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Ashghal Building Information Modelling Standards (ABIMS)

Clash Detection Template Guide

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PURPOSE OF THE DOCUMENT

This document provides guidance on how to use the PWA pre-defined Clash Detection templates.

These templates should be used to federate Building Information Models for Checking, Design Coordination, Clash Detection and Clash Reporting to PWA as described below.

The PWA template contains:

- Navisworks Clash Test templates in ***.XML***,
- Appearance Profile template in ***.DAT***
- An Excel file (for creating clash report) based on the 3D Coordination methodologies as laid out in the BIM Use Processes Design Phase Guide, Clash Detection Matrix Template Guide and Modelling and Data Management Guide.

Included are the following files, split by discipline:

Template Name	Volumes	Application
Clash Test	Clash Tests – Volumes.xml	Navisworks
Appearance Profile	Appearance Profiler - Volumes.dat	Navisworks
Clash Report	Clash Report - Volumes.xlsx	Excel

Table 1: Templates for Volumes

Template Name	Infrastructure	Application
Clash Test	Clash Tests - Infrastructure.xml	Navisworks
Appearance Profile	Appearance Profiler - Infrastructure.dat	Navisworks
Clash Report	Clash Report - Infrastructure.xlsx	Excel

Table 2: Templates for Infrastructure

Template Name	Buildings	Application
Clash Test	Clash Tests - Buildings.xml	Navisworks
Appearance Profile	Appearance Profiler - Buildings.dat	Navisworks
Clash Report	Clash Report - Buildings.xlsx	Excel

Table 3: Templates for Buildings

1 NAVISWORKS OVERVIEW

The entire Clash Detection process is split across different applications. Some applications have template files that are required to be filled by the users. *Figure 1* demonstrates the sequential order of steps and template files. The **Red** boxes identify processes covered by this document, the **Blue** boxes identify processes covered in the Clash Detection Matrix Template Guide.

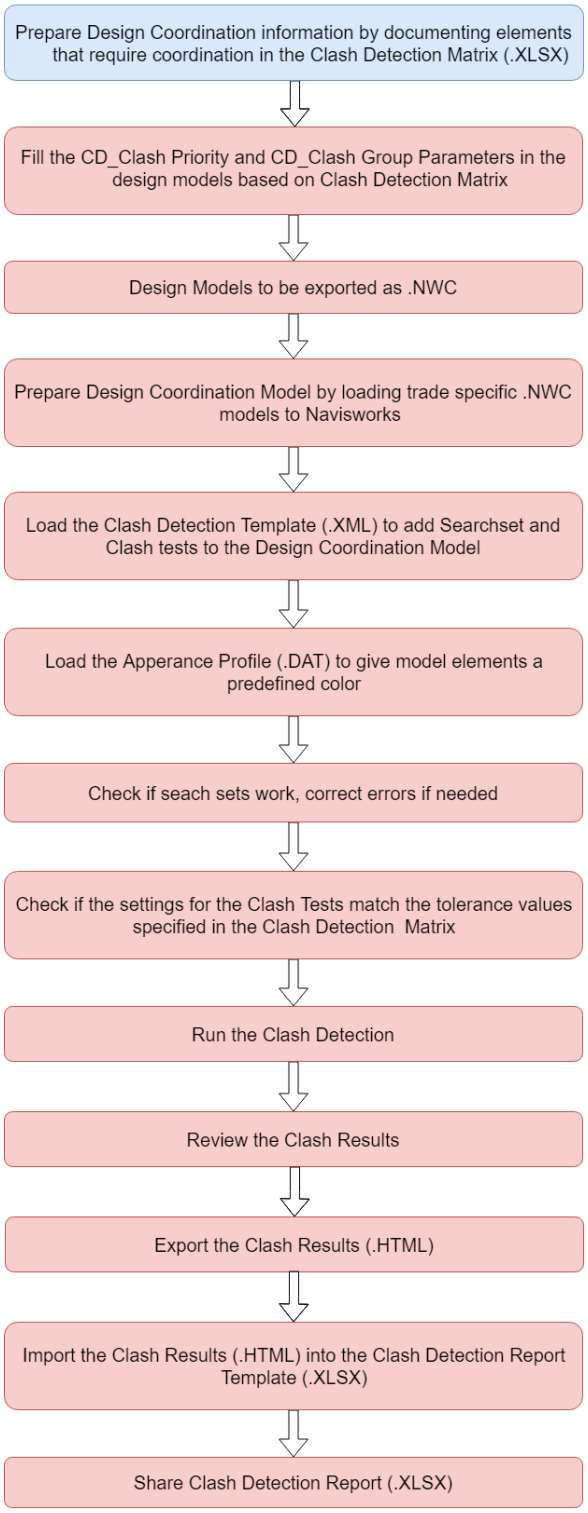


Figure 1: Overview of Different Steps in Design Coordination

2 CLASH TEST TEMPLATE

The Clash Tests Template contains a predefined set of tests for each discipline and the elements within, in accordance with the PWA Clash Detection Strategy. Clash Tests are grouped by Elements /Volumes.

Example:

- ***Elements*** *- A single element-based clashes - Pipes and fittings compared with Chambers as SW1010_v_IR2120.*
- ***Volumes –*** *All elements of one sort - Architecture elements compared with all Irrigation elements as AR_v_IR.*

The Clash Test Template currently includes for the checking of self-intersecting groups (i.e., Elements ***SW1010*** against Elements ***SW1010***), this can be valuable in many cases however it should be something that design teams address inherently and it can result in the identification of large volumes of false positives that need reviewed. The use of self-intersecting checks should be reviewed based on project requirements.

This section describes all steps from loading templates to exporting a Clash Report.

2.1 Quick Properties Definitions

The Quick Properties Definitions option displays the properties that modellers should have provided in the parameter/property sets fields during model authoring. For the purpose of this document these will be referred to as parameters.

A number of parameters have been identified as required to support this process and will need to be developed in every model that is to be reviewed; refer to *Section 5.2* for Revit Parameters and *Section 5.3* for Civil3D Property sets.

After appending the **.NWC** models into Navisworks, the Quick Properties Definitions in Navisworks have to be adjusted to ensure properties are correctly mapped. The required settings required to be updated are shown in *Figure 2 (exports from Revit)* and *Figure 3 (exports from Civil3D).*

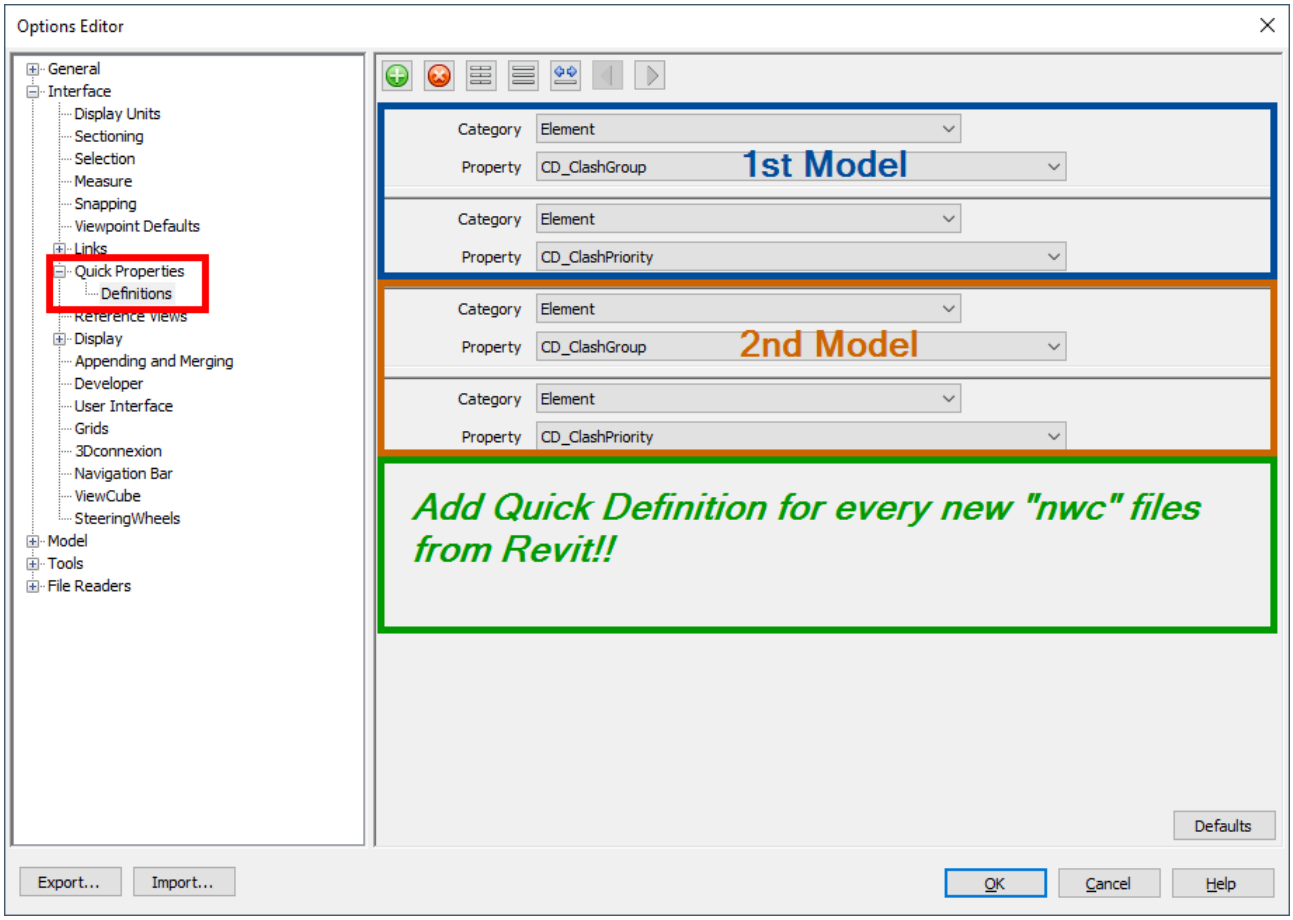


Figure 2: Quick Properties Definitions for Revit NWC Exports

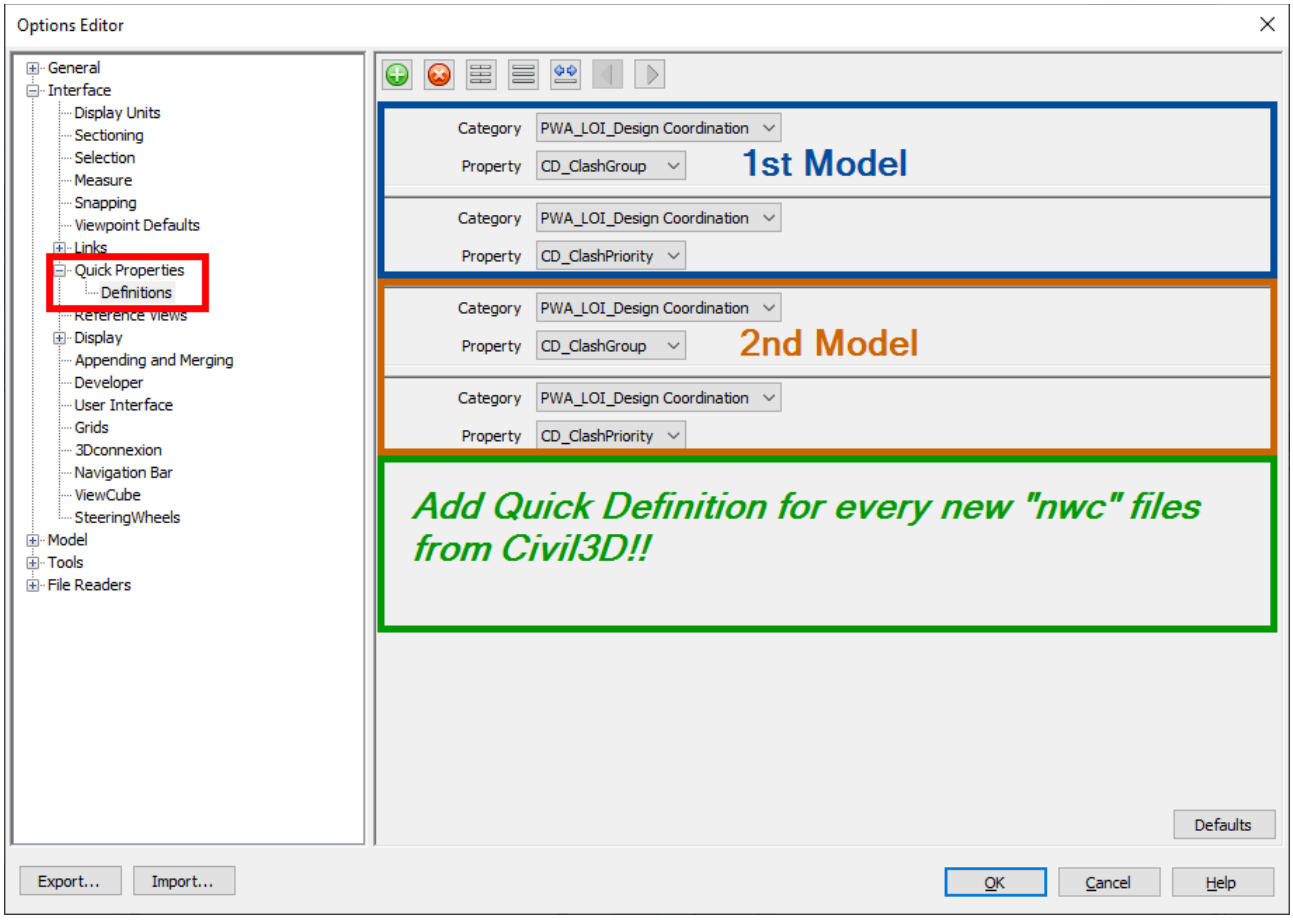


Figure 3: Quick Properties Definitions for Civil3D NWC Exports

2.2 Importing Clash Tests

The user should import the appropriate Clash Tests (.xml) file into Navisworks based on the project type (e.g., Building for a model including a building, Infrastructure for a model including linear assets or Volume for all sub disciplines models), by the following steps:

1. From Home Tab >> Tools Panel >> Clash Detective >> Click *Import Clash Tests* >> locate the appropriate Clash Test on local system.
2. To avoid having unused Clash Tests, ensure the Clash Tests loaded match the Clash Tests that have been identified in the approved Clash Detection Matrix.

Note: This will automatically load the associated Search Sets, refer to Section 5.1 for more information.

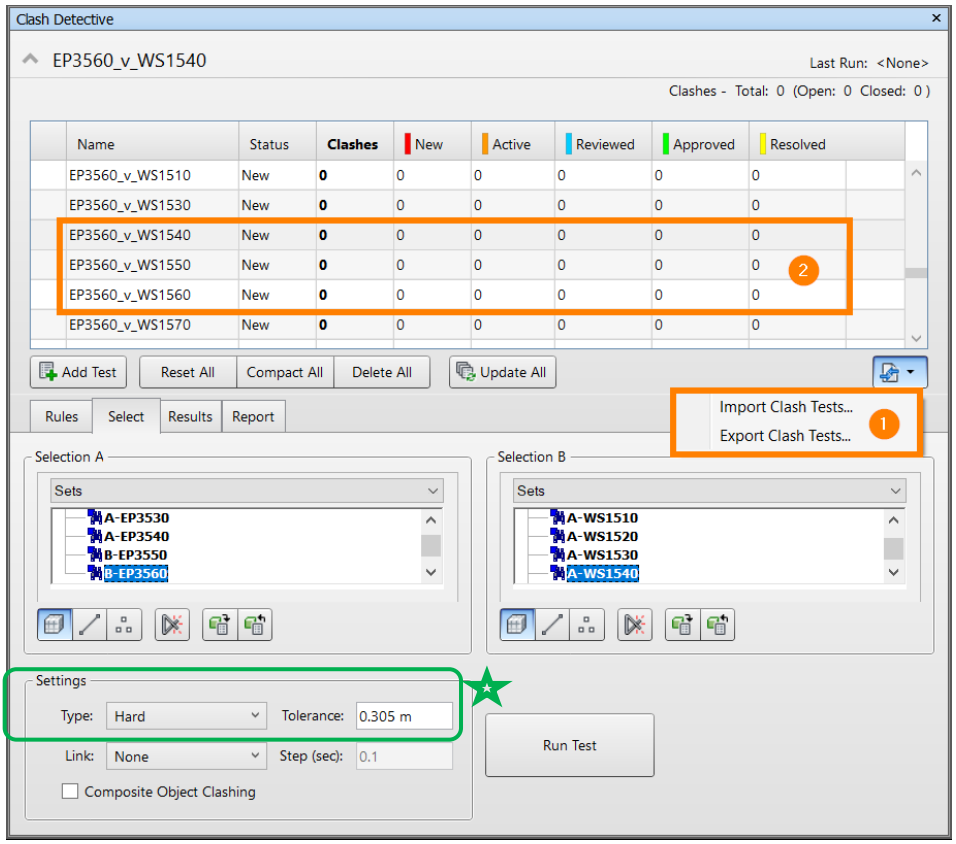


Figure 4: Importing Clash Tests

Note:

The Tolerance value and Clash Type settings are sample values and should be amended based on project requirements and design/construction standards prior to using.

2.3 Run Clash Detection

After loading the Clash Test, the results will show zero's (0) against each test, this is because the actual Clash Test has not been run yet. After running the Initial Clash Detective, the number of Clashes will be populated in the overview. When updated models are received the test can be run again, this time the number will reflect the changes compared to the previous Clash Test.

For the purpose of producing progress reports, as required on the project, the issue tracking functionality available within Navisworks can be ignored, as this is handled through the Clash Reporting Template (Excel) that will be used to provide a high-level overview of the active coordination issues.

Click the "***Update All***" button to run the clashes for all required Clash Tests.

Note: Running only an individual or a selection of Clash Test will impact the usability of the information.

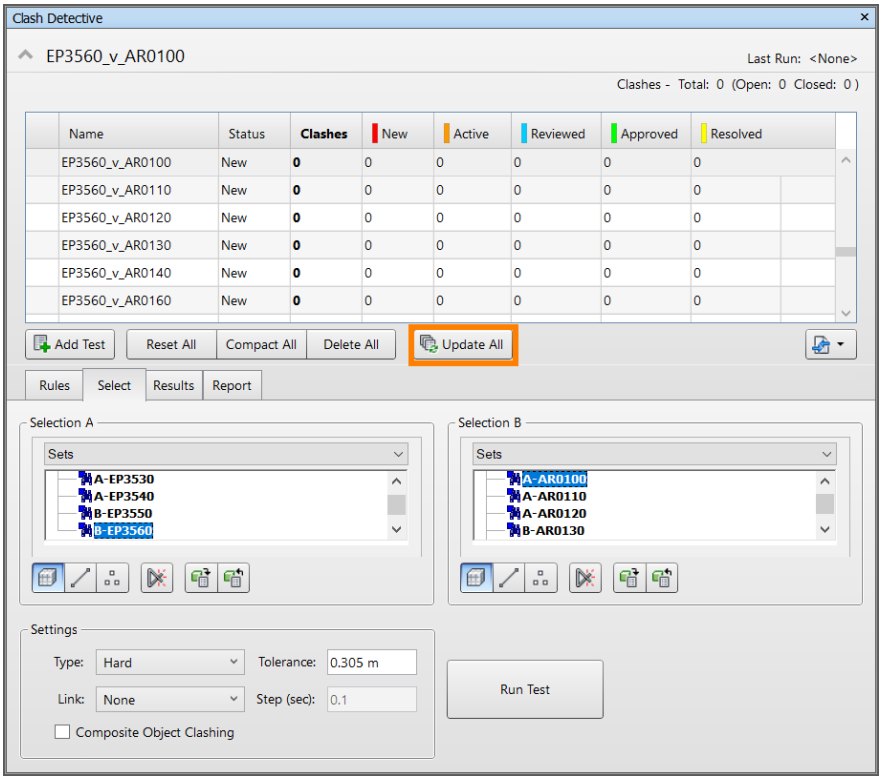


Figure 5: Clash Run for All Clash Tests

2.4 Exporting Clash Tests

Once the tests have finished running, the results must be exported. Also refer to *Section 4* to understand how this information is used to create an overview.

From the Home tab >> Tools Panel, select Clash Detective

1. Select all the boxes identified in ***"Report >> Contents"* (1).**
2. Select ***"All tests (combined)" (2)*** as Report Type and ***"HTML (Tabular)" (2)*** as Report Format.
3. Click ***"Write Report" (3)*** button to save the *(.html)* file on the local computer.

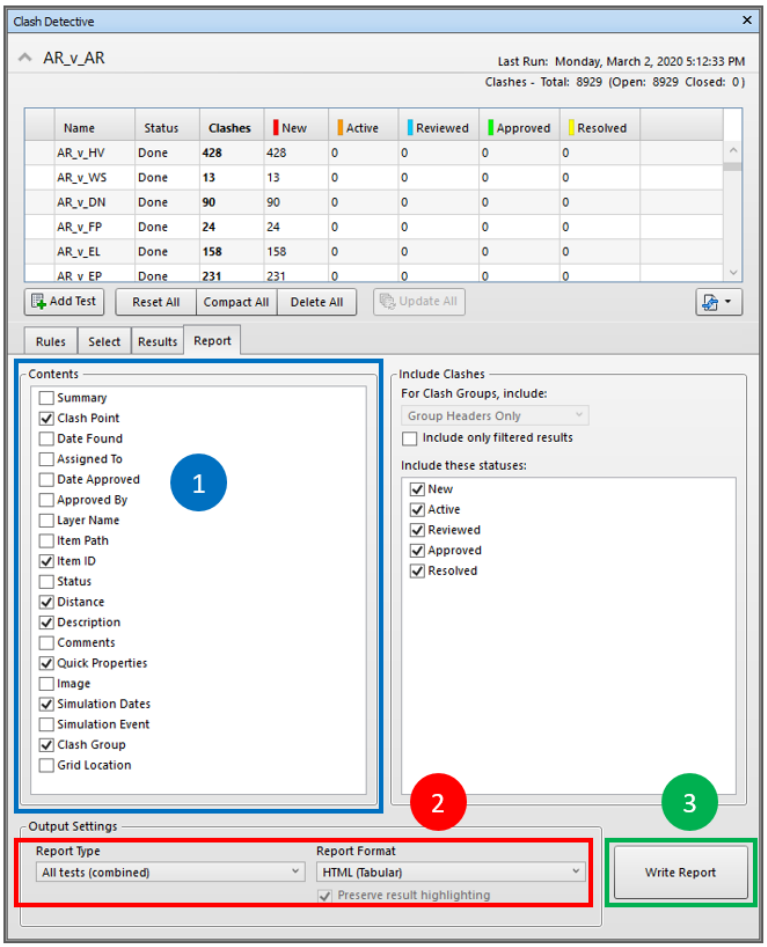


Figure 6: Exporting Clash Reports

3 APPEARANCE PROFILE TEMPLATE

The Appearance Profiler allows the use of custom appearance profiles for model elements based the colour coding adopted in the Modelling and Data Management Guide. The appearance profiler uses the same Search Sets as the Clash Test, refer to *Section 5.1*.

3.1 Loading Appearance Profiler

1. From the Home tab select Appearance Profiles, Click Load based on project type, then load the appropriate .DAT file *(Appearance Profiler - Volumes.dat, Appearance Profiler - Buildings.dat, Appearance Profiler - Infrastructure.dat)* into Navisworks from local machine.
2. Click the Run button to apply the colours to all Elements.

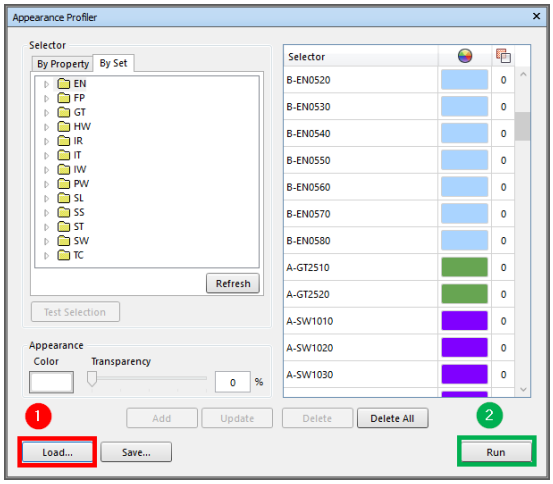


Figure 7: Loading Appearance Profiler

3.2 Resetting Appearance Profiler

To reset colour overrides and return to original values
From the Home tab >> Project panel >> Reset All drop-down >> Appearances

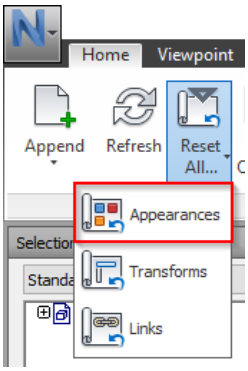


Figure 8: Resetting Appearance Profiler

4 CLASH REPORT TEMPLATE

The Clash Report identifies the number and type of objects that are present (Hard and Clearance clashes) within the models. The report should be read in conjunction with the Clash Detection Matrix and the federated model when determining actions.

Note: To Process or Update the Clash Report "Microsoft Power Query" plugin for Excel is required to be installed. (Installation Link)

The Clash Report document consists of five tabs in excel as shown in *Figure 9:*

01_Input - Where the (.html) information is placed.

02_ETL – An ETL (Extract, Transform and Load) sheet required to prepare the information for the Clash Report Overview sheet.

03_Clash Report Introduction – An overview of the clashes is presented at discipline level.

04_Clash Report Overview – An overview of all the clashes by each test.

05_Element Names – A sheet holding all element codes and their names from the approved Clash Detection Matrix which is required to create the Clash Report Overview.

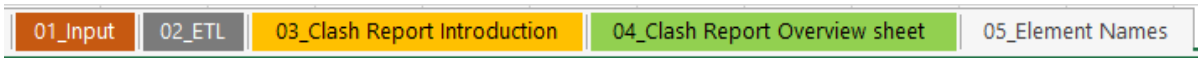


Figure 9: Clash Report Document Tabs

Note: The Clash Report Template is used to process/review the results from Section 2.4.

4.1 Import Clashes

To import the clashes into the Clash Report, do the following:

1. Rename the default table name T_HTML_Import to use that specific name in the Power Query used to generate outcomes. E.g., to T_HTML_Import_OLD

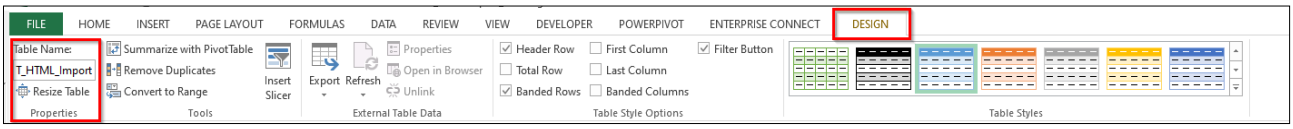


Figure 10: Table Renaming

2. Drag and drop the exported Clash Tests (.html) into a blank excel sheet, then Move or copy the newly populated excel sheet to Clash Report Template.
3. Select all fields on the newly imported information by selecting:
    - Row ***"8 to Last"*** and
    - Column ***"A to Last"*****,** this depends on the number of models used within Navisworks.
4. Convert the range to a Table by using "*CTRL + T*", ensuring that *"My Table has Headers"* is selected to make it readable in the ETL sheet.

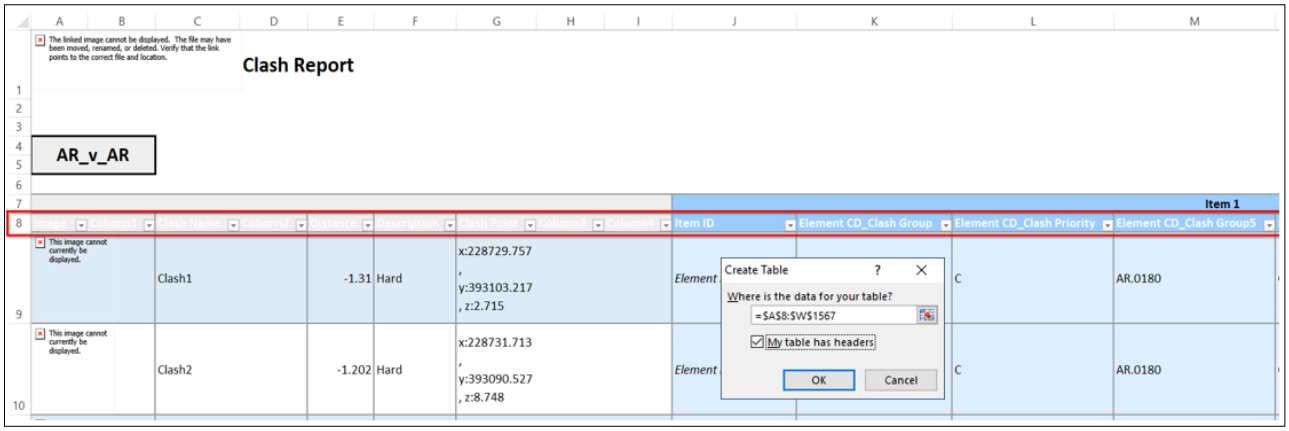


Figure 11: Input Table from .html Export

5. Rename the table on the Input sheet from DEFAULT TABLE NAME to **T_HTML_Import** to link the information to the ETL sheet as shown in *Figure 12.*

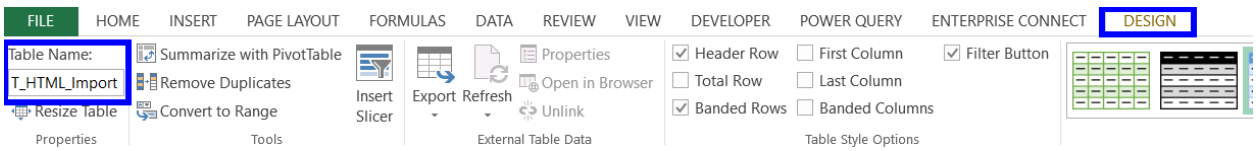


Figure 12: Table Renaming

Note: If the order does not match, the functionality can be affected refer to Section 2.4 for the correct export settings.

4.2 Update the Workbook Query

Once the (.html) file has been added to Excel and the table has been created, the **T_Input** Query on the "***02_ETL tab"*** must be refreshed to retrieve the newly imported information.

1. Refresh the "***T_Input***" query in Workbook Queries using the Power Query Tool.

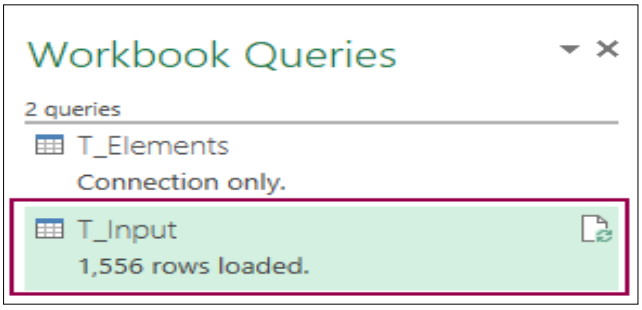


Figure 13: Refreshing Workbook Queries

2. If required, the Power Query can be adjust based on the number of exported files by opening the Query and selecting the Remove Additional Columns Field.

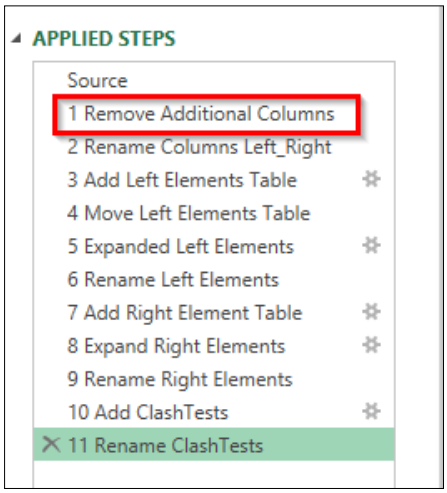


Figure 14: Select Step in the Query

3. Depending on the number of model and the Quick Properties Definitions, the Navisworks exports will contain different columns for each model.

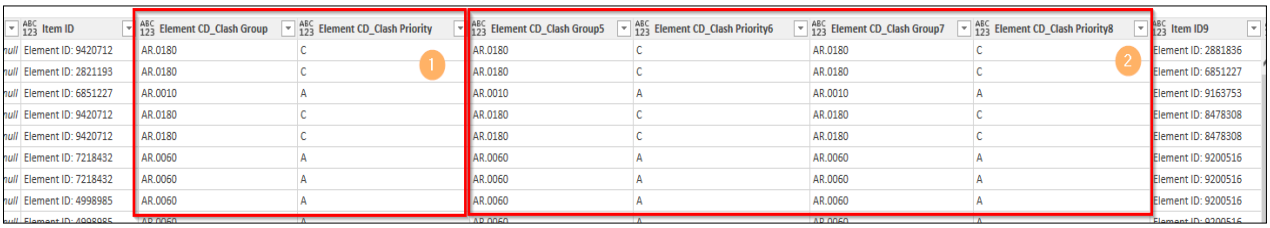


Figure 15: Columns after Importing

For the purpose of analysis this needs to be reduced to only two columns (1) on the left side with the columns (2) on right to be removed. These columns correspond with the clash detective window from Navisworks.

4. To remove the columns, select the columns and click **Remove Columns** in the Power Query Tool.

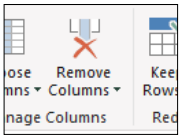


Figure 16: Remove Columns

5. When additional columns have been removed it should look like *Figure 17*.

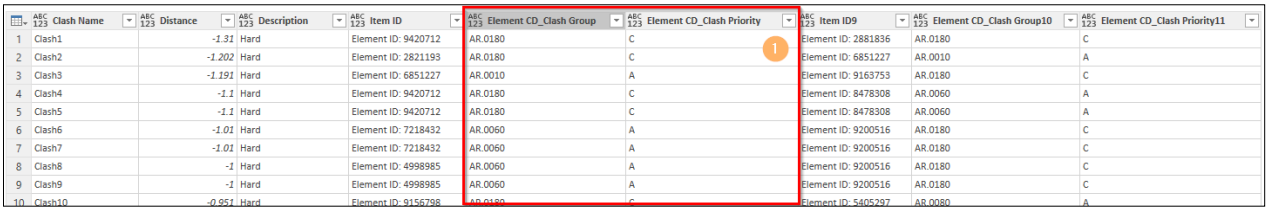


Figure 17: Columns after Removing

6. The updated query, if edited, should be saved to make it available for further use.

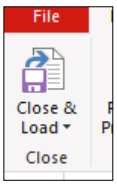


Figure 18: Close & Load

4.3 Clash Report Introduction Sheet

The Clash Report Introduction Tab consists of three Parts mentioned below.

a. **Document Title Block** – The Project Team shall complete the document title block to identify the project and to make it easier to track any revisions to the file.

b. **Clash Tests Matrix** – The overview of Clash Tests by Discipline.

c. **Test Settings** – References to the Clash Detection Matrix for the type of clashes and tolerance.

Clash Report - Buildings

Contract Number	
Project Title	
Authority	
Contractor	
Date	

a

Introduction

This report identifies the number and type of objects that are present as hard clashes within the models. The report is to be read in conjunction with the federated model which contains further data that can be used to resolve and review the clashes.
Double clicking on any number within the clash matrices within the excel document will generate an itemised schedule of the clashing components.

The Clash Detection Matrix acts as a tool to identify critical issue types and the quantity that are present. The tables can be further interrogated so that issues can be classified by level and grid whilst maintaining fidelity with the Navisworks model to enable an efficient clash resolution process. It is recognised that not all clashes represent a design issue and that not all design issues are shown as a clash.

Tests Run

Discipline		AR	ST	HV	WS	DN	FP	EL	EP	ES	TC	FA
Architecture	AR	AR_v_AR										
Structure	ST	AR_v_ST	ST_v_ST									
HVAC	HV	AR_v_HV	ST_v_HV	HV_v_HV								
Water Supply	WS	AR_v_WS	ST_v_WS	HV_v_WS	WS_v_WS							
Drainage	DN	AR_v_DN	ST_v_DN	HV_v_DN	WS_v_DN	DN_v_DN						
Fire Protection	FP	AR_v_FP	ST_v_FP	HV_v_FP	WS_v_FP	DN_v_FP	FP_v_FP					
Electrical lighting	EL	AR_v_EL	ST_v_EL	HV_v_EL	WS_v_EL	DN_v_EL	FP_v_EL	EL_v_EL				
Electrical Power	EP	AR_v_EP	ST_v_EP	HV_v_EP	WS_v_EP	DN_v_EP	FP_v_EP	EL_v_EP	EP_v_EP			
Electrical Security	ES	AR_v_ES	ST_v_ES	HV_v_ES	WS_v_ES	DN_v_ES	FP_v_ES	EL_v_ES	EP_v_ES	ES_v_ES		
Telecommunication	TC	AR_v_TC	ST_v_TC	HV_v_TC	WS_v_TC	DN_v_TC	FP_v_TC	EL_v_TC	EP_v_TC	ES_v_TC	TC_v_TC	
Fire Alarm	FA	AR_v_FA	ST_v_FA	HV_v_FA	WS_v_FA	DN_v_FA	FP_v_FA	EL_v_FA	EP_v_FA	ES_v_FA	TC_v_FA	FA_v_FA

b

Test Settings

Clash Detection Tolerance	Refer Clash Detection Matrix
Detection Type	Refer Clash Detection Matrix
Clash Objects	Objects within the same system and category have been checked against each other as well as with all other object geometry
Excluded Elements	Model lines were hidden and excluded during the clash detection tests

c

Clash Methodology

It is essential that a clash categorisation strategy is outlined and followed accordingly. Clashes are to be categorised according to their severity level e.g. any Level 1 clashes identified must be resolved by designer, Level 2 clashes are to be resolved by the contractor. This Strategy will later be provided as instructions / directions for the adoption by the contractor.

Figure 19: Clash Report Introduction

4.4 Clash Report Overview Sheet

After updating the ETL sheet the Clash Reports Overview tab can be updated by selecting the Pivot Table and selecting refresh. For element-based Clash Detection, the filters can be used to control the amount of information presented.

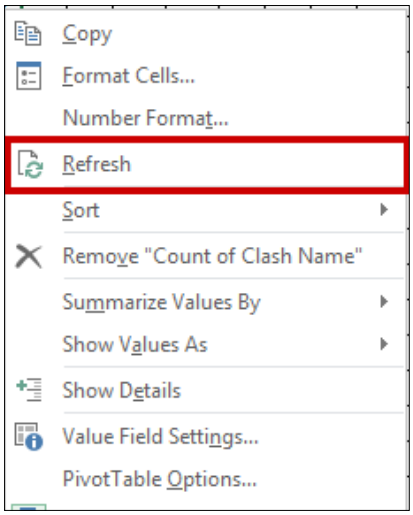
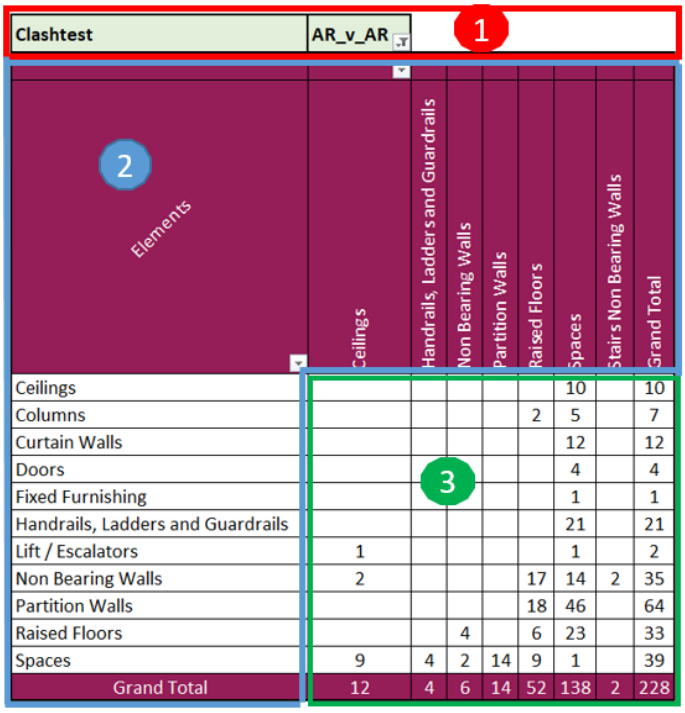


Figure 20: Pivot Table Refresh

The pivot table consists of three parts within each Clash Test Group

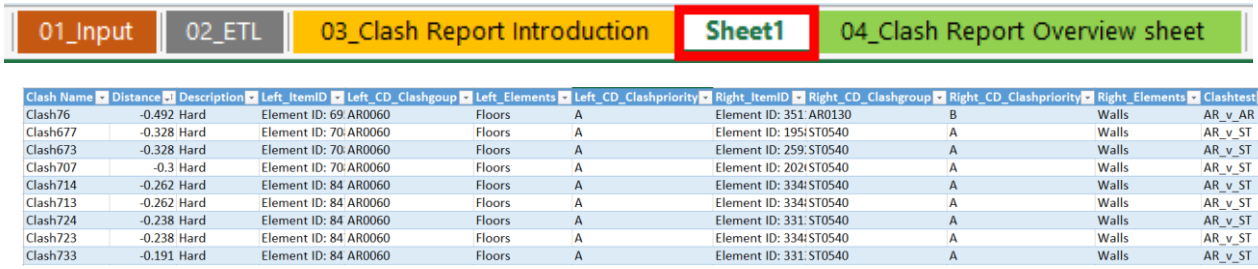
1. **Clash Tests** – Choose clash tests to view the number of clashes for Design Coordination to focus on specific clash tests from *Section 4.3.*
2. **Element Names** – The name of the Elements for the selected disciplines
3. **Clash Numbers** – An overview of the number of clashes against other elements.



Elements	Ceilings	Handrails, Ladders and Guardrails	Non Bearing Walls	Partition Walls	Raised Floors	Spaces	Stairs Non Bearing Walls	Grand Total
Ceilings						10		10
Columns					2	5		7
Curtain Walls						12		12
Doors						4		4
Fixed Furnishing						1		1
Handrails, Ladders and Guardrails						21		21
Lift / Escalators	1					1		2
Non Bearing Walls	2				17	14	2	35
Partition Walls					18	46		64
Raised Floors			4		6	23		33
Spaces	9	4	2	14	9	1		39
Grand Total	12	4	6	14	52	138	2	228

Figure 21: Clash Report Overview

Double click on any number in the third section, to see a list of the individual clashes. This list will automatically open in a newly created Tab with "*Sheet **x**",* see *Figure 22*.



Clash Name	Distance	Description	Left_ItemID	Left_CD_Clashgoup	Left_Elements	Left_CD_Clashpriority	Right_ItemID	Right_CD_Clashgroup	Right_CD_Clashpriority	Right_Elements	Clashtest
Clash76	-0.492	Hard	Element ID: 69	AR0060	Floors	A	Element ID: 351	AR0130	B	Walls	AR_v_AR
Clash677	-0.328	Hard	Element ID: 70	AR0060	Floors	A	Element ID: 195	ST0540	A	Walls	AR_v_ST
Clash673	-0.328	Hard	Element ID: 70	AR0060	Floors	A	Element ID: 259	ST0540	A	Walls	AR_v_ST
Clash707	-0.3	Hard	Element ID: 70	AR0060	Floors	A	Element ID: 202	ST0540	A	Walls	AR_v_ST
Clash714	-0.262	Hard	Element ID: 84	AR0060	Floors	A	Element ID: 334	ST0540	A	Walls	AR_v_ST
Clash713	-0.262	Hard	Element ID: 84	AR0060	Floors	A	Element ID: 334	ST0540	A	Walls	AR_v_ST
Clash724	-0.238	Hard	Element ID: 84	AR0060	Floors	A	Element ID: 331	ST0540	A	Walls	AR_v_ST
Clash723	-0.238	Hard	Element ID: 84	AR0060	Floors	A	Element ID: 334	ST0540	A	Walls	AR_v_ST
Clash733	-0.191	Hard	Element ID: 84	AR0060	Floors	A	Element ID: 331	ST0540	A	Walls	AR_v_ST

Figure 22: Clash Result

Note: After reviewing, this sheet can be removed to reduce document size and to ensure users only have the main tabs, as previously shown in Figure 9.

5 ADDITIONAL INFORMATION

This section contains additional information related to the preparation of ***.NWC*** models and the use of Search Sets contained within the Clash Template.

5.1 Navisworks Search Sets

Search Sets are a dynamic group of items filtered by a set criteria. Search Sets will automatically re-run if the underlying models change. When loading the Clash Test template, Search Sets will be automatically added to the Navisworks model.

The Search Sets have been developed based on the PWA Clash Detection Matrix. Every Model Element needs to have two parameters for Revit; refer to *Section 5.2* and two Property Sets for Civil3D; refer to *Section 5.3,* in order for the Search Sets to function:

1. CD_ClashPriority – these values should be taken from "*Clash Priority*" in CDM for all Elements.

2. CD_ClashGroup – these values should be taken from "*Clash Group*" in CDM for all Elements.

3. Search Sets – this value is a combination of CD_ClashPriority and CD_ClashGroup with a separator "-".

*Example: **A-IT5520** is the search set name that has been assigned to all Ducts within Intelligent Transportation System model*.

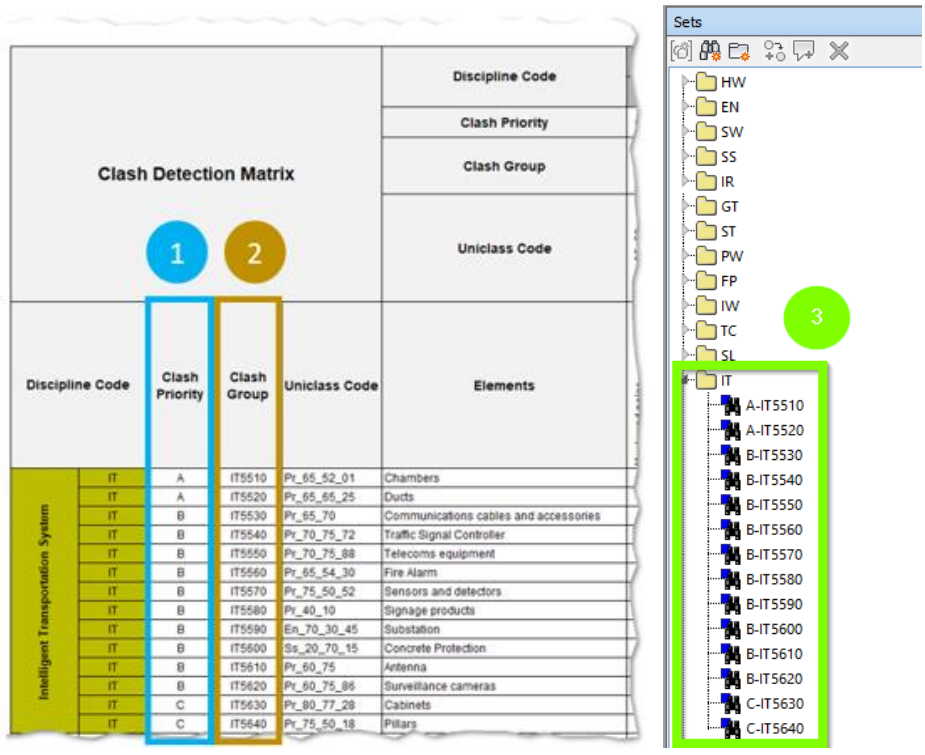


Figure 23: CDM in Relation to Search Sets

5.2 Revit Parameters

Parameters for “CD_ClashPriority” and “CD_ClashGroup” shall be added under Project Parameters in Revit and assigned to all modelling Elements.

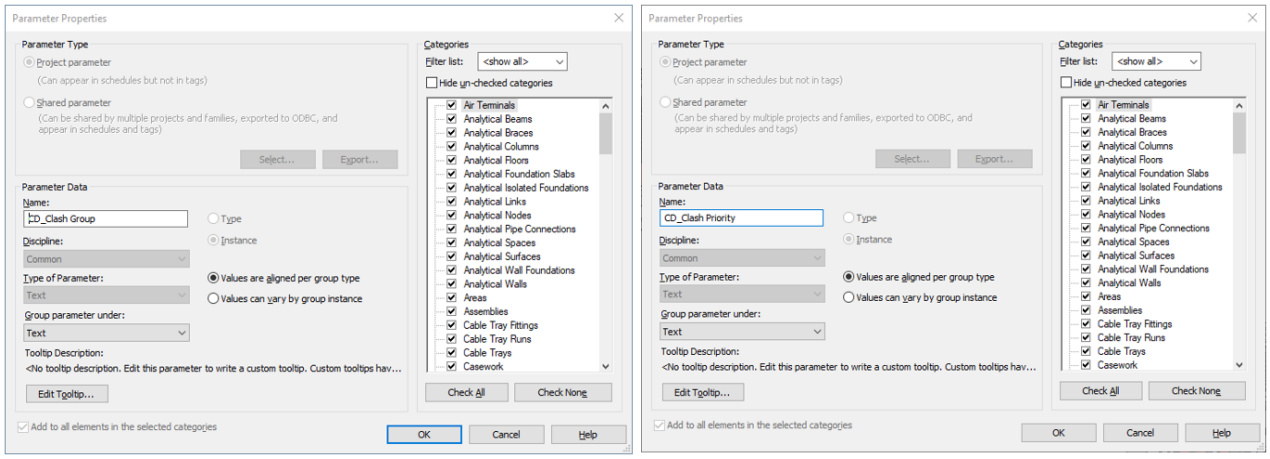
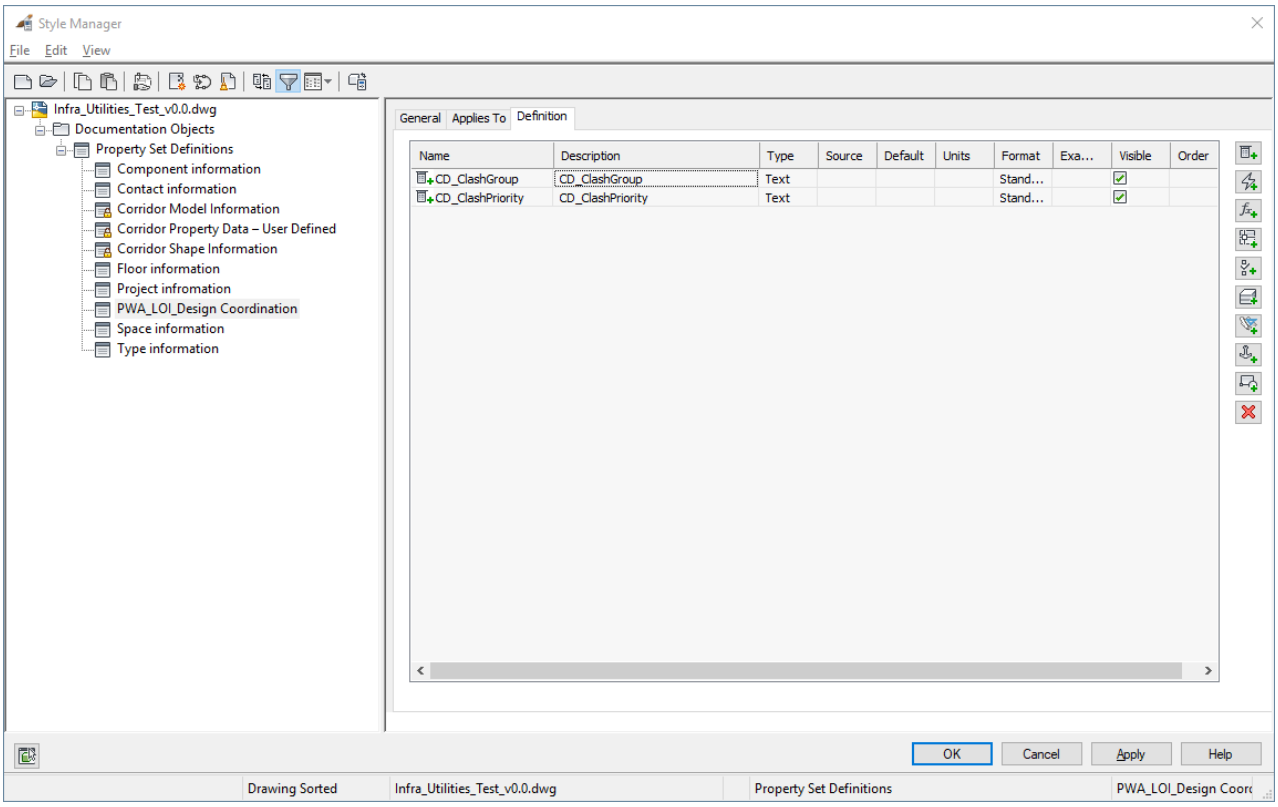


Figure 24: Clash Detection Parameters in Revit

5.3 Civil 3D Property Set Definitions

Field for “CD_ClashPriority” and “CD_ClashGroup” shall be added in “Property Set Definitions” in a group named “PWA_LOI_Design Coordination” and assign to all modelling relevant Elements.



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