

CS317848-L

Navisworks Clash Detection: Saving Time and Money by Setting up Clash Templates

Deepak Maini
Cadgroup Australia

Learning Objectives

- Learn how to create and save simple and complex search sets
- Learn how to run clash tests based on search sets
- Learn about the process of saving clash templates
- Learn how to import clash templates to run various clash tests in variety of projects

Description

One of the core features of delivering a BIM (Building Information Modeling) project is design coordination and clash detection. You need to check clashes between different discipline models to ensure reduced site-errors issues. This lab will focus on creating clash templates that can be reused on various BIM projects to save time and money. In this lab, you'll create search sets for items such as structural members, mechanical ductwork, plumbing, floors, ceilings, and so on. These will be created by searching Revit element categories that are common to most Revit models. You'll then perform clash tests based on these search sets. These clash tests will then be exported as a clash template and then imported into other files. This will let you save time when setting up these standard clashes in other files and projects.

Speaker

Deepak Maini a qualified Mechanical Engineer with more than 20 years of experience working in the design industry. Currently working as the National Technical Manager - Named Accounts with Cadgroup Australia, Deepak is also the author of the [Up and Running with Autodesk Navisworks](#), [Autodesk Navisworks 2020 for BIM/VDC Managers](#), and [Up and Running with Autodesk Advance Steel](#) series of textbooks.

Deepak is a regular speaker at Autodesk University in Las Vegas USA and was awarded as the [Best Speaker in the Instructional Demo category two years](#) in a row at AU Las Vegas 2018 and 2017. He was also recently voted as the [Best Speaker at the Bluebeam XCON 2019](#) conference in Washington DC.

Additionally, he is among the Top Speakers at various BILT conferences in ANZ and Asia. He is also a guest lecturer at the University of Technology Sydney (UTS) and the University of New South Wales (UNSW), two of the biggest universities in Australia.



Levels of Clashes

The clashes are generally divided into the following three categories:

Level 1 Clashes

These are assigned the top priority and are to be fixed as soon as possible. Examples include Mechanical Ducts and Pipes Vs Structure, Mechanical Ducts and Pipes Vs Cable Trays, Mechanical Ducts and Pipes Vs Plumbing Pipes, and so on.

Level 2 Clashes

These are considered important for the construction process and must be rectified as the second priority. Examples include Mechanical Ducts and Pipes Vs Floors, Mechanical Ducts and Pipes Vs Fire Sprinklers, Cable Trays Vs Structure, Cable Trays Vs Ceilings, and so on.

Level 3 Clashes

These are generally with the items that change on a regular basis during the design process. These need to be fixed only before the submission of the models. Examples include Hydraulic Pipes Vs Electrical Equipment and Fixtures, Hydraulic Pipes Vs Mechanical Equipment and Fixtures, and so on.

Important Note

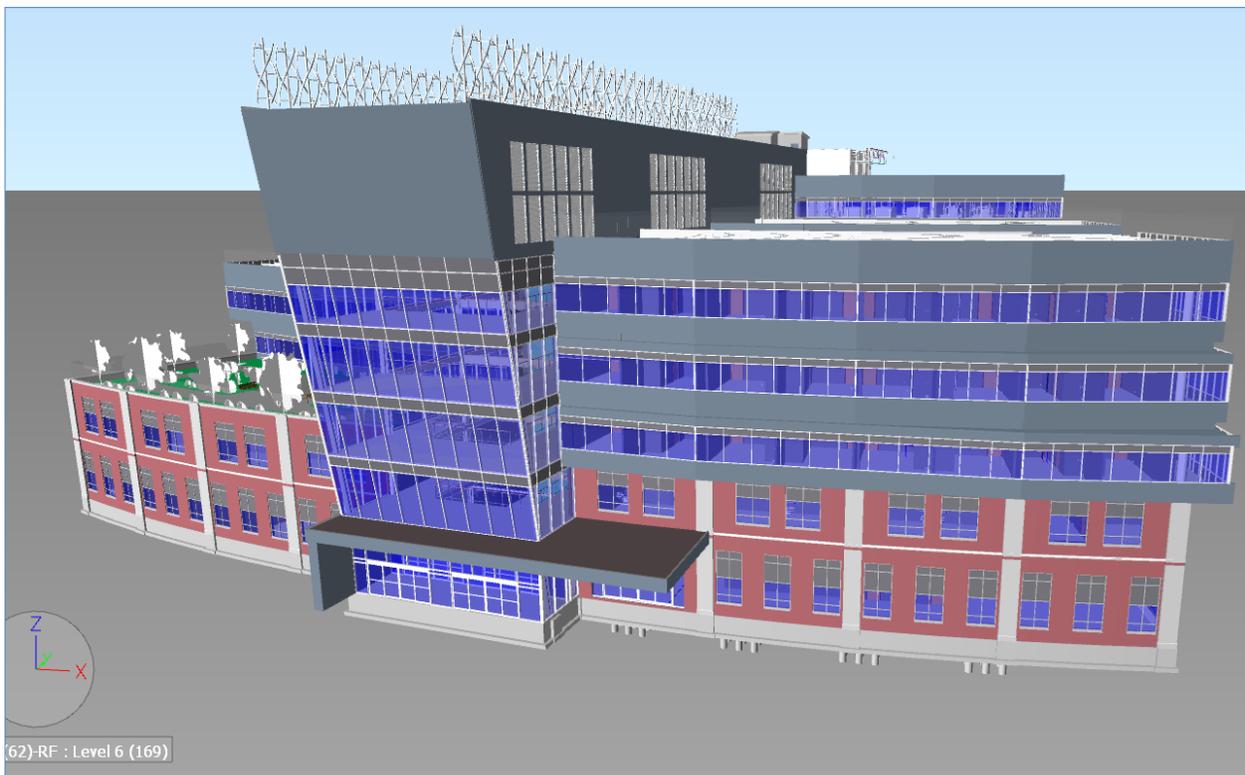
One important quote that I want you to always keep in mind while running clashes or while signing a BIM contract is that “**Fully Coordinated Doesn't Mean Clash Free**”.

A fully coordinated design means that clashes were detected and reviewed, but not necessarily resolved. For example, valid penetrations are clashes that are detected and reviewed, but do not necessarily need to be resolved as some holes can be drilled on site to let the pipes through.

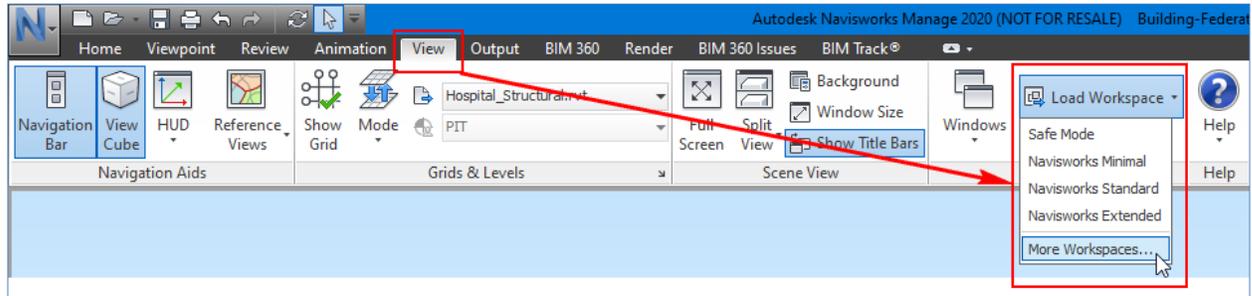
Section 1: Opening Autodesk Navisworks Model and Changing Workspace

In this section, you will open an Autodesk Navisworks file and then load a predefined workspace.

1. Start Autodesk Navisworks, if it is not already started on your computer.
2. From the **Quick Access** toolbar, select **Open**; the **Open** dialog box is displayed.
3. From the **Files of type** list at the bottom of the dialog box, select **All Files**.
4. Browse to the **Clash Template Lab** folder and double-click on the **Building-Federated.nwd** file; the **Publish** dialog box is displayed showing you the information about this file.
5. Click **OK** in the dialog box; the Autodesk Navisworks scene opens, as shown in the figure below.



- From the **View** ribbon tab > **Workspace** ribbon panel, click on the **Load Workspace > More Workspaces**, as shown in the figure below; the **Load Workspace** dialog box is displayed.



- Browse to the **Clash Template Lab > Workspaces** folder and double-click on the **AU-Lab.xml** file; Autodesk Navisworks resets and shows you the **Selection Tree** and **Sets** windows on the left of the graphics window and **Properties** and **Saved Viewpoints** windows on the right.
- Move the cursor to the center of the graphics window. Now, press and hold down the **SHIFT** key and the **Wheel Mouse Button** and drag the mouse to orbit the model.

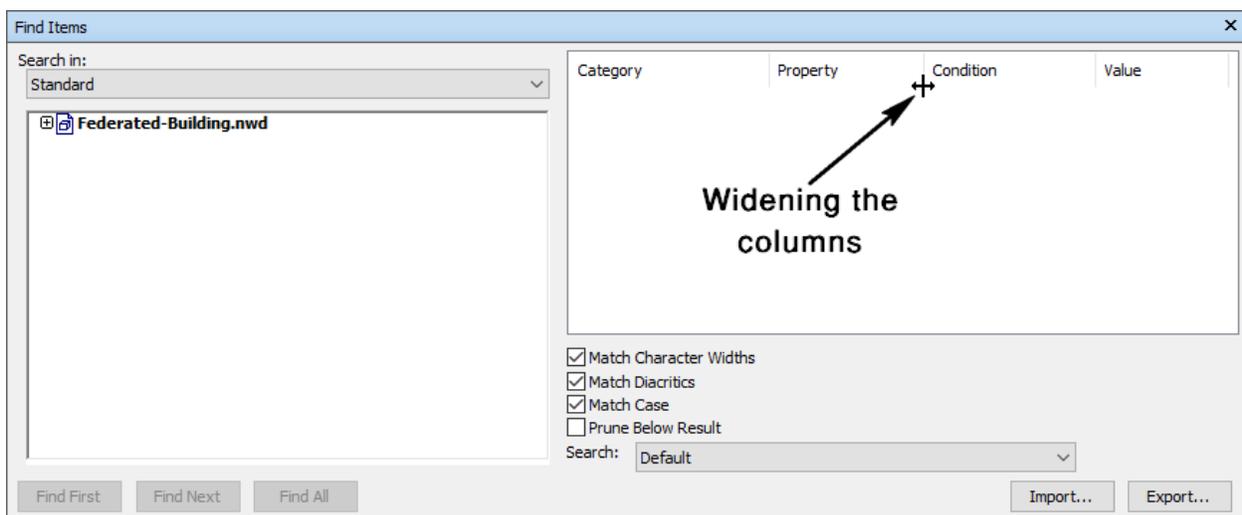
Tip: You can scroll on any face, edge or corner of the model to change the orbit pivot point to that face, edge or corner.

- From the **Saved Viewpoints** window on the right side of the graphics window, click **Overview** to activate this viewpoint.

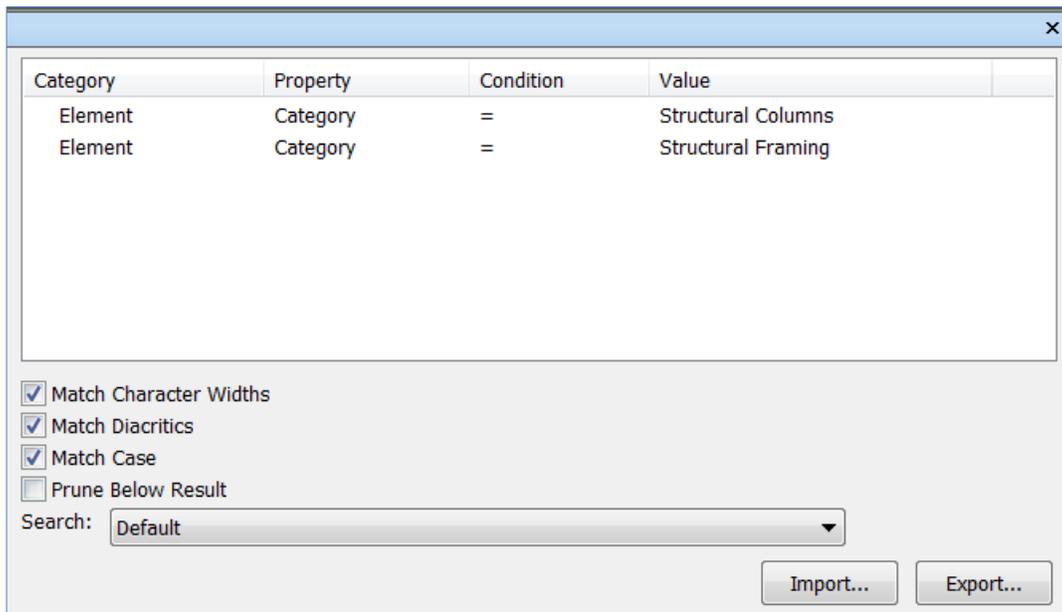
Section 2: Creating Search Sets

In this section, you will create various search sets that will be used to perform clash tests in later sections. To keep the sets general, they will be created by searching based on **Element Categories**, which are common in most Autodesk Revit models.

1. From the bottom of the graphics window, click the **Find Items** window and pin it below the graphics window.
2. Make the columns in this window wider, as shown in the figure below.



3. From the **Category** column in the **Find Items** window, select **Element**.
4. From the **Property** column, select **Category**.
5. From the **Condition** column, select **=**.
6. From the **Value** column, select **Structural Columns**; a second row of the search category is added.
7. In the second row, from the **Category** column, select **Element**.
8. From the **Property** column, select **Category**.
9. From the **Condition** column, select **=**.
10. From the **Value** column, select **Structural Framing**, as shown in the figure below.



- From the bottom left corner of the **Find Items** window, select **Find All**; an error message is displayed informing you that no object is found.

The reason no objects were found is that the two rows of search criteria were added as "And" condition. Therefore, you need to change the second to condition to "Or" condition. Alternatively, you can change the Condition to Contains instead of =. This is what you will do in this example.

- Click **OK** in the **No objects found** dialog box.
- Right-click on the second search condition and select **Delete Condition** from the shortcut menu; the second condition is deleted.

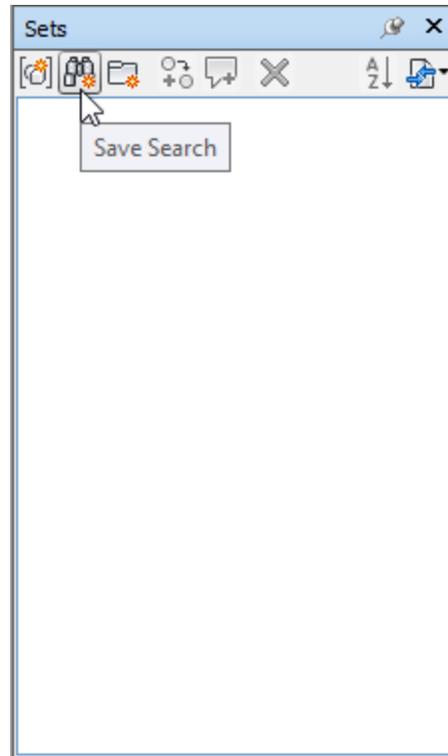
*You will now change the Condition of the first row from = to **Contains** and type **Structural** in the **Value** field.*

- From the **Condition** list of the first search row, select **Contains**.
- In the **Value** field, type **Structural** and press ENTER.

*It is important that you press ENTER or what you type in the **Value** field will not be registered.*

- Now, click **Find All**; the **Properties** window shows 2818 items selected.

17. From the toolbar at the top in the **Sets** window, click **Save Search**, as shown below; a new search set is added.



18. Rename this search set to **Structure**.

Next, you will create a search set for Mechanical Ductwork. This search set needs to include ducts, duct accessories, duct fittings, and Mechanical Equipment. One option to create this search set is to search for all three items as 'Or' condition. Alternatively, you can use the **Contains** condition instead of = condition to search for the duct items. This is what you will do in this case.

19. Click on the **Value** list of the search row and type **Duct**.

*Please make sure you don't type **Ducts** as adding "s" at the end will not search for duct accessories and duct fittings.*

20. Click **Find All**; the **Properties** window shows 9195 items selected.

The problem with this search is that it also includes flexible ducts. We generally do not include flexible ducts in our clashes. To ignore the flexible ducts, you will add another search row and change it to "**Negate Condition**".

21. Add another search row with the criteria as **Element > Category = Flex Ducts**.
22. Right-click on the second search row and select **Negate Condition**. This will ensure that everything except **Flex Ducts** is selected.

Next, you need to include Mechanical Equipment to this search set, which will be added as an “OR” condition.

23. Add a third two of the search with the criteria as **Element > Category = Mechanical Equipment**.

24. Right-click on the third search row and select **Or Condition** from the shortcut menu.

25. Click **Find All**; the **Properties** window shows 9432 items selected.

26. From the toolbar at the top in the **Sets** window, click **Save Search**; a new search set is added.

27. Rename this search set to **Mechanical Ductwork**.

The next search set you will create is for Ceilings.

28. Click in the blank area of the graphics window to deselect everything.

29. With the three rows of search still listed in the **Find Items** window, right-click on the third row and select **Delete Condition**.

30. Delete the second row as well.

31. From the **Condition** list of the search row, select **=**.

32. Click on the **Value** list and click on ... at the bottom of the list to show additional items in this list.

33. Once the additional items are listed, select **Ceilings**.

34. Click **Find All**; the **Properties** window shows 602 items selected.

35. From the toolbar at the top in the **Sets** window, click **Save Search**; a new search set is added.

36. Rename this search set to **Ceilings**.

37. Click in the blank area of the graphics window to deselect everything.

The next search set you will create is for **Floors** items.

38. With the row of search still listed in the **Find Items** window, change the **Value** to **Floors**.

39. Click **Find All**; the **Properties** window shows 74 items selected.

40. From the toolbar at the top in the **Sets** window, click **Save Search**; a new search set is added.

41. Rename this search set to **Floors**.

42. Click in the blank area of the graphics window to deselect everything.

The next search set is to select cable trays and cable tray fittings. You will use the **Contains** condition and **Cable** as the value.

43. With the row of search still listed in the **Find Items** window, change the **Condition** to **Contains**.

44. In the **Value** field, type **Cable** and then press ENTER.

45. Click **Find All**; the **Properties** window shows 84 items selected.

46. Save this search set with the name **Cable Trays**.

The next search set is for **Walls** items. You will search the element category that contains Walls.

47. With the row of search still listed in the **Find Items** window, in the **Value** field, type **Walls** and then press ENTER.

48. Click **Find All**; the **Properties** window shows 1467 items selected.

49. Save this search set with the name **Walls**.

The last search set is for **Plumbing** items. You will first search for pipe category and will then add additional rows to filter them to sanitary pipes. Finally, you will add an additional row to include plumbing fixtures.

50. With the row of search still listed in the **Find Items** window, change the **Value** to **Pipe** and press ENTER.

If you search with just this information, Navisworks will select plumbing pipes, but will also select all other pipes from all other disciplines. So, you will now add an additional row to make sure these are sanitary pipes.

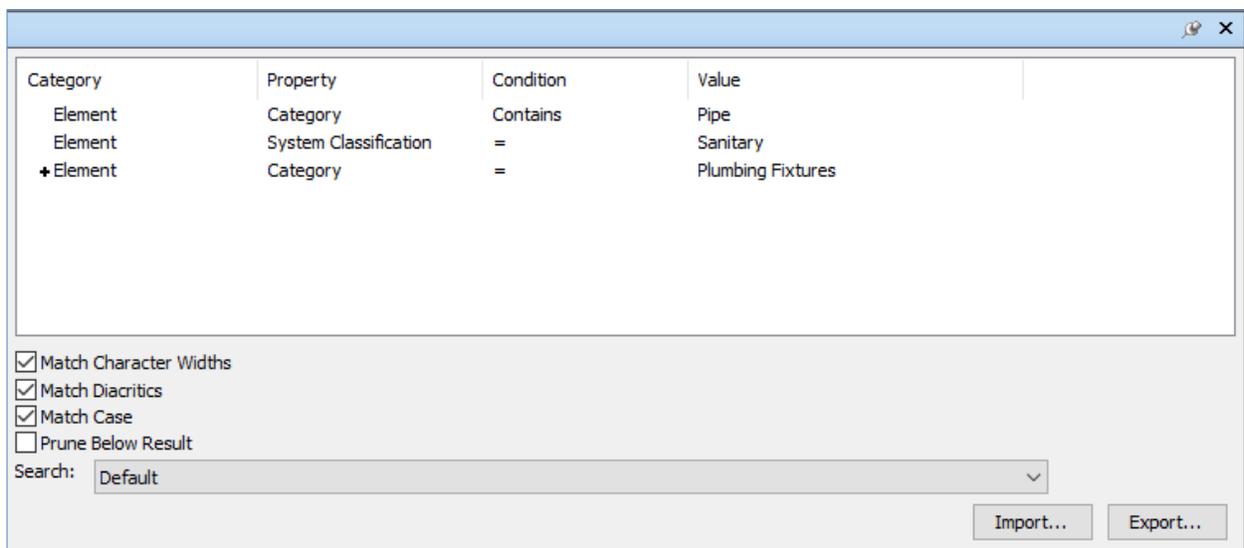
51. Add another row of search based on **Element > System Classification = Sanitary**, refer to the figure below.

Lastly, to include plumbing fixtures, you will add another row of search.

52. Add another row of search based on **Element > Category = Plumbing Fixtures**, refer to the figure below.

53. Right-click on the last row and select **Or Condition** from the shortcut menu.

The figure below shows the **Find Items** window with these three search conditions.



54. Click **Find All**; the **Properties** window shows 3858 items selected.

55. From the toolbar at the top in the **Sets** window, click **Save Search**; a new search set is added.

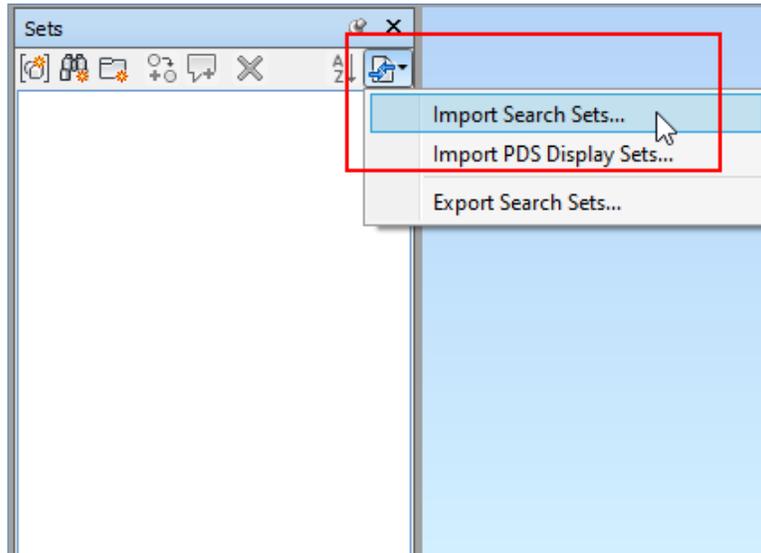
56. Rename this search set to **Plumbing**.

57. Click in the blank area of the graphics window to deselect everything.

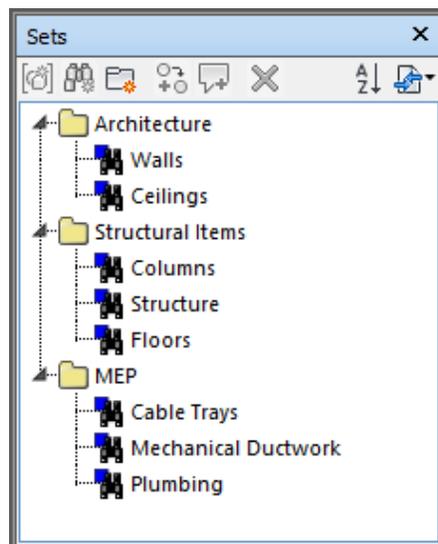
For this tutorial, you will now delete these search sets and import the ones that are provided to you. The search sets provided to you are all created exactly the way you created yours.

58. In the **Sets** window, select all the search sets and delete them.

59. Click on the **Import/Export** flyout on the top right of the **Sets** window and select **Import Search Sets**, as shown in the figure below:



60. Browse to the **Clash Template Lab > Search Sets** folder and double-click on the **For-Clashes.xml** file; the **Architecture**, **Structural Items**, and **MEP** folders are added to the **Sets** window. Each of these folders contains search sets for that discipline, which are similar to the ones you created earlier in this section, as shown in the figure below.



Section 3: Performing Clash Tests

In this section, you will perform various clash tests using the search sets created in the previous section. You will add the following Level 1 and 2 clash tests:

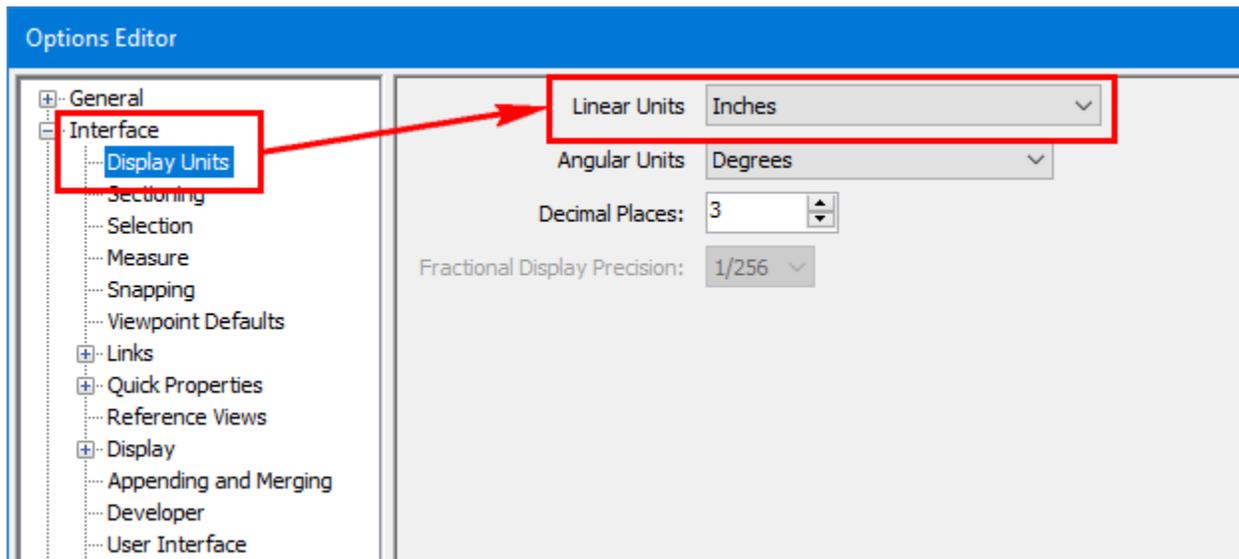
- **Mechanical Ductwork Vs Structure**
- **Mechanical Ductwork Vs Cable Trays**
- **Mechanical Ductwork Vs Ceilings**
- **Mechanical Ductwork Vs Plumbing**
- **Mechanical Ductwork Vs Floors**
- **Cable Trays Vs Plumbing**

But first, you need to change the workspace to display the **Clash Detection** window and turn off all the other windows.

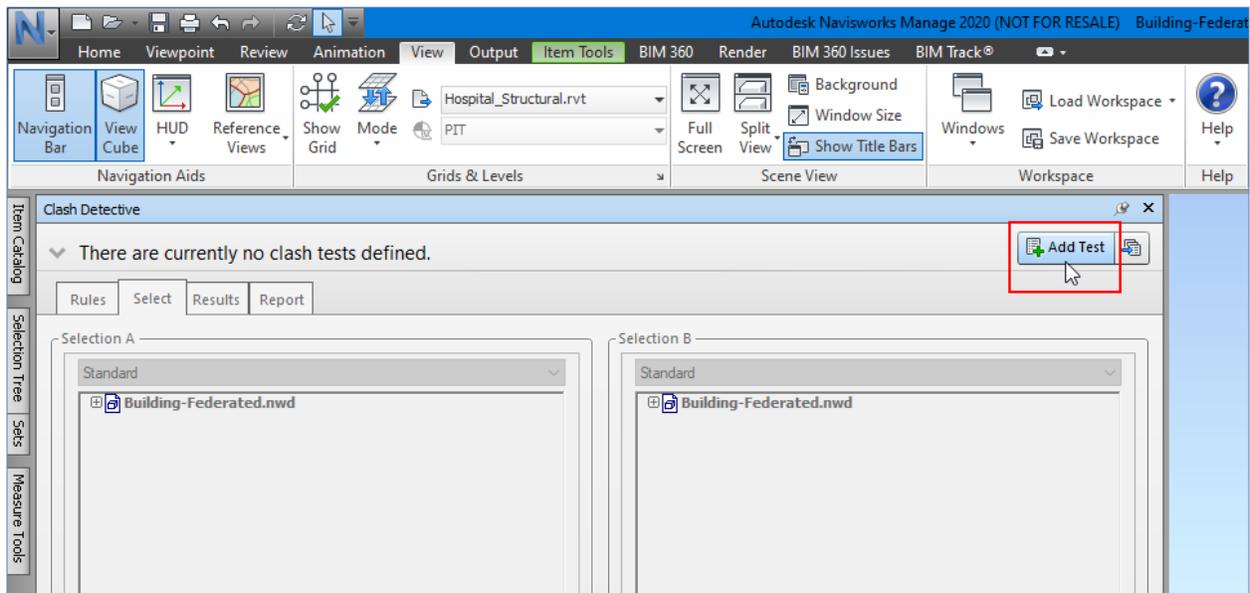
1. From the **View** ribbon tab > **Workspace** ribbon panel, click on the **Load Workspace > More Workspaces**; the **Load Workspaces** dialog box is displayed.
2. Browse to the **Clash Template Lab > Workspaces** folder and double-click on the **Clash Detection.xml** file; Autodesk Navisworks resets and shows you the **Clash Detection** window on the left of the graphics window. All the other windows are hidden. This ensures more area in the graphics window to display the model.
3. From the **Saved Viewpoints** window (hidden on the right of the graphics window), select the **Overview** viewpoint.

You will first change the display units to your preferred units.

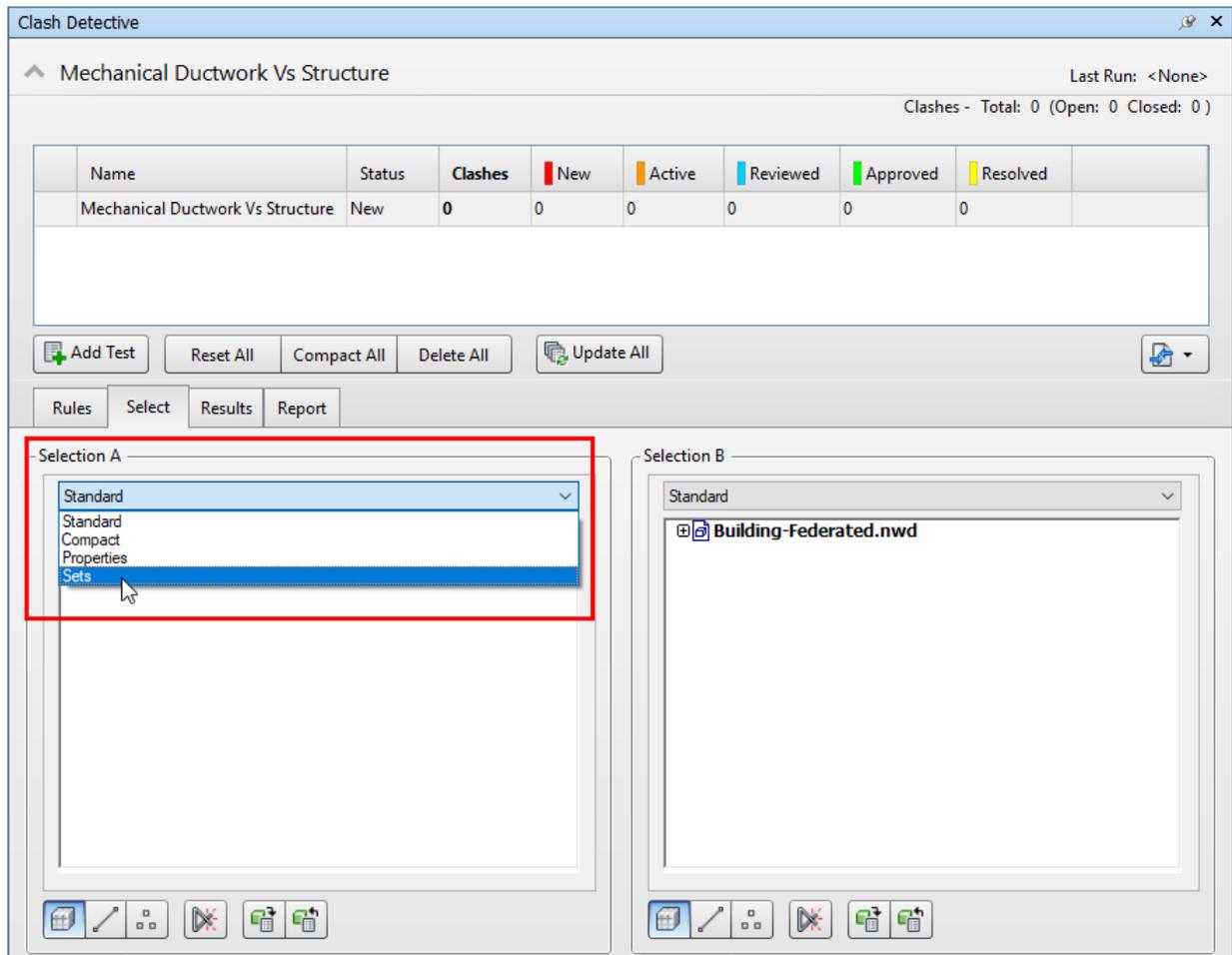
4. Press the F12 key to display the **Options Editor** dialog box.
5. From the left pane, expand **Interface** and select **Display Units**.
6. From the right pane, click on the **Linear Units** list and select **Inches** or **Meters** as the units, as shown in the following figure:



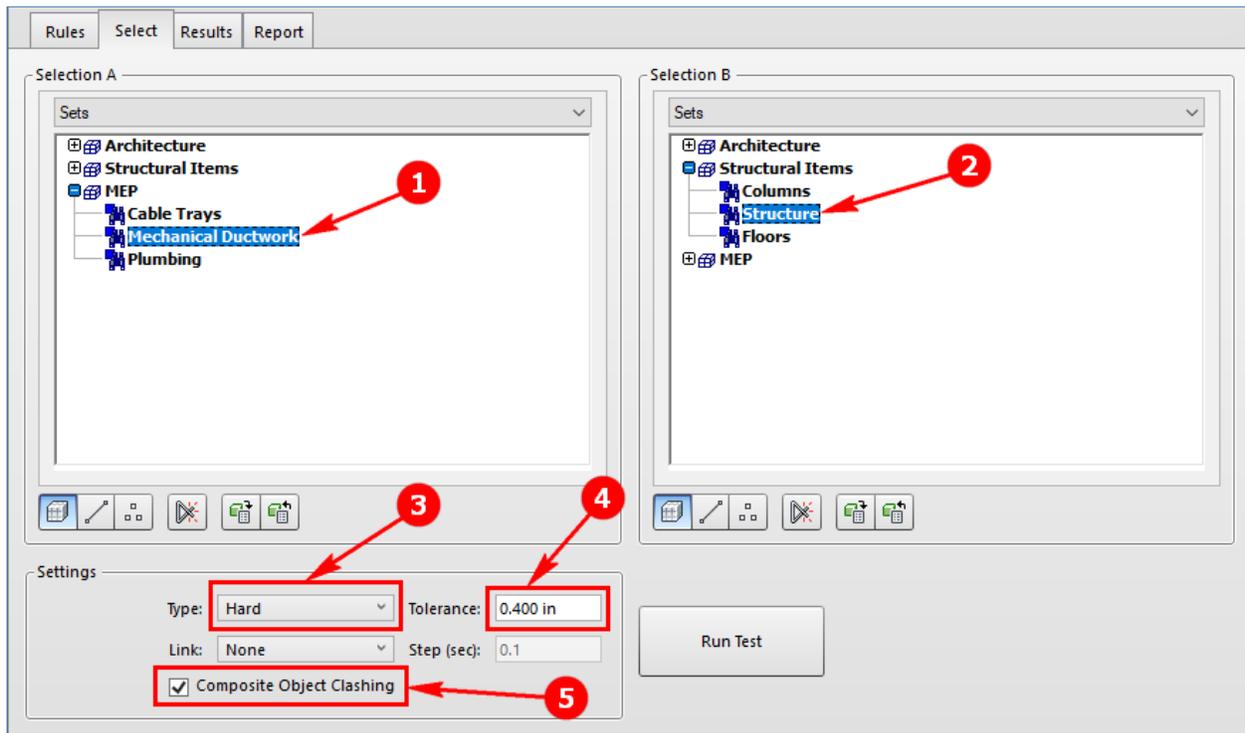
- From the top right of the **Clash Detective** window, click **Add Test**, as shown in the figure below; a new clash test is added.



- Rename the clash test to **Mechanical Ductwork Vs Structure**.
- In the **Select** tab > **Selection A** area, click the **Standard** list and select **Sets**, as shown in the figure below; the folders with all the search sets are now listed.



10. Expand the **MEP** folder and select the **Mechanical Ductwork** search set.
11. In the **Select** tab > **Selection B** area, click the **Standard** list and select **Sets**; the folders with all the search sets are now listed.
12. From the **Structural Items** folder, select the **Structure** search set.
13. Make sure in the **Settings** area > **Type** list, **Hard** is selected.
14. Change the **Tolerance** value to **0.4 Inches** or **0.01 m (10 mm)**, as shown in the figure below.
15. Make sure the other settings are similar to the one shown in the figure below.



16. Click **Run Test**; you will be informed that there are 324 (Imperial) or 327 (Metric) clashes found, as shown in the figure below.

Clash Detective

Mechanical Ductwork Vs Structure Last Run: Sunday, 13 October 2019 2:40:22 PM
Clashes - Total: 324 (Open: 324 Closed: 0)

Name	Status	Clashes	New	Active	Reviewed	Approved	Resolved
Mechanical Ductwork Vs Structure	Done	324	324	0	0	0	0

Name	Status	Level	Grid
Clash1	New	Level 5 (6713)	R3(5)-f
Clash2	New	Level 5 (6704)	R7(1)-f
Clash3	New	Level 4 (6702)	R4(5)-f
Clash4	New	Level 5 (6680)	L7(12)-f
Clash5	New	Level 5 (6680)	R5(-4)-f
Clash6	New	Level 5 (6554)	R5(7)-f
Clash7	New	Level 5 (6554)	R5(7)-f
Clash8	New	Level 5 (6693)	R3(-24)-f

Highlighting

Item 1 ● Item 2 ●

Use item colors

Highlight all clashes

Isolation

Transparent dimming

Auto reveal

Viewpoint

Auto-update

Animate transitions

Items

Item 1 ● Highlight

Element Category: Ducts
Item Name: Rectangular Duct
Item Type: Ducts: Rectangular Duct: Mitered Elbows / Taps

Building-Federated.nwd
Hospital_HVAC.rvt
Level 6
Ducts
Rectangular Duct
Mitered Elbows / Taps
Rectangular Duct

Item 2 ● Highlight

Element Length: 629.921 in
Element Category: Structural Framing
Item Name: W33X152
Item Type: Structural Framing

Building-Federated.nwd
Hospital_Structural.rvt
Level 6 TOS
Structural Framing
W-Wide Flange
W33X152
W-Wide Flange
W33X152

17. In the **Results** tab, one by one click on the clash results to interrogate these clash results.

18. Add a second clash test and rename it to **Mechanical Ductwork Vs Ceilings**.

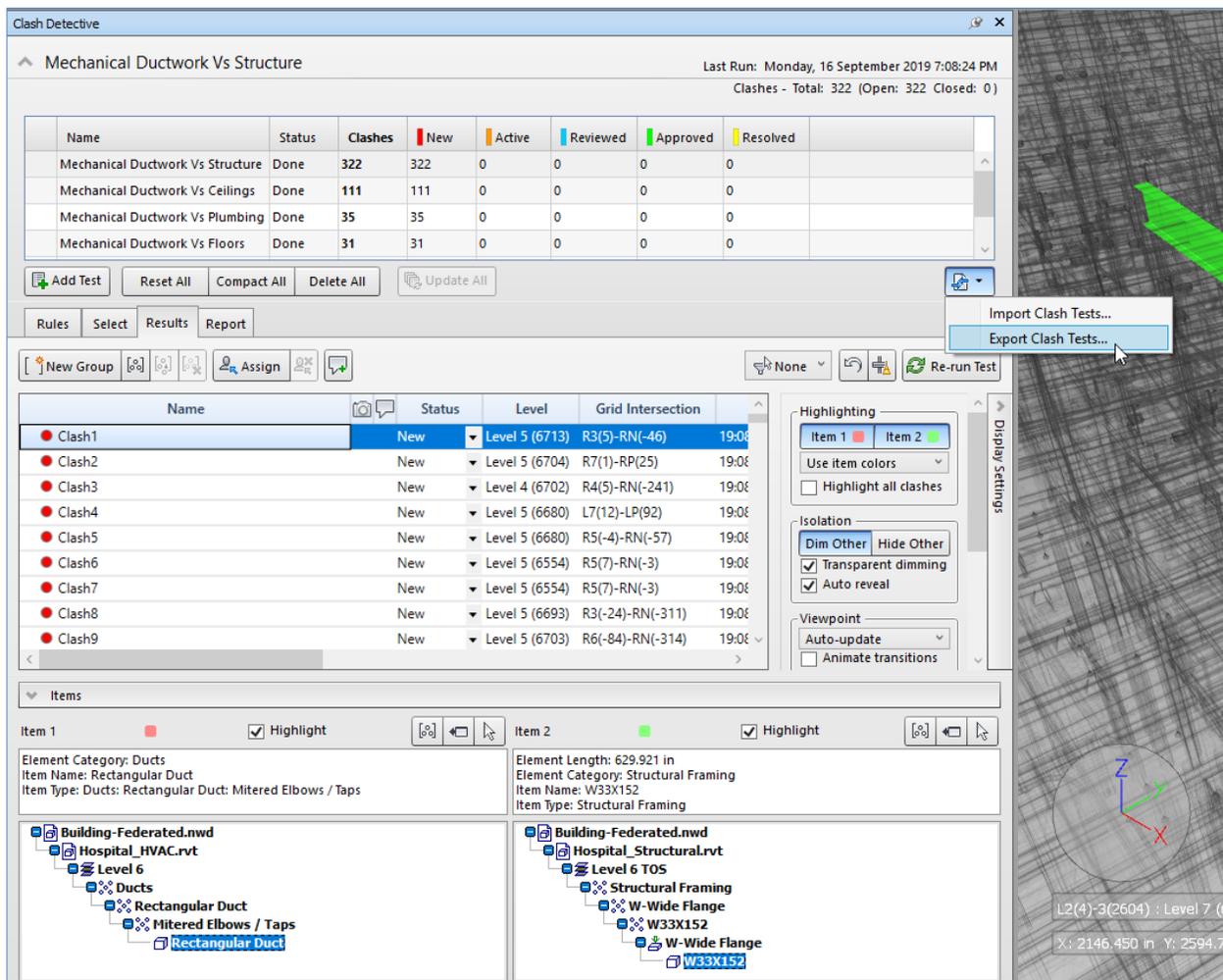
19. In the **Selection A** area > **Standard** list > **Sets** > **MEP** folder, select the **Mechanical Ductwork** search set.

20. In the **Selection B** area > **Standard** list > **Sets** > **Architecture** folder, select the **Ceilings** search set.
21. Accept the remaining settings similar to the one in the previous clash test and click **Run Test**; you will be informed that there are 116 clashes found.
22. Add a third clash test and rename it to **Mechanical Ductwork Vs Plumbing**.
23. In the **Selection A** area > **Standard** list > **Sets** > **MEP** folder, select the **Mechanical Ductwork** search set.
24. In the **Selection B** area > **Standard** list > **Sets** > **MEP** folder, select the **Plumbing** search set.
25. Accept the remaining settings similar to the one in the previous clash test and click **Run Test**; you will be informed that there are 37 clashes found.
26. Add a fourth clash test and rename it to **Mechanical Ductwork Vs Floors**.
27. In the **Selection A** area > **Standard** list > **Sets** > **MEP** folder, select the **Mechanical Ductwork** search set.
28. In the **Selection B** area > **Standard** list > **Sets** > **Structural Items** folder, select the **Floors** search set.
29. Accept the remaining settings similar to the one in the previous clash test and click **Run Test**; you will be informed that there are 31 clashes found.
30. Similarly, add another clash test between **Mechanical Ductwork Vs Cable Trays**, which will not have any clashes
31. Add the last clash test between **Plumbing Vs Structure**.

Section 4: Exporting Clash Templates

Because the clash tests you created were based on search sets, these can now be exported as clash templates. In this section, you will do this.

1. Click the **Import/Export Clash Test** flyout and select **Export Clash Tests** as shown in the figure below; the **Export** dialog box is displayed.



2. Browse to the **Clash Template Lab** folder and save the file there with the name **Project-Critical-Clashes**. The file will be saved with XML as the extension.

All the clash tests you created will be saved in this template.

3. Click the **Select** tab in the **Clash Detective** window.

4. From the **Saved Viewpoints** window (hidden on the right of the graphics window), select the **Overview** viewpoint.
5. On the **Quick Access** toolbar, click **Save** to save the file.

Section 5: Importing Clash Templates

Because the clash tests you created were based on search sets, these can now be imported in another file. In this section, you will do this.

1. On the **Quick Access** toolbar, click **Open**.
2. Browse to the **Clash Template Lab** folder and double-click on the **Clash-Import.nwd** file.
3. Review the information about this file in the **Publish** dialog box and then click **OK**. This model is totally different from the model you were working on earlier, as shown in the figure below. (*Thanks to Arman Gukasyan of Revizto for providing the model*)



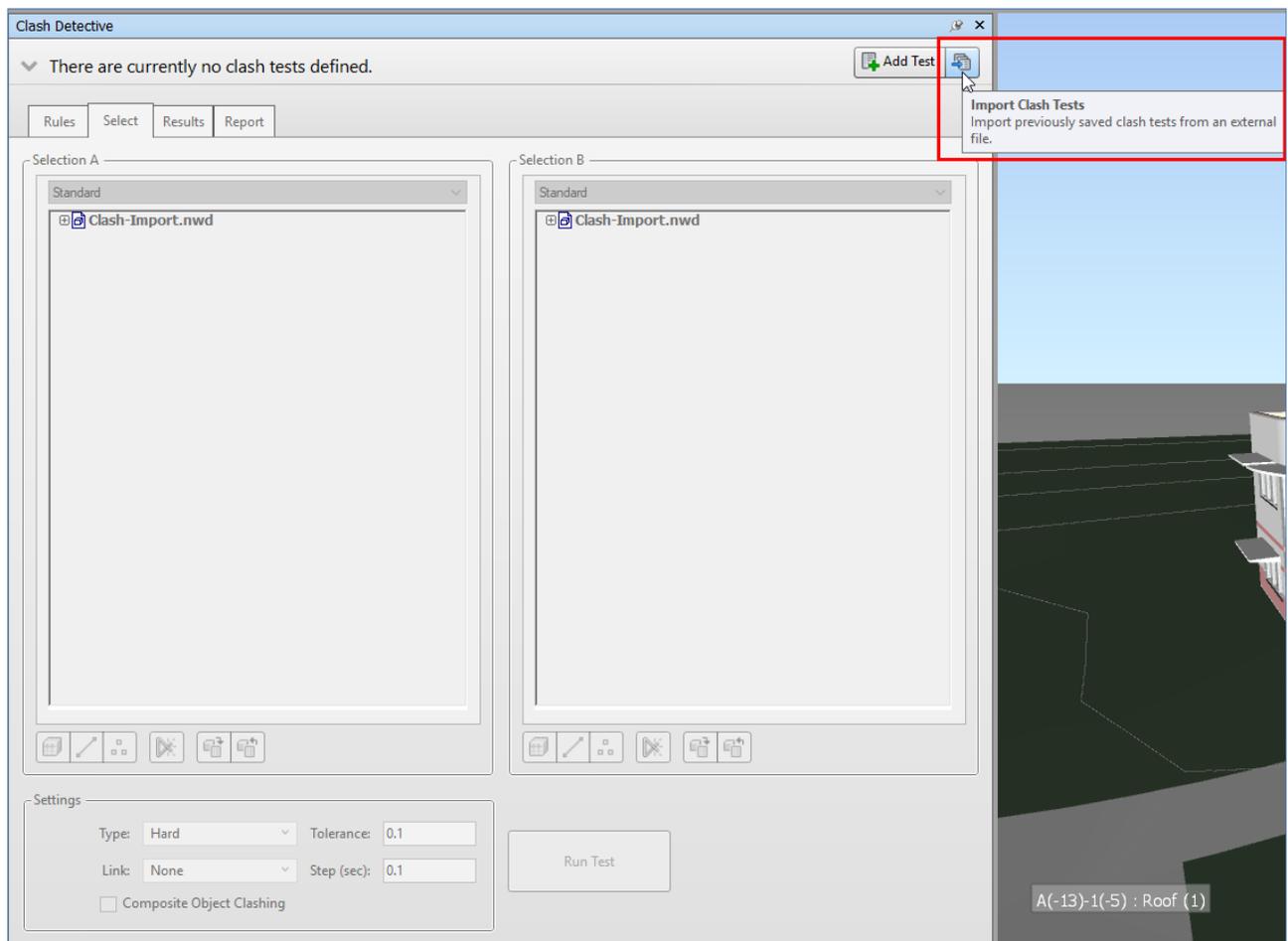
4. Press and hold down the SHIFT key and the Wheel Mouse Button and drag to orbit the model.
5. From the **Saved Viewpoints** window (hidden on the right of the graphics window), select the **Overview** viewpoint.

Notice that the **Clash Detective** window is blank as there are no clash tests created in this file.

6. Hover the cursor over the **Sets** window; this window slides out. Notice there are no search sets created in this file.

When you import the clash template, all the search sets that were used to create those clashes are also imported with the clash tests.

7. From the top right corner of the **Clash Detective** window, click **Import Clash Tests**, as shown in the figure below; the **Import** dialog box is displayed.



8. From the **Clash Template Lab** folder, double-click on the **Project-Critical-Clashes.xml** file; all the clash tests are imported and listed in the **Clash Detective** window now.
9. Click the **Update All** button; the clash tests are updated and you can see various clashes in these clash tests, as shown in the figure below.

Clash Detective									
Mechanical Ductwork Vs Structure									
Last Run: Sunday, 13 October 2019 2:46:14 PM									
Clashes - Total: 22 (Open: 22 Closed: 0)									
Name	Status	Clashes	New	Active	Reviewed	Approved	Resolved		
Mechanical Ductwork Vs Structure	Done	22	22	0	0	0	0		
Mechanical Ductwork Vs Ceilings	Done	5	5	0	0	0	0		
Mechanical Ductwork Vs Plumbing	Done	2	2	0	0	0	0		
Mechanical Ductwork Vs Floors	Done	1	1	0	0	0	0		
Mechanical Ductwork Vs Cable Trays	Done	0	0	0	0	0	0		
Plumbing Vs Structure	Done	0	0	0	0	0	0		

10. With the **Mechanical Ductwork Vs Structure** clash test selected, click the **Results** tab.
11. Click on the clash results to view and interrogate the clashes.
12. Similarly, interrogate the other clash results as well.
13. Once finished, click the **Select** tab in the **Clash Detective** window.
14. Activate the **Overview** viewpoint.
15. Save the current file.

Section 6: Bonus Section – Grouping Clashes

This is a bonus section and is used to explain the process of grouping clashes in Autodesk Navisworks. This section also shows how to highlight resolved clashes.

1. From the recent files list, open the **Building-Federated.nwd** file.
2. Create a clash test called **Columns Vs Walls** by selecting the **Structural Items** folder > **Columns** set and the **Architecture** folder > **Walls** set.
3. Run the clash test; a total of 490 clashes are found, as shown in the figure below:

Clash Detective

Columns Vs Walls

Last Run: Sunday, 13 October 2019 2:50:14 PM
Clashes - Total: 490 (Open: 490 Closed: 0)

Rules Select Results Report

New Group Assign Re-run Test

Name	Status	Level	Grid Int
Clash1	New	PIT (6575)	L3(-401)-3
Clash2	New	Level 2 TOS (6528)	L1(202)-L1
Clash3	New	PIT (6575)	L3(-1975)-
Clash4	New	PIT (6575)	L3(-1920)-
Clash5	New	PIT (6575)	L2(-386)-3
Clash6	New	Level 5 (6528)	R7(-7)-RA
Clash7	New	PIT (6575)	L3(-1531)-
Clash8	New	PIT (6575)	L3(-362)-3
Clash9	New	PIT (6575)	L3(-2211)-
Clash10	New	PIT (6575)	L3(-1173)-
Clash11	New	PIT (6575)	L3(-2138)-
Clash12	New	PIT (6575)	L3(-1567)-
Clash13	New	PIT (6575)	L3(-795)-3
Clash14	New	PIT (6575)	L2(-350)-3
Clash15	New	PIT (6575)	L3(-1143)-
Clash16	New	PIT (6575)	L1(-7)-3(8
Clash17	New	PIT (6575)	L3(-1810)-

Items

Item 1 ■ Highlight

Element Length: 486.000 in
Element Category: Structural Columns
Item Name: W14X176
Item Type: Structural Columns

- Building-Federated.nwd
 - Hospital_Structural.rvt
 - Level 1
 - Structural Columns
 - W-Wide Flange-Column
 - W14X176
 - W-Wide Flange-Column
 - W14X176

Item 2 ■ Highlight

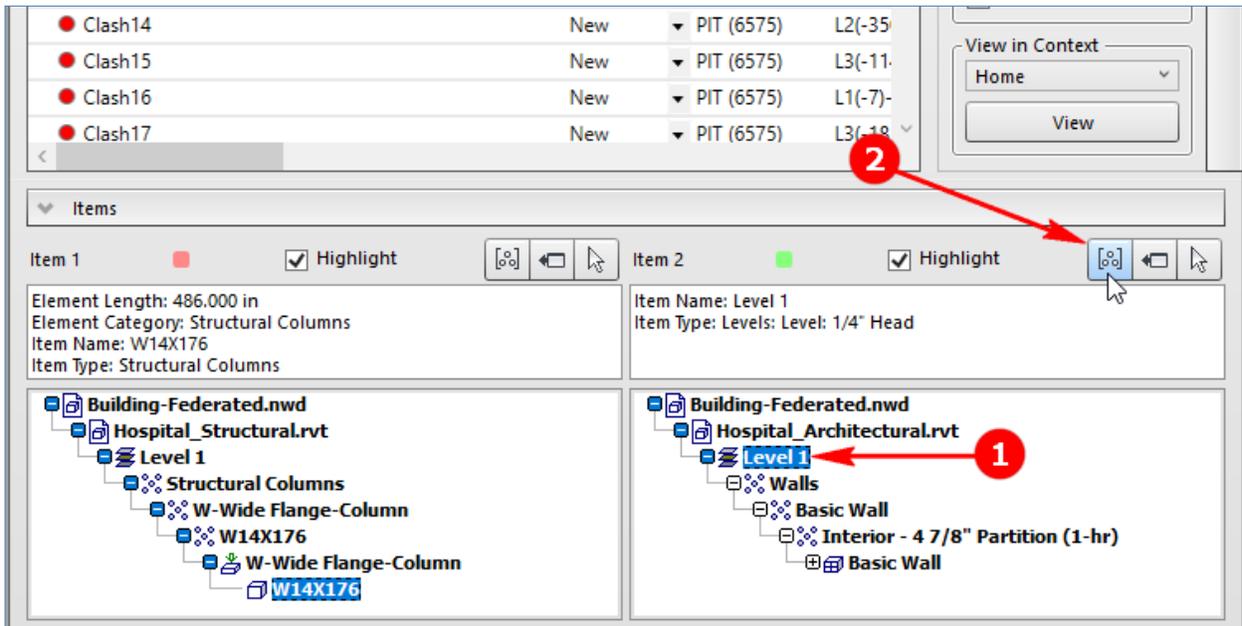
Element Category: Walls
Item Name: Basic Wall
Item Type: Walls: Basic Wall: Interior - 4 7/8" Partition (1-hr)

- Building-Federated.nwd
 - Hospital_Architectural.rvt
 - Level 1
 - Walls
 - Basic Wall
 - Interior - 4 7/8" Partition (1-hr)
 - Basic Wall

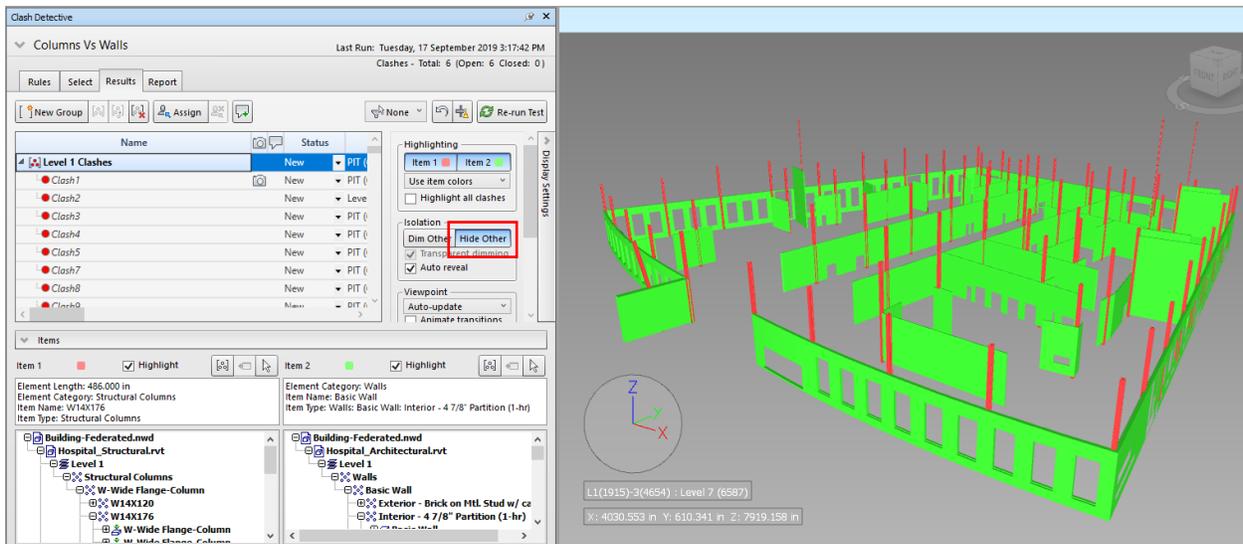
You will now group clashes based on levels. Note that it is important to group based on the items that will change. In this case, the walls will move for the structure. So you will group based on walls.

- With the first clash result selected, from the **Item 2** area, click **Level 1**, labeled as **1** in the figure below.

- From the toolbar above the **Item 2** area, select the **Group Clashes Involving Item** button, labeled as **2** in the figure below; all clashing walls on Level 1 are grouped together and the total clashes are reduced from 490 to 326.



- Rename the group to **Level 1 Clashes**.
- From the **Display Settings** area, click **Hide Others**, as shown in the figure below; the items other than the clashing items are turned off, as shown in the figure below.



- Collapse the group by clicking on the arrow on the left of its name.

9. Select the **Clash6** result.
10. From the **Item 2** area, click **Level 5**, refer to the figure above.
11. From the toolbar above the **Item 2** area, select the **Group Clashes Involving Item** button, labeled as **2** in Figure 13 above; all clashing walls on Level 1 are grouped together and the total clashes are reduced from 326 to 263.
12. Select the **Clash21** result and group clashes based on Level 4.
13. Similarly, group the remaining clashes based on the levels of the walls.

Summary

In this lab, you created various search sets such as structural members, duct items, ceilings, plumbing items, and floors. Then you performed clashes based on these search sets. This allowed you to export those clashes as templates that you imported in another file.

Additional Information

Instead of creating a single search set for all structural items, you can also create separate search sets for Structural Columns, Structural Framing, and Structural Foundation. That way you can perform individual clashes with these search sets rather than one single clash test with all these items.