SE2080 - Autodesk® Revit® Structure: Model, Design, Connect, and Fabricate Steel Buildings

Kevin Lea – CSC Inc
David Zabka – Design Data

Autodesk industry partners with CSC and Design Data have combined their expertise to deliver the first smooth Building Information Modeling (BIM) process for the entire design of steel structures. This process links Fastrak™ from CSC, Autodesk Revit Structure software, and SDS/2 Connect from Design Data software. This class demonstrates how a fully code-compliant design of the steel structure can be produced in Fastrak, which can be synchronized with Revit Structure to create BIM documentation and with SDS/2 Connect for the full design and detailing of the steel connections. The fully designed Revit model can then be exported to SDS/2 Detailing software to create the fabrication model. Integration between Fastrak, SDS/2 Connect, and Revit Structure is a powerful solution for the steel industry. Bridging the information gap between design and fabrication shortens timelines, enhances project communication, and ultimately reduces project costs.

Learning Objectives

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

- Implement integration between Revit, Fastrak, and SDS/2 Connect

- Realize productivity gains through a combined workflow

- Share Revit/Fastrak models downstream with steel fabricators

- Capitalize on the full potential that structural BIM offers steel building design

About the Speaker

Kevin Lea – Beng (Hons)
CSC Inc.

Kevin has worked closely with Consulting Engineers and steelwork fabricators throughout the world assessing their requirements for structural design and BIM solutions.

He has been with CSC for 19 years and is currently the BIM Business Development Manager. He specializes in both structural design and structural BIM technology and has assisted many of CSC's corporate clients such as Arup, Atkins, Buro Happold, Aecom, Ramboll, WSP, White Young Green, et al to implement the latest Structural BIM tools.

He is an active speaker on the topic and involved with numerous leading industry and government organizations promoting the adoption of Structural BIM around the world.

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Kevin also coordinates CSC's activities with Autodesk as Structural Industry Partners. A working relationship focused on the promotion and enhancement of BIM technology for the structural community.

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1. Implement integration between Revit, Fastrak, and SDS/2 Connect

As Industry Partners with Autodesk it is our combined objective to build awareness of Structural BIM and the benefits integration between CSC's design solutions, Revit Structure and Design Data's SDS2Connect offer to the structural engineering community.

This class investigates how integration is achieved and implemented.
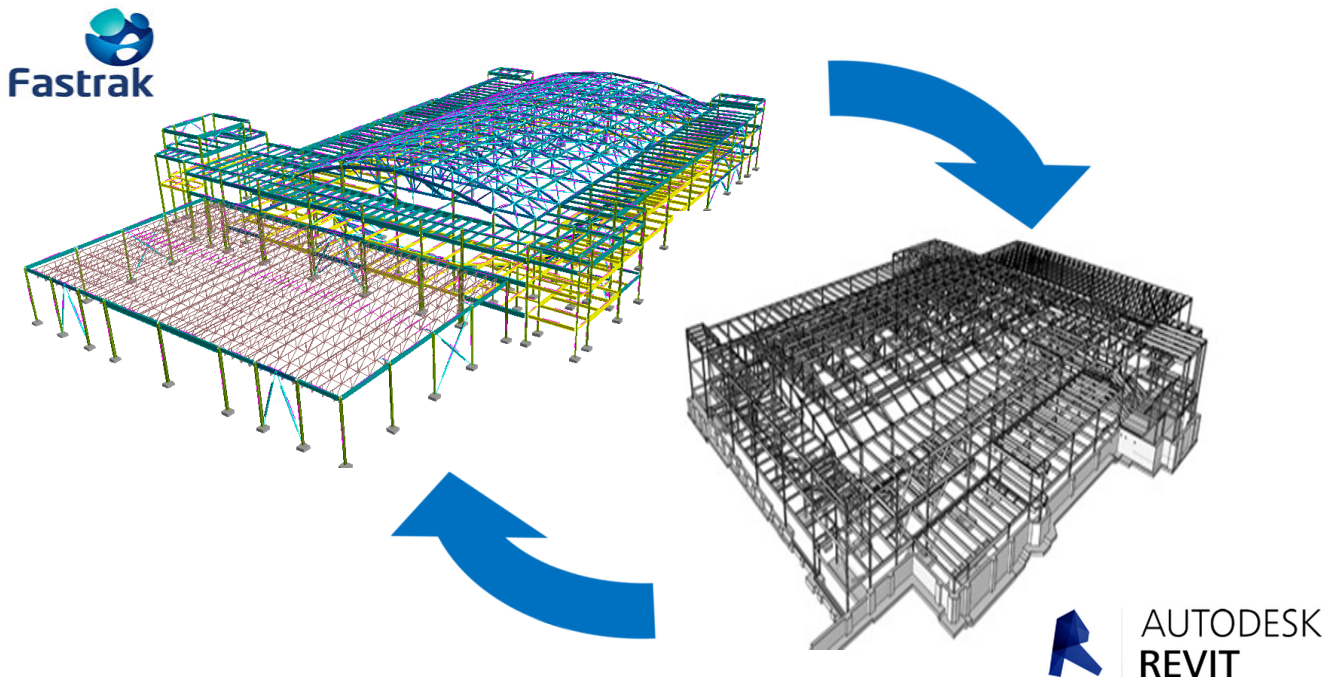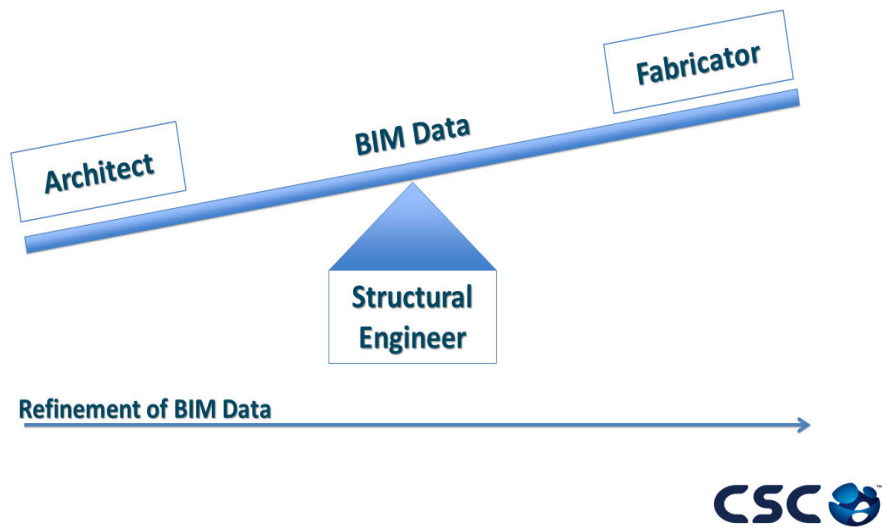

Example of Integration between Revit Structure and CSC's Fastrak
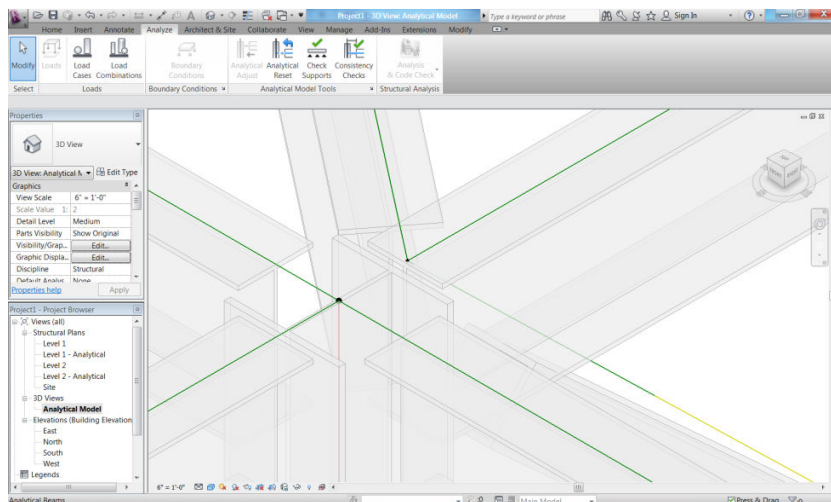Courtesy of SDI Structures

2. Realize the productivity gains that are achievable with a combined workflow

To obtain the maximum use out of Structural BIM data there are a number of fundamental rules that must be understood. This class will consider the key aspects to help ensure BIM data is utilized fully ensuring maximum productivity gains.
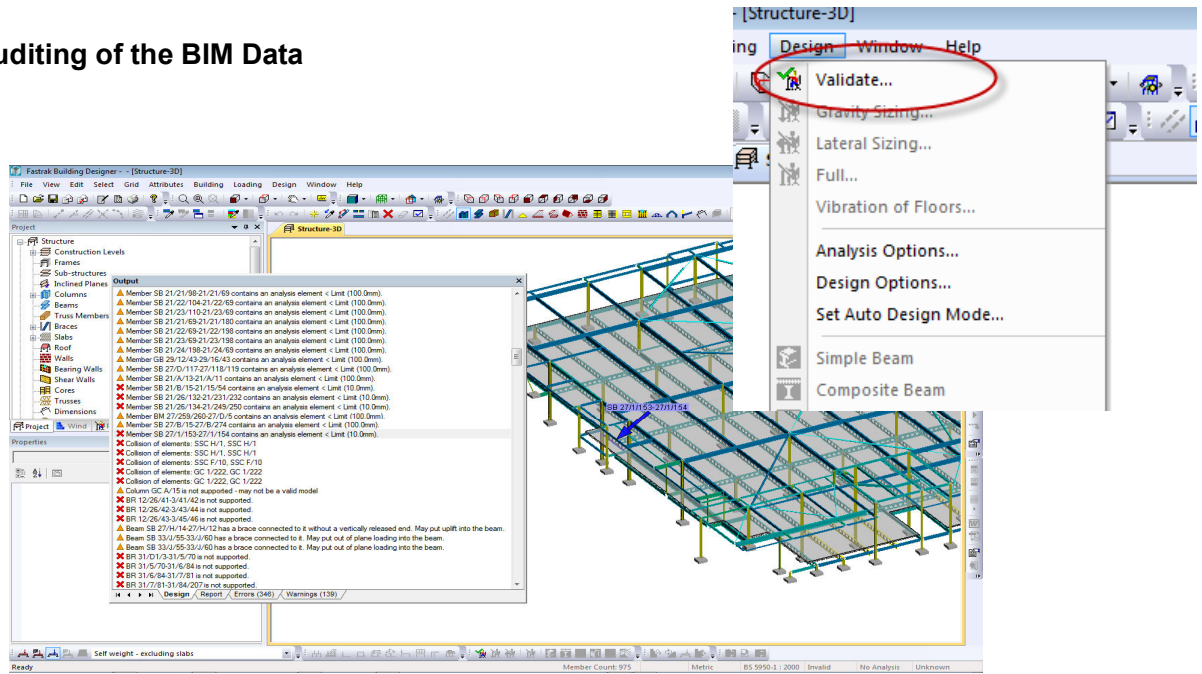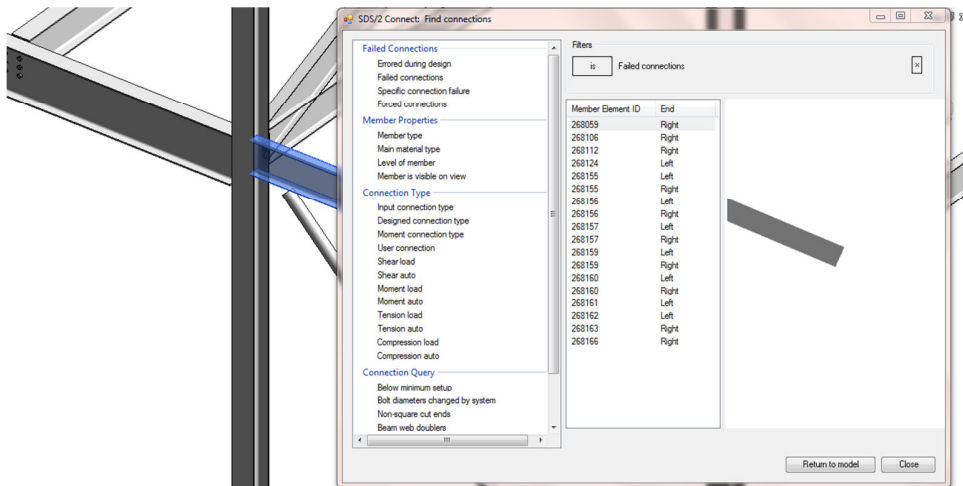
1. The Pivotal role of the Engineer

2. Connectivity

3. Auditing of the BIM Data

In Fastrak

In SDS2Connect

4. Engineers Deliverables

For effective integration with a code based modeling solution such as Fastrak it is important to understand the similarities in functionality and the elements that are unique to each system.

Firstly Fastrak enables BIM modeling for the purpose of code compliant design of the structure (i.e. steel building design to EC3,BS5950, AISC, EC1, BS6399, AISC/SEI) and SDS2Connect provides connection design to AISC. Revit's strengths lie in project documentation and coordination.

As Revit Structure is not a code-based design system it has no concept of code-based design data required to complete a design. Information such as live load reductions, wind loading, notional horizontal forces, top flange beam restrains, effective length rules etc. are all code-based criteria needed to complete a design of a steel building.

Principally, engineers have two deliverables:-

1. Code complaint design (Fastrak/ SDS2Connect)

2. Project documentation (Revit)

The combination of Revit, Fastrak & SDS2Connect, when integrated, provides the perfect tools to optimize the workflow within a typical structural engineering office.
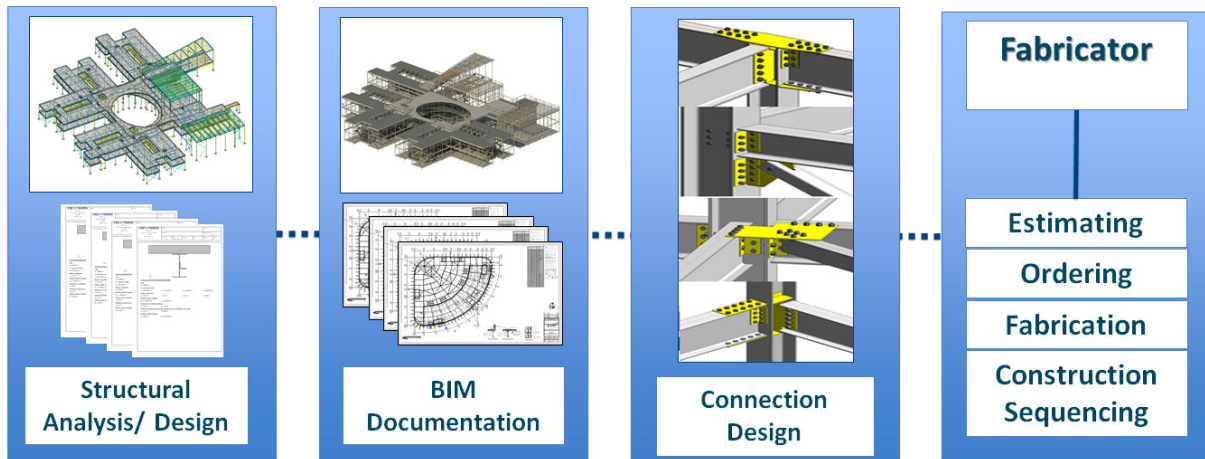
This class will focus on passing Revit models into Fastrak and synchronizing changes back.
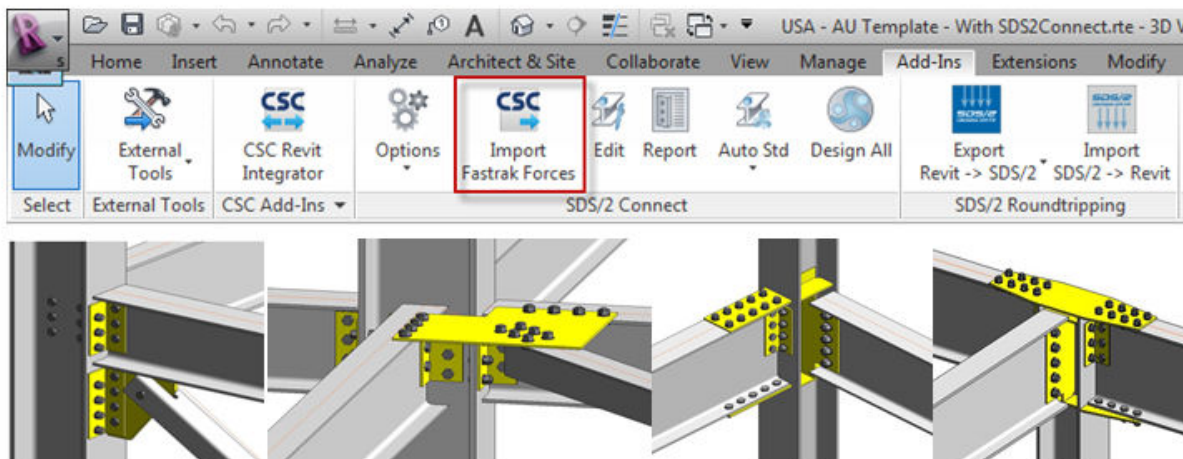
Example of connection in Revit by SDS2Connect

3. Share Revit/Fastrak models downstream to steel fabricators

Live demonstrations of Fastrak/ Revit and SDS2Connect will demonstrate the workflow between the engineer and the fabricator.

4. Capitalize on the full potential structural BIM offers steel building design

Benefits to the Engineer

- Code compliant structures and connection design integrated with Revit
- Automated sharing of connection forces
- Improves accuracy, communication and efficiency
- Reduces effort, cost and time
- The latest technology from the leading software vendors
  - o CSC
  - o Design Data
  - o Autodesk
- Reduces repetition - Geometry efficiently shared
- For structural design
- For structural BIM documentation
- For Fabrication
- All for the same effort
- React to changes/ variations quicker

Benefits to the Fabricator

- Accurate project data earlier
- Leads to accurate costing
  - Tender/ Bid
  - Project
- Reduces project variations – increases consistency
- Helps with pre-ordering steel from rolling mills
  - Often on the critical path
- Improves communication up and down stream
- Clearer communication
- Reduce the number of RFIs
- Allows manufacturing input in design decisions
- Enables the sharing of workload

Benefits to the Client

- Significantly improved communication between project members
- Maximum use of BIM data on the project
- Therefore maximum efficiency
- Enhanced design data earlier
- Reduction on cost
- Reduction in waste
- Reduction in carbon
- Improved project deliverable

Additional Notes: for successful Fastrak Integration with Revit

1. Create a connected model

This is the number one issue that must be accepted. Revit controls a wireframe model that is used to control both parametric controls and integrate with analysis tools. Although Fastrak communicates both physical and wireframe data (including offsets) if the wireframe is not connected the analysis used to establish the forces in the structure will not work.

Corrections can be made in either Fastrak or Revit. However auditing the wireframe for potential problems can be difficult in Revit.

Fastrak can assist by using its design verification tools. If members are unsupported it will show you graphically as below.

2. Member Classifications

As Revit is not a code compliant design tool its structural member classifications are limited to beam, column, brace etc. To enable a thought building design Fastrak breaks these classifications down further to include elements such as simple beams, general beams, composite beams, steel joists etc.

If a Revit's model is created without considering these additional classifications the model will import to Fastrak successfully. In Fastrak the additional design parameters can easily be added. (This maybe the preferred process as it may not be considered a technicians responsibility to define whether a beam will behave compositely.)

To improve the workflow even further specific Fastrak parameters can be added into your Revit template defining the design intent for member prior to export.
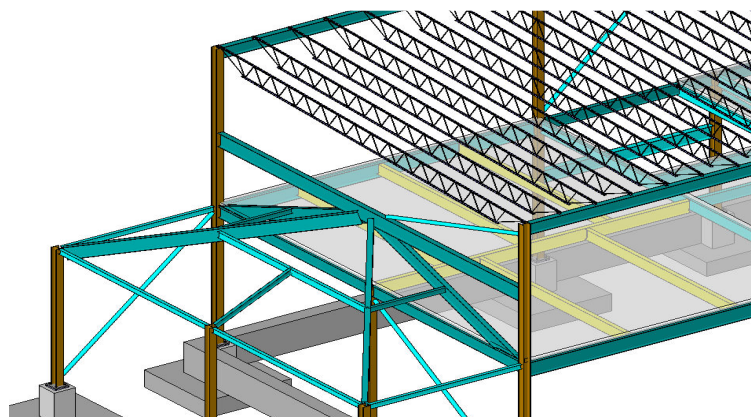
Design rules set in Revit. I.e. composite beams (in yellow) defined prior to export to Fastrak

3. Members for Design Identified

Often we find Revit models are created without consideration for the design. Revit has extensive features to control members for design. It is important to only consider the elements required for design and not to export every element as this will more than likely prevent analyses to run successfully.
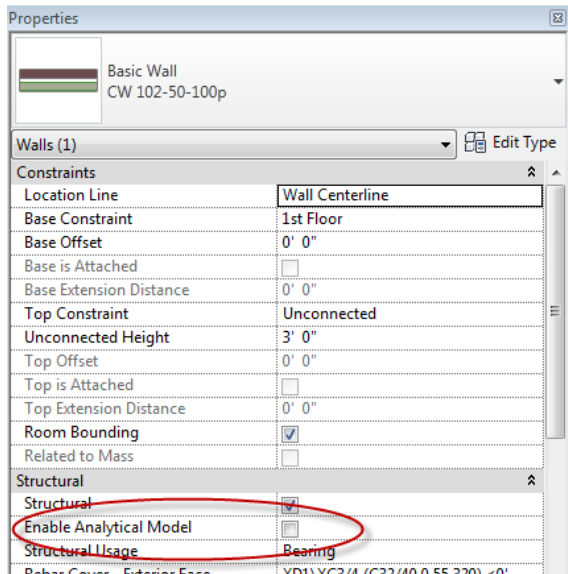
For steel structures, walls, in the main, are used for cladding purposed (unless part of a stability core) and therefore 'Enable Analytical Model' should be un-ticked.

Hint: It may be worth making this a default setting on your template. You can always switch it on if you need a shear or bearing wall.
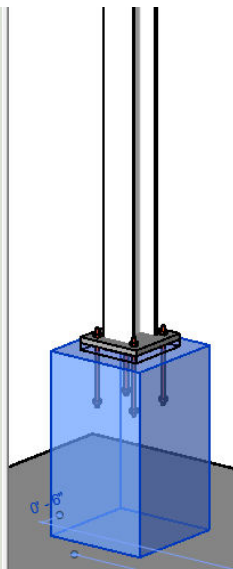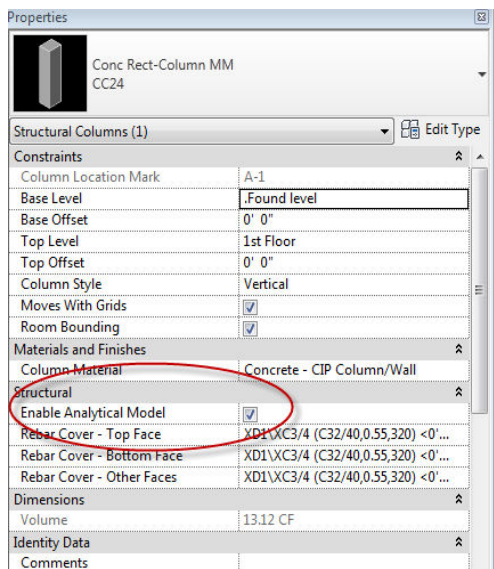
Sometimes we use beam and column elements to model other elements (i.e. Foundations) However these elements are often not required as part of the design model and should therefore have 'Enable Analytical Model' un-ticked.

4. CSC's Integrator

CSC's Integrator has been developed to allow Revit models to synchronize with CSC's Fastrak and Orion software. It is available free at www.cscworld.com

Once installed it will embed automatically into Revit and is available from the add-ins tab. It is available for Revit Structure 2011, 2012 & 2013.

From the Integrator, elements can be included or excluded, geometrical changes ignored and mapping of families can take place.


5. Mapping of Families

Often when building Revit models families are adapted to suite the project requirements or even pre-defined company standards. When families are edited (renamed etc.) it becomes difficult to control mapping of family types between systems and a user can spend a long time resolving the problem.

CSC's Integrator inspects all families used on the project and intelligently maps them together. This functionality also allows for full review of the mapping and the ability to control mapping files to suit a project or companies standards. All mapping is live and interactive.

6. **Manage the two-way integration processes throughout the timeline of the project.**

Tracking design changes in Revit can sometimes be difficult. Once integration has taken place members that are added, deleted or modified can be tracked intelligently.
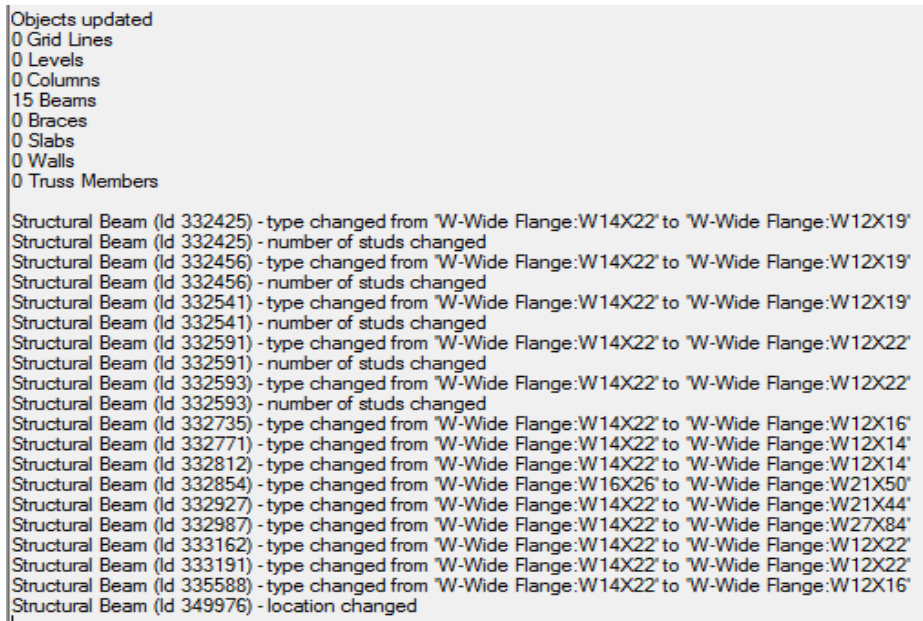
7. **Manage variations in design throughout the project**

The Revit model and the Fastrak model can be colored to help manage any variations between the two models.
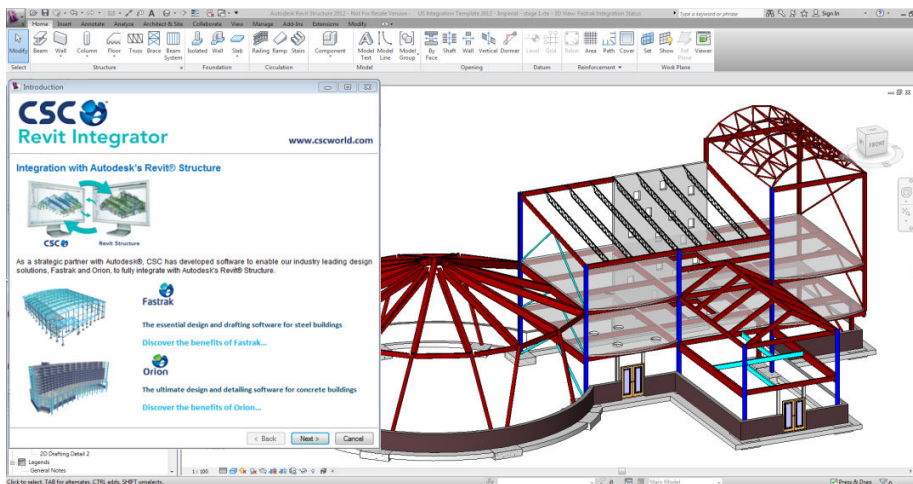
An example of the integration status in Fastrak.

"At Martin/Martin we have being using CSC's Revit Integrator to great effect. Two-way integration between Revit and Fastrak for steel structures really does work well. Fastrak is easy to use and a worthwhile addition to your BIM arsenal of programs."

Grant Doherty - BIM Specialist
Martin/Martin
USA