit Structure, SDS/2 Connect and SDS/2 Detailing to drive the design model to manufacturing.

**KPFF Consulting Engineers**
KPFF Consulting Engineers is a multi-office, multi-discipline engineering firm with an international presence. The Portland, Oregon branch of KPFF has been using SDS/2 Connect for about six months and have used the Oregon Military Depot (OMD) as a pilot project for testing SDS/2 Connect as they incorporate it into their work process.

The driving force behind using SDS/2 Connect on this project was the requirement that their deliverable for the OMD be at LOD 400. According to Steve Voorhees of KPFF, "Using SDS/2 Connect to design and apply connections was the only way to achieve LOD 400 inside Revit." In fact, he also mentioned that "it would be nearly impossible to make budget and still meet the LOD 400 requirement without SDS/2 Connect for Revit Structure."

KPFF is still in the midst of this pilot project, so the full benefits have not yet been realized. However, already SDS/2 Connect has helped KPFF to avoid erection clashes during the design phase by enabling their engineers to see the problem areas and adjust the design before there is a problem. In addition, having the automation incorporated into the connections also helped in that their connections all have been verified and have the calculations to prove it.

At the time of creating this presentation and handout, no steel detailer has been hired on the project. Depending on the detailers' product of choice, there are two paths forward in terms of what BIM files would be delivered to the detailer. As a part of the SDS/2 software solutions, SDS/2 Connect transfers a model directly to the SDS/2 Detailing product. A detailer using that product would be able to take advantage of the API output, which is an XML file containing the model and all connections designed in Revit. This would include the connection schedule, among other setup information. Receiving a model with all the connections already on it will save a great deal of time and reduce RFIs from the detailer.

To pass their BIM model to a detailer using any other products, their deliverable will be very similar to the more traditional method of sending separate information, including an IFC, the connection schedule, corresponding connection section views, and possibly the design calculations. Once the detailer brings the IFC into their own product, using the connection schedule and standard sections, they would have to manually re-model all the connections into their manufacturing model.

## Summary

In closing, BIMfg is not necessarily a buzzword that will catch on, but the practice of including more detailed manufacturing information in your BIM model absolutely will. The AIA is aware of this as they have already defined LODs for BIM models. As owners begin to realize the benefits of this added information, it won't be optional on new projects, it will be required.

The best you can do is educate yourself and find the best way for your company to become capable of delivering higher LOD BIM models. LOD has potential to be the deciding factor for winning work in the years to come, so you have to ask yourself….Do you have the vision to move forward to the next level of BIM?