

Reviewing the Fabrication Model - An Industry Direction -

By James Schwartz

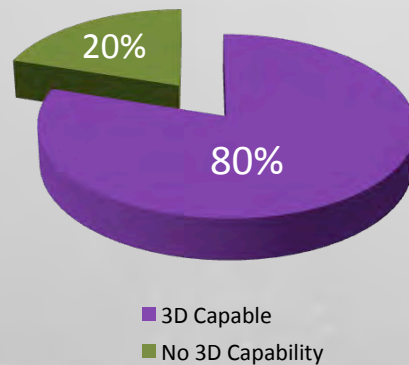
Why am I Here?

Goal:

- Support AISC's initiative to raise awareness about model based review.
- Transition the drawing review process to incorporate models and electronic technology
- Increase productivity of the steel manufacturing process to be more competitive vs. other construction methods/materials.
- **Cut to the chase. To show you how to survive the "accelerated schedule" to get accurate steel quickly to the site.**
 - Present information on how to implement Model Review on your current or next project.

How many Fabricators have 3D Model capability?

Fabricator 3D Model Capability
Ca. 2010



Model Integrity - objection

- Model review within detailing offices has been around for some time.
 - Detailers learned early to verify the model before detailing and incorporated into checking process.
- Why is it important for the engineer that quality detailing firms review their Model? **Model integrity!**
 - Though it is true that members are still assembled from 2D images, but BIM/VDC and CNC (data to run the machines) is generated from the Model. Therefore the fabrication model must be **100% accurate on critical elements** for steel production. Incorrectly fabricated material will sink a project.
- To ensure that the data being reviewed is accurate and complete, it is highly suggested to review the model in the native format.

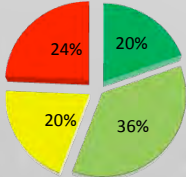
Level of Development LOD

	<p>LOD 100 - Essentially the equivalent of conceptual design, the model would consist of overall building massing and the downstream users are authorized to perform whole building types of analysis (volume, building orientation, cost per square foot, etc.)</p>		<p>LOD 400 - This level of development is considered to be suitable for fabrication and assembly. The MEA for this LOD is most likely to be the trade contractor or fabricator as it is usually outside the scope of the architect's or engineer's services or would constitute severe risk exposure if such parties are not adequately insured.</p>
	<p>LOD 200 - Similar to schematic design or design development, the model would consist of "generalized systems or assemblies with approximate quantities, size, shape, location and orientation." Authorized uses would include "analysis of selected systems by application of generalized performance criteria."</p>	 <p><small>Image courtesy of Mortenson Construction</small></p>	<p>LOD 500 - The final level of development represents the project as it has been constructed - the as-built conditions. The model is suitable for maintenance and operations of the facility.</p>
	<p>LOD 300 - Model elements are suitable for the generation of traditional construction documents and shop drawings. As such, analysis and simulation is authorized for detailed elements and systems.</p>		

[2013 LOD SPECIFICATION](#)

This is new so I will wait till the bugs are worked out.

- Pioneers of the Model Review back early 2000's
 - Ghafari , HGA Architects & Engineers, Arup – Chicago, URS two locations, Giffels / IBI group, (HED) Harley Ellis Devereaux, Burns & Roe, Allen Baker, HOK – St Louis, McNamara Salvia, SNC Lavalin – two locations, Fitzpatrick Engineering, etc
- AISC estimates that about 10% are already using a form of Model Review.
- People surveyed predictions.



- 0-4 Years
- Between 5-9 years
- More than 10 Years

- This is not a pipe dream or vapor ware.

AISC is on Board

- Promotion around the country (12 cities plus)
- The response was quite positive. As Luke Faulkner from the AISC mentioned, “they found that people were more open to this than they anticipated”.
- Articles found in MSC and other publications. This is coming to a neighborhood near you!
- Documentation being created by AISC.

5 cent workflow tour

The Following will be demonstrated: (AISC three forms)

- Hybrid (Model Assist) with FREE viewer
 - We are not trying to drastically change workflow but instead supply tools to enhance it!
- Model based (Lite & Full) – with Approval Station
 - Focus on 3D model instead of 2D images.
- Data Transfer

All that is to be shown is out of the box!

Current method of Shop drawing Review?

- Think for a moment on how you currently review shop drawings.
 - The searching for members, sifting through pages to find the 100 1B1 beams.
 - Trying to interpret what the detailer did.
 - Paper or electronic documents spread everywhere.
 - The excitement of spending all that time on the review of shop drawings instead of designin



Models graciously provided by the following:



Structural Detailing, LLC

- Project consists of 8483 members.
 - 2623 Beams, Columns and Vertical braces
 - 5860 Stairs, lintels, hangers and pour stops.

DEMO

Review Requirements

Required to be reviewed by engineer:

- ✓ Point to Point.
- ✓ Section Sizes
- ✓ Number of Connecting members
- ✓ Member Location, position and elevation
- ✓ Grades
- ✓ Finishes
- ✓ Connection configurations and loads.
- ✓ Addition of penetrations, secondary members, supports, etc.

- ✓ Placement (Erection) drawings i.e. field works, anchorages, etc
- ✓ Detail completeness. If all issued steel has been detailed.

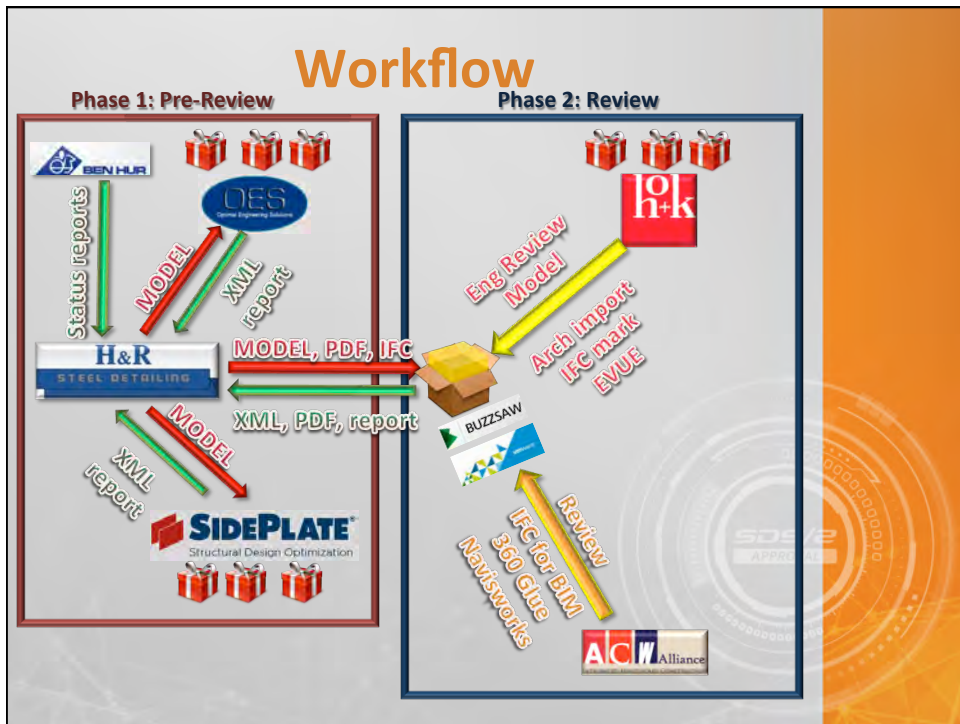
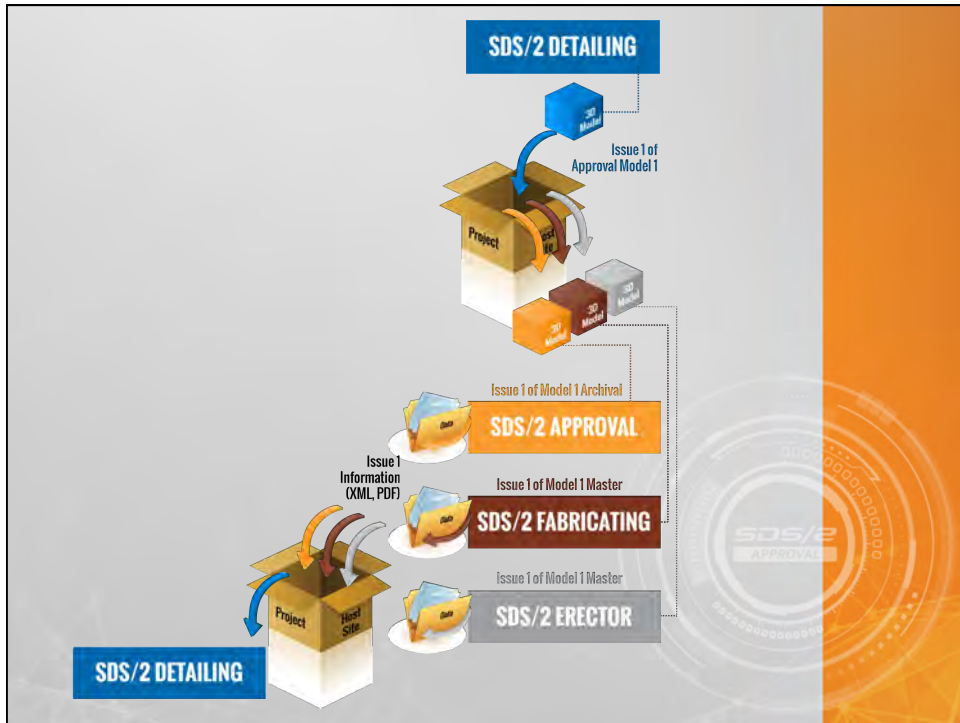
Review Requirements

NOT required to be reviewed by engineer:

- ✓ Shipping marks and batching
- ✓ Fabrication dimensions
- ✓ These items are left to the Fabricator and not the engineer's responsibility.

With Lite and Full Model Review, 2D images are to only be used if absolutely necessary to convey information to the fabricator and detailer that cannot be done so in the model.

- ✓ BlueBeam® can be used or SDS/2 Drawing Editor

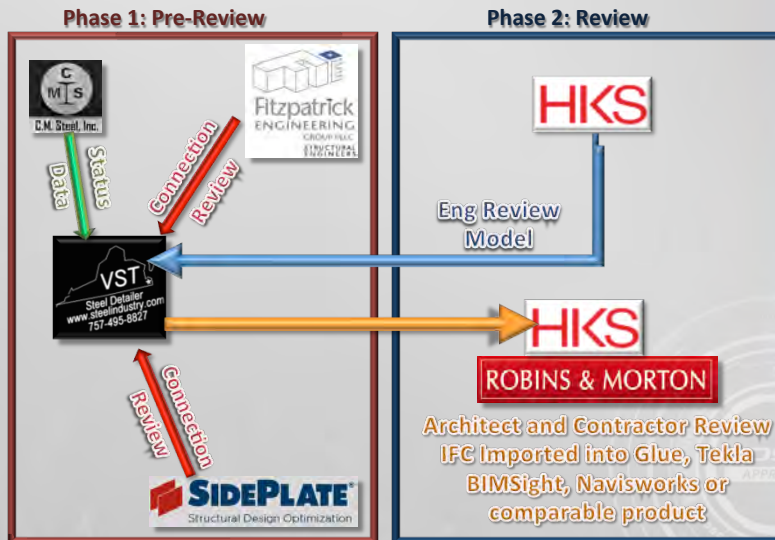


“Quote from”

[Andrew W. Gayer, PE, SE, LEED AP](#)
[Vice President | Regional Leader of Engineering](#)



Workflow



Design and Revision Sketches and Reports are placed at designation location.
VST attaches sketches to the model.

Involving other disciplines

- SDS/2 Viewer can be used.
 - If the GC wants to review the structure to see if there are any added costs, or to see if there are any critical stops to the issue.
 - Architect can see if there are any conflicts or responsibilities on their part.
- Models into Revit. [Revit Clip](#)
 - Color coded DWG
 - IFC
 - Approval Station requires a purchase of the BIM module.
- Models into Navisworks [Navisworks Clip](#)
 - NWD can be created to be used with Freedom.
- Models into BIM 360 Glue
[BIM 360 Glue clip](#)
- Models into Tekla BIMSight.
[Tekla BIMSight clip](#)

So how does this benefit me?

Engineers:

- By approving the model, or by using the model to assist in the approval process of the 2D images, you will;
 - Reduce the time it takes to search for members and their locations.
 - Be able to visually inspect member's connectivity in a 3D environment, eliminating member conflicts. Reduces interpretation questions.
 - By setting the Status and custom Property settings;
 - ✓ You can easily color code the model to view settings.
 - ✓ Quickly generate reports.
 - ✓ Reduce tracking and project control issues.

So how does this benefit me?

- With Model review, you will be able to review individual members, leaving the fabricator and detailer to be responsible for the shipping marks and fabrication dimensions. For example, handrails can be approved for their location in the model.
 - The engineer is not responsible for fit up, erection or fabrication practices. You can focus on what you are responsible for.
- Streamline information transfer time between disciplines.
 - Sierra MODEL REVIEW process is reviewed live on the cloud.
- Eliminate the paper shuffle.
- The approved model can be exported for clash detection. Since BIM is based on the model, why approve an extraction, i.e. the 2D image?
- 2D review existed because at the time there was not any other option.

We are not trying to drastically change workflow but instead supply tools to enhance it!

Ask an early implementer

SNC Lavalin is **pleased** with the decision to use SDS/2 for review of shop drawings on a **15000-ton** structural steel building project. The SDS/2 software is **user-friendly** and relatively **easy** to learn and use. It allows 3D visualization of connection details and measurement of any desired dimension. It is also easier to find pieces in the model, easier to catalog them using status display, and easier to track their progress through the shop drawing process.

SDS/2 made **it possible to expedite** the review and approval process through electronic commenting and approval in a format that allows the modeler to easily incorporate our review status and comments in his model. In brief, we **have compressed the overall schedule to return submittals, compared to the traditional way of reviewing 2D shop drawings only.**

Another big advantage of using SDS/2 is the **ability to convert the SDS/2 model to the project Smart Plant model** and use it to check clashes of connections with equipment, piping, ducting, etc.

Atef Shehata/P.Eng.
Senior Structural Engineer
Global Mining & Metallurgy

So how does this benefit me?

Fabricator:

- Cary Grant from Cives Steel Company
 - Again a quick approval turn around
 - Less paperwork
 - **Less interpretation questions from the engineers.**
 - Cives has gone as far as stipulating it in their contracts with Detailing firms.
- Brian McLaughlin - Brad MacPhee from Ocean Steel
 - echos the same comments

So how does this benefit me?

Detailer:

- Maurice Roy – Steltec
 - For a detailer, the biggest advantage for doing a model approval is that the engineer has viewing access to the 3D model, which **allows him to better understand the detail, resulting in fewer questions and comments on our drawings.** In addition, by being the pioneers of these tools, the engineering firms then refer us to different fabricators to do their detailing which brings an increase of work to our office.
- Chris Harms – H&R detailing
 - Quick turn around from approval.
 - Marketing – the ability to provide the service makes their firm more attractive.
 - **Better communication between fabricator, engineer and detailer.**
 - Most import is that his clients are asking for it.

Getting Started

- When the contract is awarded to the Fabricator, determine the Fabricators capabilities, and what they are willing to do.
 - Set model revisions, submitted date and held date.
 - Attach drawings, RFI and Addendums.
 - Deliverables. i.e. PDF, Status Transfer XML, IFC for Architect and CM.
 - Delivery method, i.e. FTP site.
 - What is missing – make all parties aware of what is not in the model, for example buy out items. Don't make the engineer have to guess.
- Document your procedure! "Fences make good neighbors."
 - Establish lines of communications
- Training for detailer and engineers. (contact James Schwartz james@sds2.com)

Obstructions



- Model Origin – Get it right early on.
- Lack of communication
- Getting lost in contractual agreements
 - The inverted U – squeezing new technology into old practices.
- Hardware, especially video cards.
- File sizes – can get large creating download speed issues
- Only send PDF for submittal.
- Project storage. All of the duplicates can become quite large.
 - Remember storage media does not last for ever.
- Must resist at the beginning to going back to the comfort zone.
 - We are all prone to this.
- Cost
 - Can be incorporated into project cost
 - Some detailing and fabrication firms have portable licenses to be used on projects.
- Security
- Training – after installed, up and running in a 2 hour GoTo meeting.

Security

- One of the first questions asked is about security. This is an extremely valid question.
- Here is what is the response I received from the AISC solution center concerning the use of electronic format of 2D drawings, i.e. PDF.

*“There is not a code requirement stating one way is preferred over the other. The contract documents in printed or electronic format are acceptable. In this case it is a matter of what is not said. **The Code does not say that you cannot**, thus the use of electronic 2-D drawings is permitted in the approval process. The intent is clear, concise, and complete drawings. The means to which they are delivered (printed or electronic) is likely a matter of preference.”*

- Concerning the review of models, this documentation is currently being developed by the AISC – contact Luke Faulkner at AISC.

Security

- When approving a model with SDS/2 Approval Station, you will be working in the **native format**, so there will not be any concerns about lost data due to file format transfer issues.
- The Approvers work on a copy of the project, keeping their information intact.
- Once the project has been approved, the project model you approved can be zipped and stored.
 - Software such as **SecureZIP** by Pkware can be used to provide security of the approved project.
- SDS/2 provides true real-time multi-users in the project

In Conclusion “Quote”

“We are encouraged by the progress we have made reviewing steel shop drawings in SDS/2 enough to promote it on most of our new structural steel building projects. **Despite some architects’ and some CMs’ hesitations, we have identified multiple benefits to the owner, architect, CM, fabricator, and structural engineer, and we have compressed the overall schedule to return submittals.** While our time reviewing each piece is not affected, we find it is easier to find pieces in the model, easier to catalog them using status display, and easier to track their progress through the shop drawing process. It also allows a more comprehensive review by **seeing each piece in 3D, to scale, and interacting with connecting pieces....**”

John J. Tracy
McNamara/Salvia Inc.
Consulting Engineers

QUESTIONS?



- Continue the conversation. Join the AISC – Model Review Approval group
- Learn more about the SDS/2 Solutions for model approval:
 - www.sds2.com
 - @SDS2_DesignData
 - www.facebook.com/SDS2ByDesignData

Comparison

Items checked during shop drawing review	2D PDF	Hybrid	Full Model
Paper drawings, multiple sets	☑	☑	
Section size	☑	*	*
Length	☑	*	*
Camber	☑	*	*
Grade of Steel	☑	*	*
Connection design	☑	☑	☑
Number of connecting members	☑	*	*
Spacing of connection members	☑	*	*
Finishes	☑	*	*
Copes to supporting members	☑	*	*
Miscellaneous attachments	☑	*	*
Holdbacks at ends of beams	☑	*	*
Connecting member sizes	☑	*	*
Erection plans	☑	☑	*
Tracking RFIs and addendums	☑	☑	*
Visualization	N/A	yes	yes

* These items can now be verified visually – galvanized lintels, grades of steel, copes, measurements, etc.

Courtesy of Doug Fitzpatrick, Fitzpatrick Engineering Group