AUTODESK UNIVERSITY 2015

PM9677

Factory Design Suite: The Power Is in the Workflow

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Learning Objectives

- Learn how to sync between AutoCAD, Inventor, and Navisworks
- Learn about Revit Interoperability with Inventor
- Learn how to use Navisworks to create collaborated factory designs with factory buildings and machine layouts
- Learn how to perform clash tests in Navisworks to resolve clashes between building and assembly line

Description

With so many different software systems installed with Factory Design Suite software, it's hard for a user to know where to start. This class will show you the entire workflow of Factory Design Suite software, including the use of different software systems that are installed on your machine. We will discuss how to use the Autodesk 360 cloud services to quickly get the 2D layout data from the sales engineer who is at a client site, and provide him with a completed 3D layout with the Factory Design Suite software that is in sync with the 2D layout. We will discuss Revit software interoperability in detail as to how it will enable the factory buildings to be utilized in Inventor software for a flawless completion of factory layouts from concept to completion.

Your AU Expert

*Deepak is a qualified Mechanical Engineer with more than 17 years of experience of working with various CAD software. He is currently working as the Product Manager - BIM/MFG Solutions, with Cadgroup Australia and is a regular speaker at Autodesk University in Las Vegas, USA. Deepak is also one of the lead presenters showcasing the latest Autodesk technology at various events all around Australia. Deepak is the author of the Best Selling "**Up and Running with Autodesk Navisworks**" series of books and is also the author of the "**Up and Running with Autodesk Advance Steel**" book to be released in the first quarter of 2016. In addition to his day job and the book writing hobby, Deepak is also a guest lecturer at the University of Technology Sydney (UTS) and University of New South Wales (UNSW), two of the biggest universities in Australia. More information about Deepak can be found on his website www.deepakmaini.com.*

Introduction to Factory Design Suite

Autodesk® Factory Design Suite is an interoperable 2D and 3D factory layout and optimization solution built specifically to help you design and communicate the most efficient layout by creating a digital model of your factory. It enhances AutoCAD Architecture, Autodesk Inventor, and Autodesk Navisworks software with exclusive access to interoperable layout workflows and factory-specific content to help improve your design efficiency, accuracy, and communication. It provides tools for integrating 2D layout data with 3D models of factory equipment, creating accurate factory models and 3D visual walkthroughs that help teams collaborate effectively and make more informed decisions before any equipment is installed and commissioned on the factory floor.

This suite of software comes with a number of software designed for a particular workflow of creating factory layouts. Figure 1 shows the **Autodesk Factory Design Suite 2016** dashboard from where you can invoke any of these software.

FIGURE 1: THE FACTORY DESIGN SUITE DASHBOARD

Although most of the software that form the suite are useful, there are three main software that form the core of Factory Design Suite. They are **AutoCAD Architecture**, **Autodesk Inventor**, and **Autodesk Navisworks**. The following is the brief description of these software.

AutoCAD Architecture

AutoCAD Architecture is the initial 2D design component of the Autodesk Factory Suite. The development of facility drawings is the primary focus of the initial element in the Autodesk Factory Suite. Designers need a tool to easily layout and develop Walls, Windows, and other architectural elements as the initial 2D design comes together. AutoCAD Architecture provides you the flexibility to work in the traditional AutoCAD environment if required, or in the AutoCAD Architectural workspace, where you have access to specific commands for Walls, Doors, Windows, Beams, and many more Architectural design elements. These Architecturally specific commands provide productive and efficient methods of creating facility layouts. Figure 2 shows a factory layout in AutoCAD Architecture.

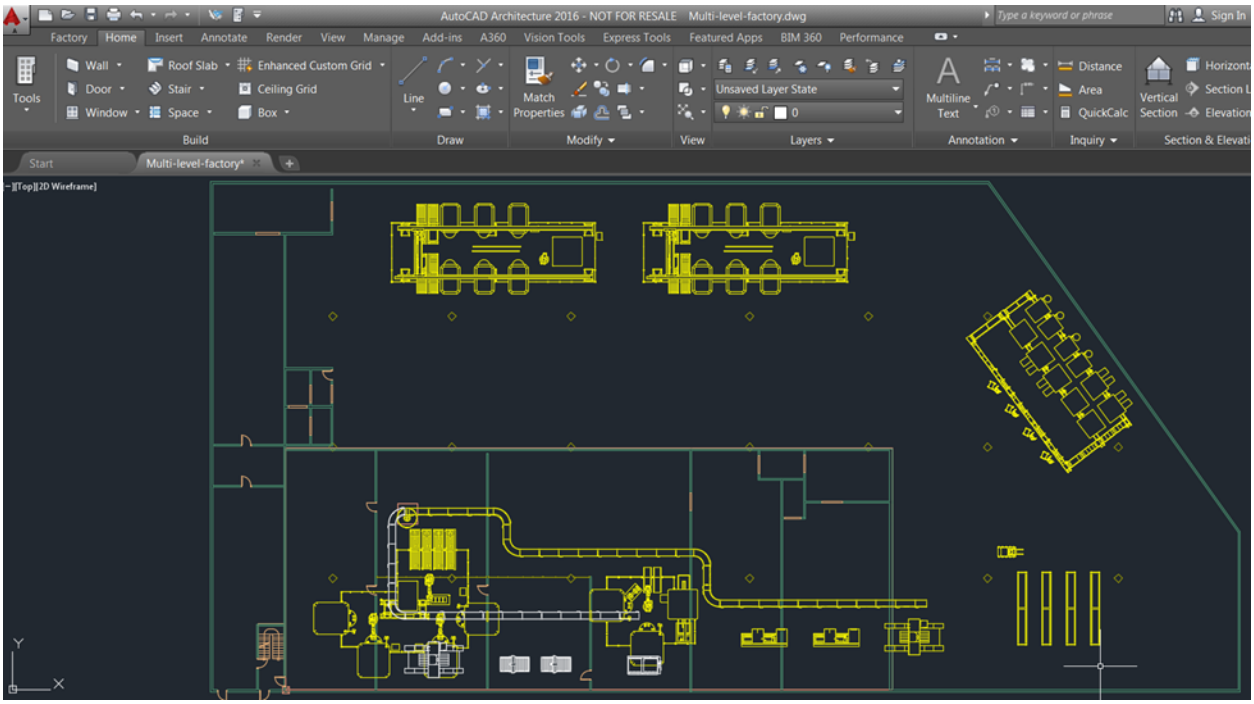

FIGURE 2: THE FACTORY LAYOUT IN AUTOCAD ARCHITECTURE

Autodesk Inventor with Factory Utilities

The nature of the Two Dimensional Factory Layout process requires a good deal of time and attention to numerous details. The Autodesk Factory Design Suite helps factory layout users save hours of effort, so they can spend time innovating rather than drafting. Users can take advantage of their existing layout data and expertise to build an accurate digital model of the factory, quickly try multiple layout 'what if' scenarios, and communicate the best solution to stakeholders and partners.

Autodesk Inventor, enhanced with the Autodesk Factory Design Utility, gives users a factory-specific parametric work environment to better design, optimize, and visualize factory layouts. Users can quickly grasp the simplified workflow without expertise in 3D modeling practices, as shown in Figure 3.

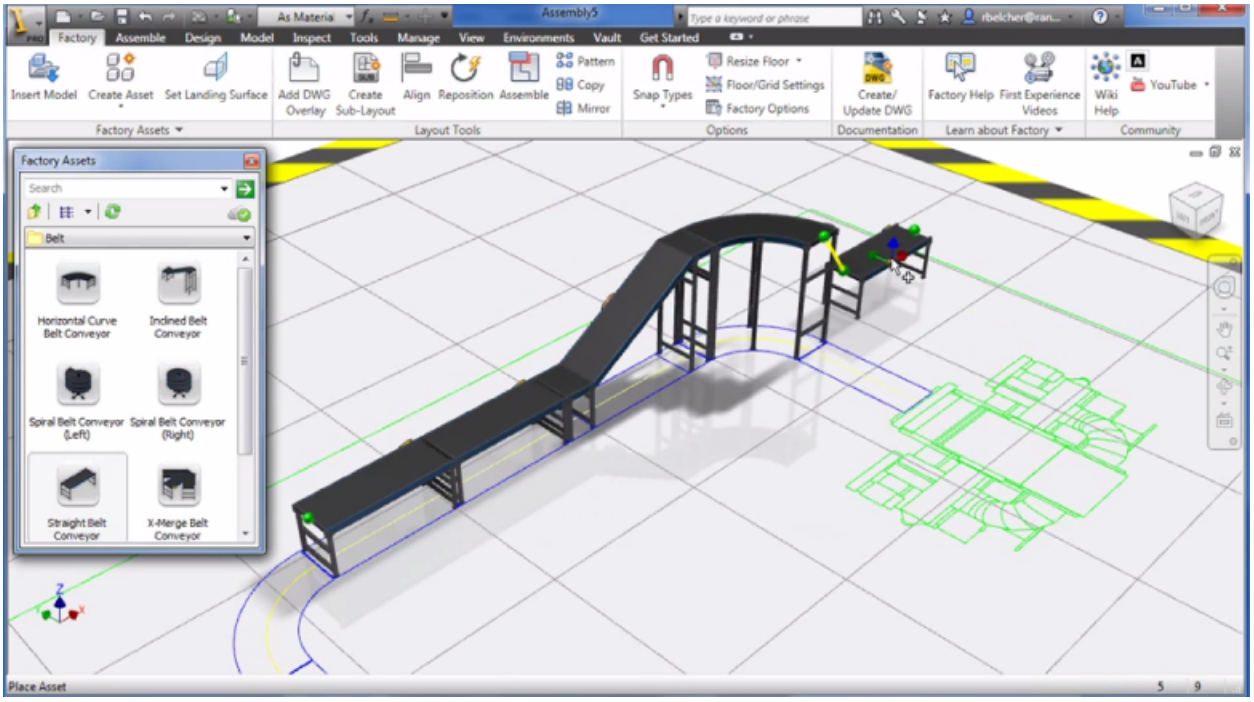

FIGURE 3: THE AUTODESK INVENTOR INTERFACE WITH FACTORY TOOLS

Autodesk Navisworks

Validating your Factory Layout requires the comparison and analysis of multiple designs from various stakeholders. Your Layout must interface with the Architectural Facility and the Manufacturing designs supplied by the System Integrators or Factory Owners. Putting all this information into a single environment is often beyond the capabilities of most software programs.

Navisworks enables Factory Layout Designers to visualize large complex Layouts with thousands of components such as complete manufacturing facilities, factory floor layouts, production lines & industrial machinery, all in a single digital model by means of real time flythrough and walk through. Customers can combine together CAD data from various design systems regardless of file format or size, for complete Factory visualization and analysis. Figure 4 shows the Autodesk Navisworks scene with an avatar walking through the federated model of the factory.

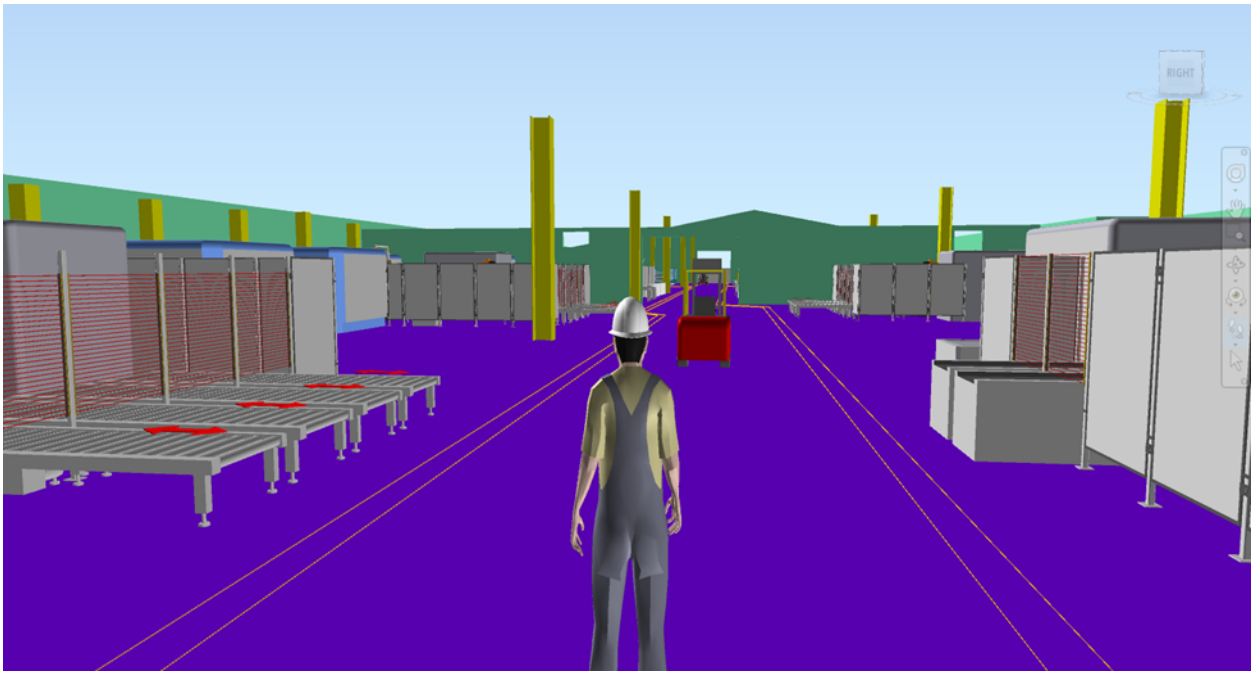

FIGURE 4: WALKING THROUGH THE FEDERATED MODEL OF A FACTORY

The other advantage of Autodesk Navisworks is that it allows you to check for any clash between various elements in the model. Figure 5 shows the Autodesk Navisworks clash.

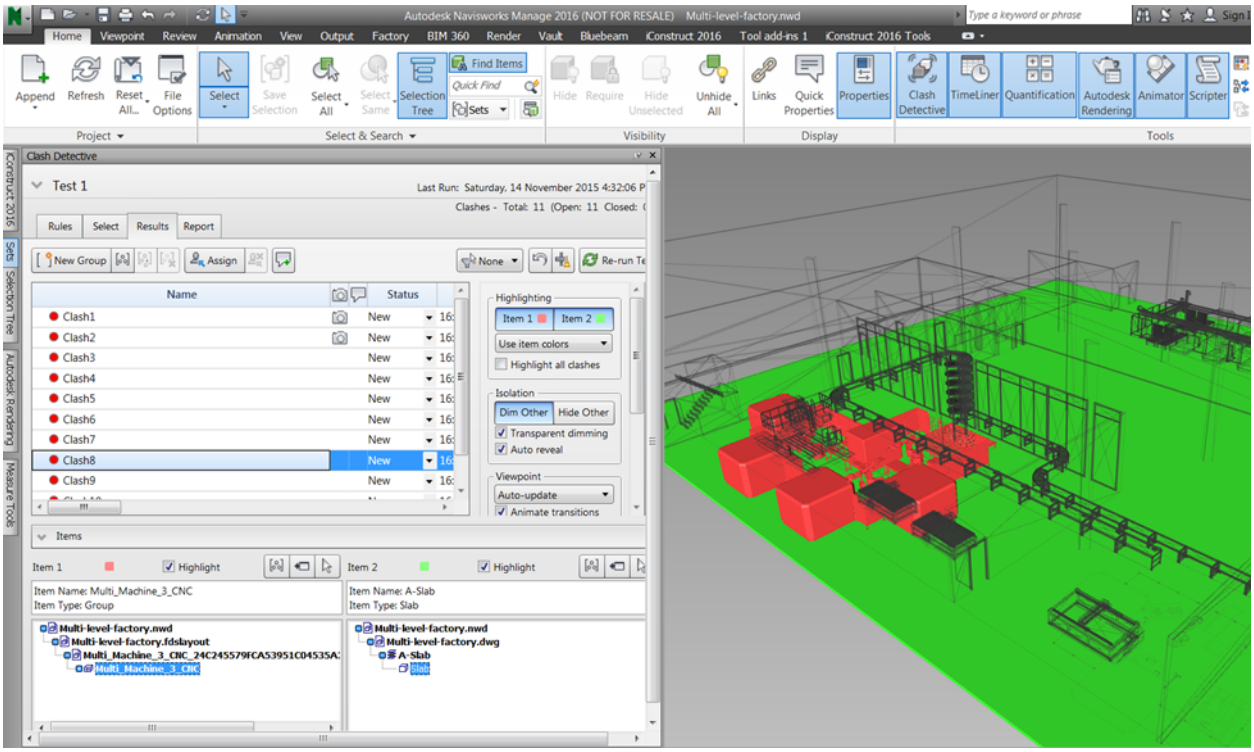

FIGURE 5: AUTODESK NAVISWORKS PICKING UP CLASHES IN THE FACTORY MODEL

Utilizing AutoCAD Factory Utilities

Whether utilizing existing 2D DWG files or making new ones you need to be able to work easily between the Factory Design Suite products. The means to work easily between 2D and 3D is available using the Factory Design Utilities inside AutoCAD. Factory System assets are available in 2D for AutoCAD and 3D for Inventor. Assets placed in a 2D factory layout in AutoCAD can be populated in the 3D layout without you having to perform the entire pick and place steps ordinarily involved in making an assembly. It is easy and reduces the effort of pulling together a 3D version of a factory layout. Figure 6 shows a 2D factory layout in AutoCAD Architecture.

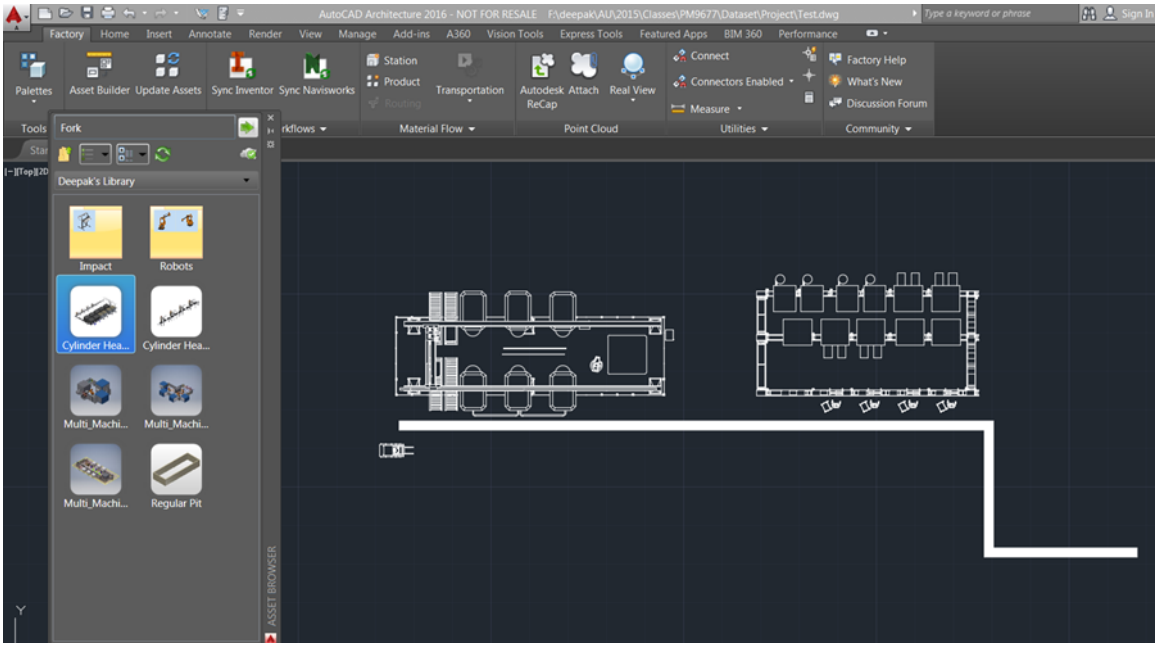

FIGURE 6: 2D FACTORY LAYOUT IN AUTOCAD ARCHITECTURE

Sync Inventor

Creating a 3D model of your 2D factory layout is easily accomplished using the Factory Design Utilities capability. The 2D DWG layout, if populated with factory assets, automatically populates 3D assets when you use Send to Inventor. The 2D layout becomes a DWG overlay on which the 3D objects are placed. Syncing Inventor helps accelerate the 3D layout process.

The following is the process of doing this:

1. Open your 2D DWG layout.
2. On the Factory tab, in the Suite Workflow panel, click Sync Inventor.
3. Inventor is started and the 2D layout becomes a DWG overlay in the new Inventor model.

Figure 7 shows the 3D Inventor layout after syncing.

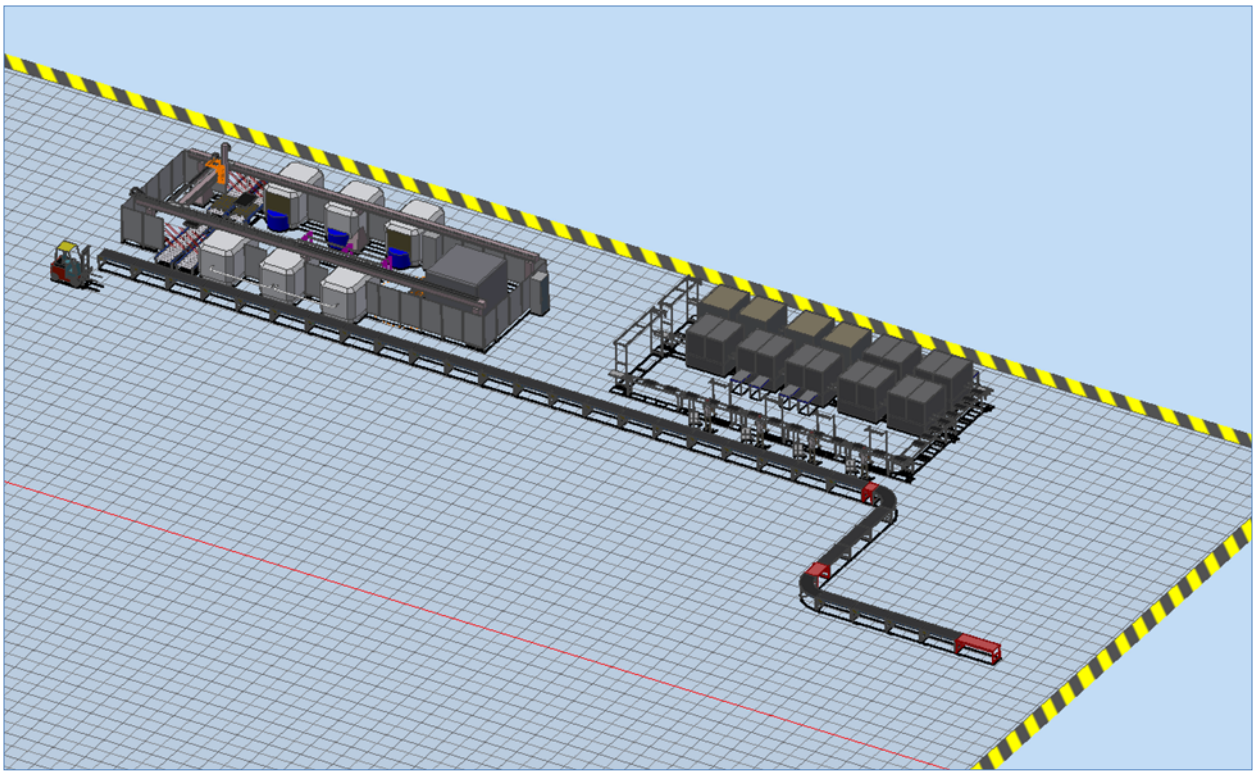

FIGURE 7: 3D FACTORY LAYOUT IN AUTODESK INVENTOR

Utilizing Autodesk Inventor Factory Utilities

A factory design can be populated with component data from multiple sources. You can insert components that exist in the Factory Assets library or you can insert external content. The Factory Assets library contains part and assembly models for use in a Factory Layout assembly. The System Assets directory contains content provided with the Inventor Factory Design Utility and the User Assets directory is for content that you publish. You access the Factory Assets library from the Assets Browser shown in Figure 8.

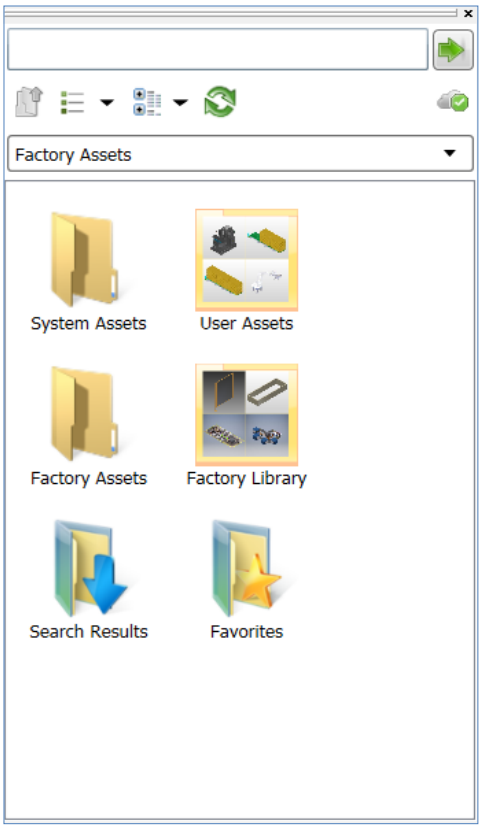

FIGURE 8: THE FACTORY ASSET BROWSER INSIDE AUTODESK INVENTOR

Modifying Asset Properties

The values of most of the parameters listed in the Factory Properties browser can be selected and edited to change the properties of the component. Any changes made to the selected component only reflect in that specific instance of the component. Changes do not affect the Factory Assets library.

The Properties Browser becomes populated with component Model and Miscellaneous parameter data when a parameterized component is selected in the Factory Layout assembly. Model parameters represent the modeling parameters that have been specified as Key Parameters within a component. The Miscellaneous parameters represent specific iProperty parameters that can be modified. Figure 9 shows the process of changing the parameters of the conveyor.

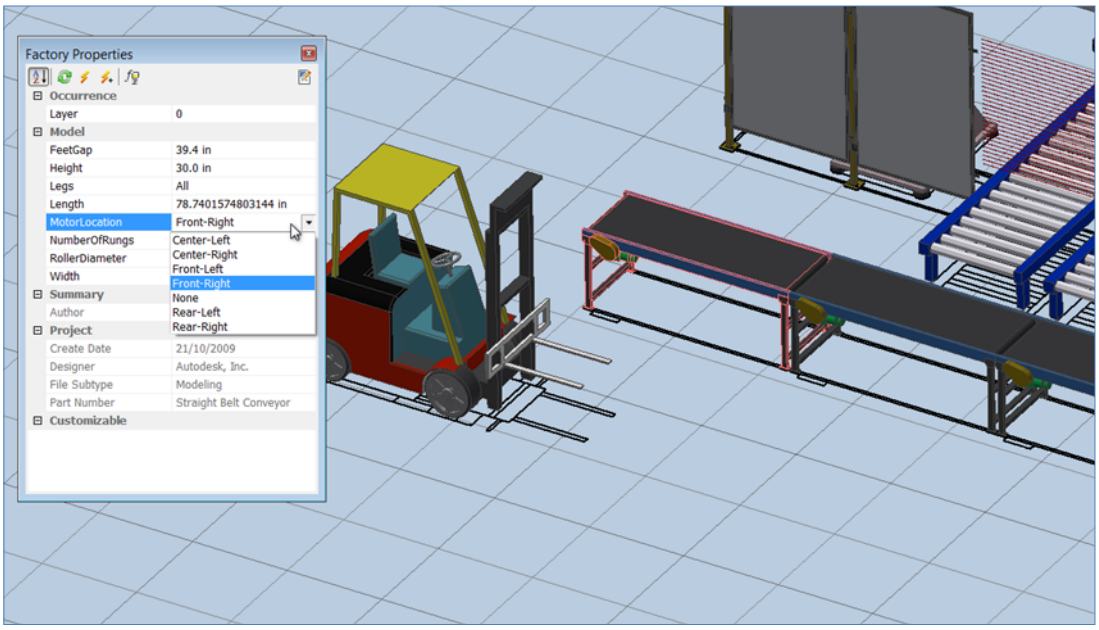

FIGURE 9: CHANGING THE PARAMETERS OF THE CONVEYOR

Creating a Multi-Level Factories

Multi-Level factory designs require a separate layout assembly for each floor. All the new factory layouts can be created in context of the main factory using the **Create Sub-Layout** tool located on the **Layout** ribbon.

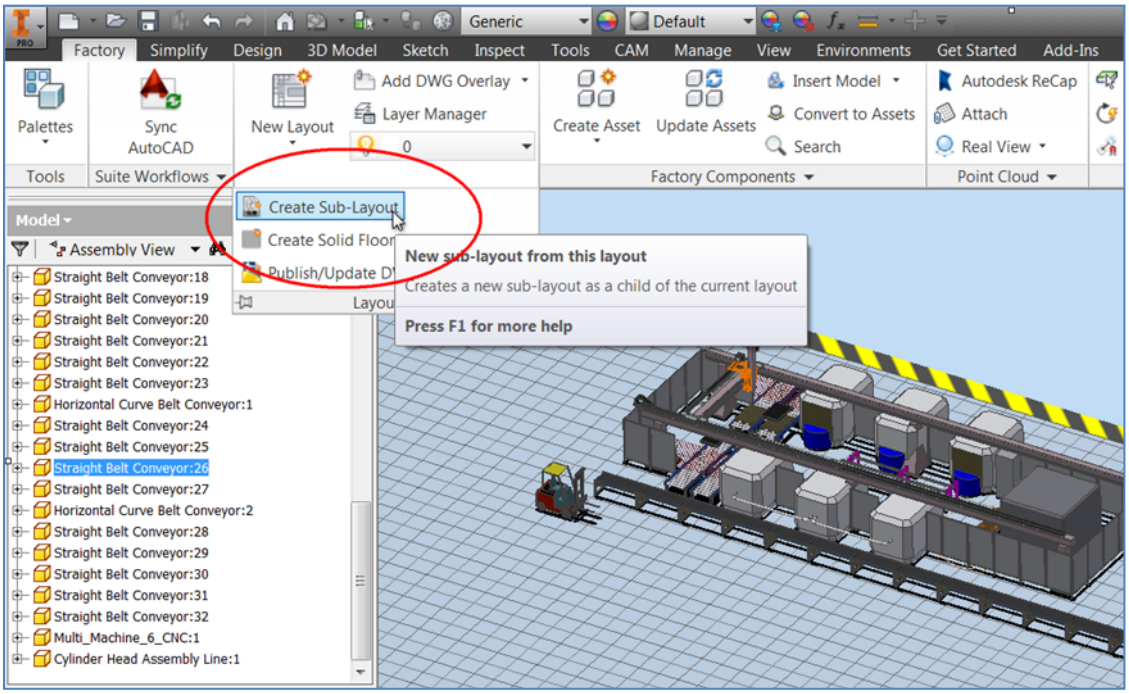

FIGURE 10: CREATING A SUB-LAYOUT

Once the new level is created as a subassembly, you will need to edit the floor location of that new level to ensure that the assets placed on that level go at the right elevation.

Syncing AutoCAD

Once you have created the 3D layout in Autodesk Inventor by either placing assets from the asset browser or by syncing Autodesk Inventor, you need to round-trip the information back into AutoCAD 2D layout by syncing AutoCAD. This is done using the **Sync AutoCAD** button on the **Suite Workflow** ribbon panel, as shown in Figure 11.

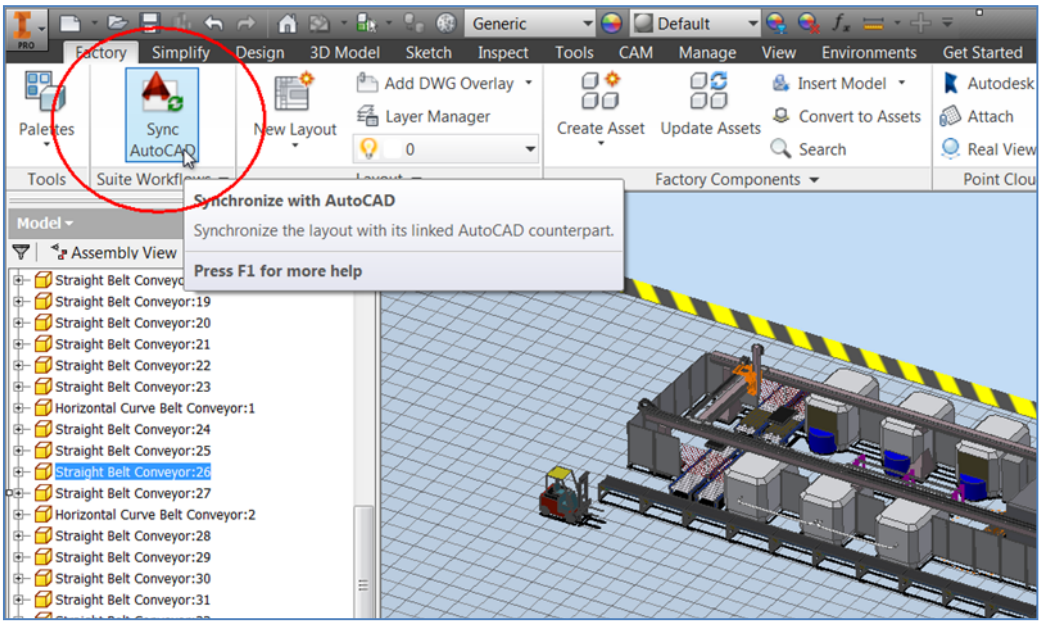

FIGURE 11: SYNCING AUTOCAD

This ensures the 2D layout in AutoCAD perfectly matches the 3D layout in Autodesk Inventor, as shown in Figure 12.

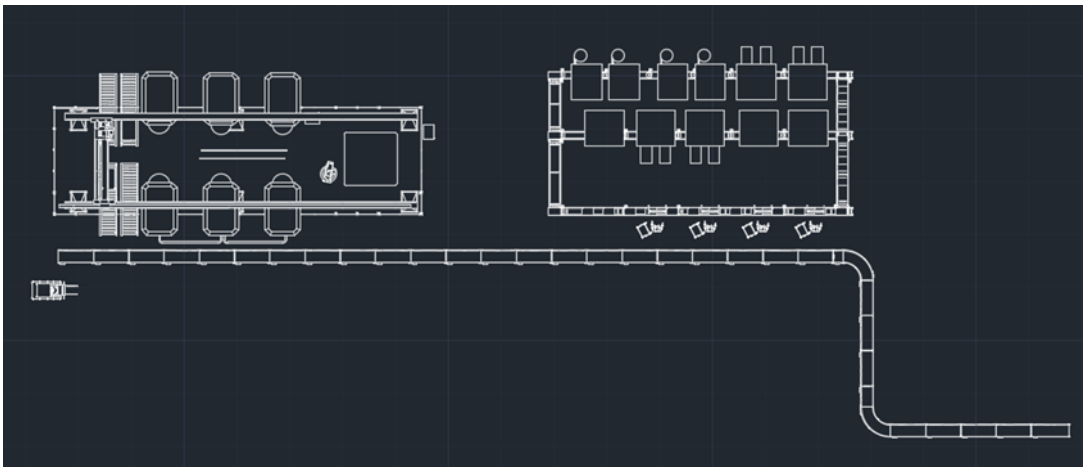

FIGURE 12: AUTOCAD 2D LAYOUT IN SYNC WITH AUTODESK INVENTOR 3D LAYOUT

Creating Federated Factory Model in Autodesk Navisworks

Validating your Factory Layout requires the comparison and analysis of multiple designs from various stakeholders. Your Factory Layout must interface with the Architectural Facility and the Manufacturing designs supplied by the System Integrators or Factory Owners. Putting all this information into a single environment is often beyond the capabilities of most software programs.

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Autodesk Navisworks allows you to open and append files from more than 50 native formats, such as AutoCAD DWG, Inventor IPT and IAM, Revit RVT, Point Cloud RCS and RCP, and so on.

To create the federated factory model, simply open the AutoCAD 2D layout in Autodesk Navisworks. Because the Inventor IAM is also linked with the DWG file, it automatically appends the IAM file with the DWG file, thus creating the federated factory model, as shown below in Figure 13.

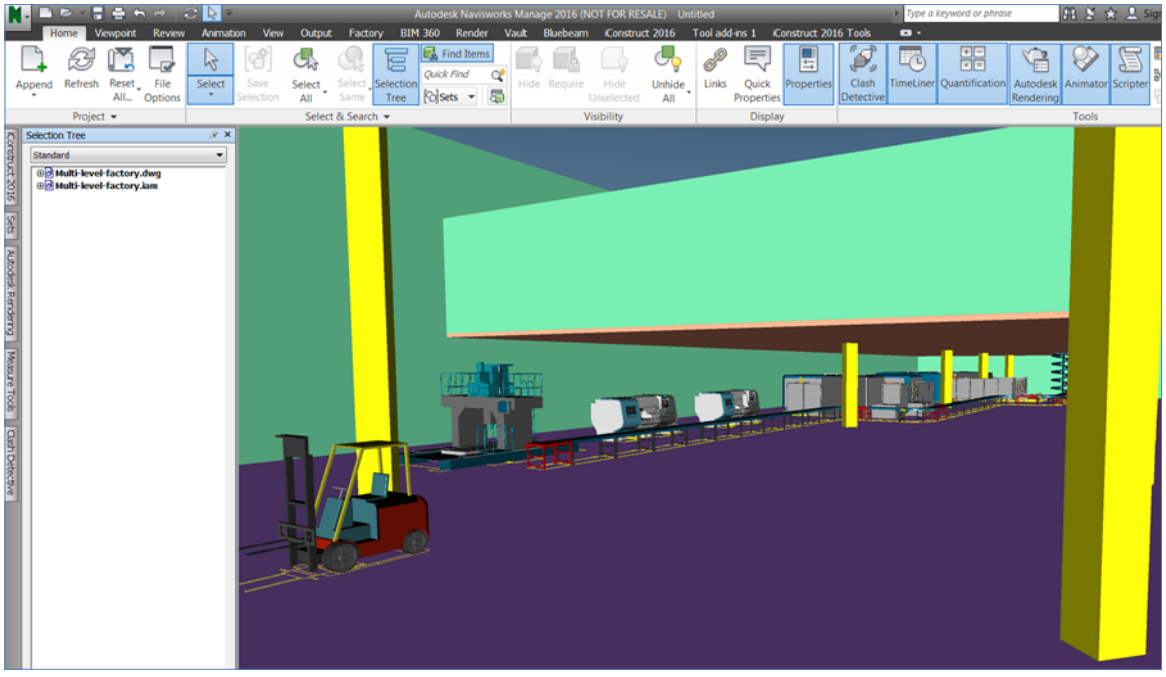

FIGURE 13: THE FEDERATED FACTORY MODEL CREATED IN AUTODESK NAVISWORKS

Checking Clashes in Autodesk Navisworks

As mentioned earlier, one of the biggest advantages of creating the federated factory model in Autodesk Navisworks is so that you could check clashes between the factory building, mechanical, electrical, and plumbing services and the machine layout.

Autodesk Navisworks allows you to perform the following four types of clashes:

Hard: In this type of clash, only the objects that physically intersect will be considered as clashing.

Hard (Conservative): In this type of clash, even though the geometry triangles are not intersecting, the objects will be considered as clashing.

Clearance: In this type of clash, the objects will be considered as clashing if they come within the specified distance of each other.

Duplicates: This type of clash is performed to make sure there are no duplicate overlapping objects in the model.

The following is the process of running hard clash between the factory building and the machine layout.

1. In Autodesk Navisworks, make sure you have the federated model of the factory opened.

2. Pin the **Clash Detective** window on the screen

3. From the top right of the **Clash Detective** window, click **Add Test**, as shown in Figure 14.

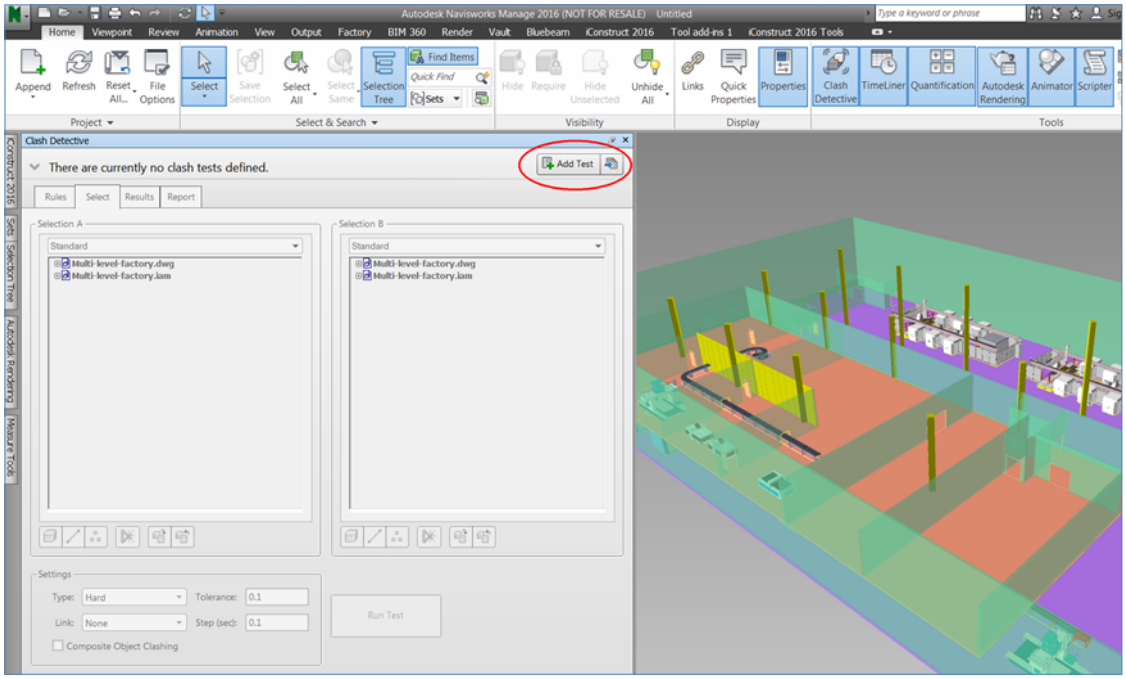

FIGURE 14: ADDING A CLASH TEST

4. Enter the name of the test as **Building Vs Machines**.

5. From the **Section A** area, select the DWG file of the factory building.

6. From the **Section B** area, select the IAM file of the assembly machine line.

7. From the **Type** list near the bottom left of the **Clash Detective** window, select **Hard** to perform hard clash.

8. In the **Tolerance** edit box, enter 0.01.

9. Click the **Run Test** button; the clash test will be run between the selected files and the results will be displayed, as shown in Figure 15.

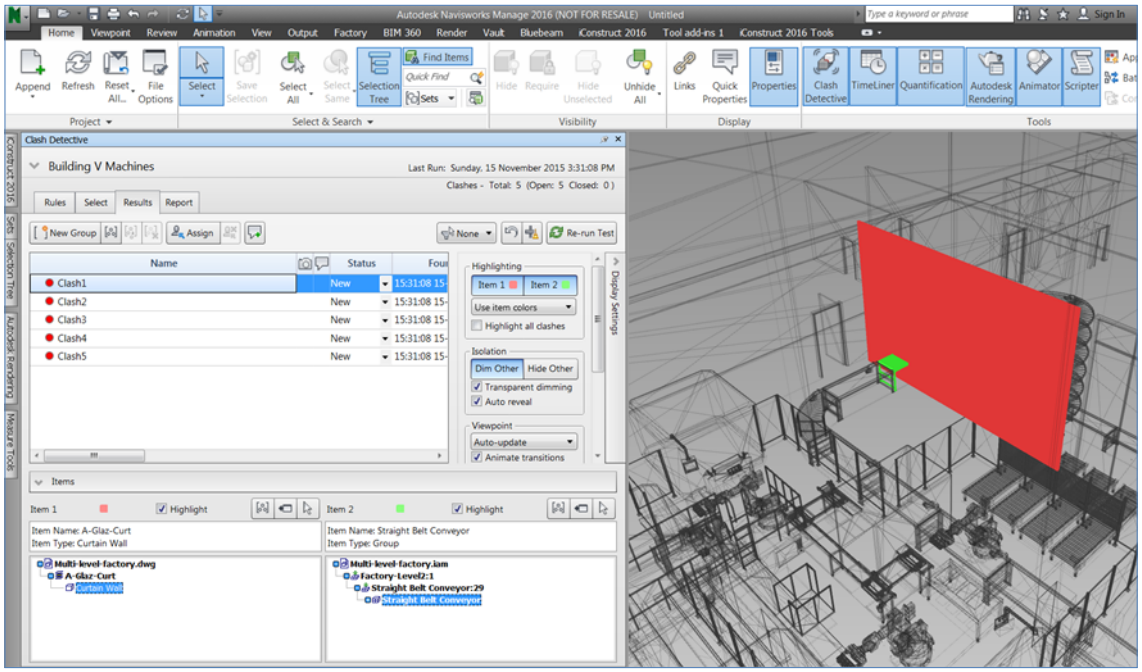

FIGURE 15: VIEWING THE CLASH RESULTS

To resolve these clashes, you can return to the AutoCAD DWG file or Autodesk Inventor IAM file, depending on what needs to be changed. Once you make the changes, the following are the steps to update the clashes.

1. From the **Quick Access Toolbar** at the top of the Autodesk Navisworks window, click the **Refresh** button; the Autodesk Navisworks model will be refreshed with the new changes.

2. Now, to update the clash test, right-click on the clash test name in the top area of the **Clash Detective** window and select **Run**, as shown in Figure 16.

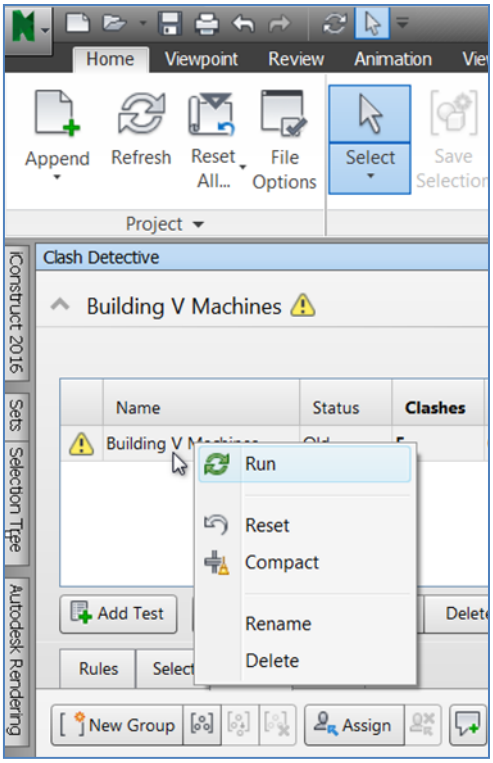

FIGURE 16: UPDATING THE CLASH RESULTS

3. Once the clash test is updated, you can see if the clashes have been resolved or not, as shown in Figure 17.

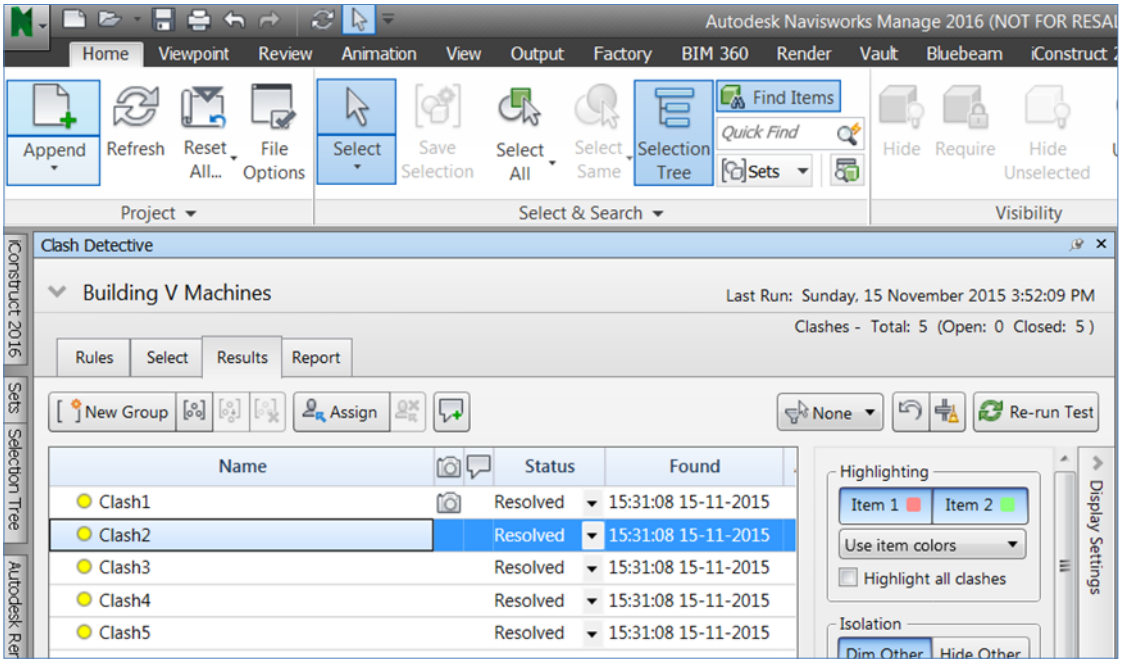

FIGURE 17: THE CLASH RESOLVED