



NCID

A DVANCED
C ONSTRUCTION
I NFORMATION
D EVELOPMENT

Autodesk Navisworks Course for Technical Officer I (Structural)

Presented by

David Fung

■ Introduction to Navisworks File System

	Autodesk Navisworks Freedom	Autodesk Navisworks Simulate	Autodesk Navisworks Manage
Project viewing	✓	✓	✓
Project Review		✓	✓
Simulation and Analysis		✓	✓
Coordination			✓
Remarks	Open NWD only	✕ Clash Detection	

▪ Navisworks file types

NWC (Navisworks Cache File)

- interpreter between Navisworks and other software

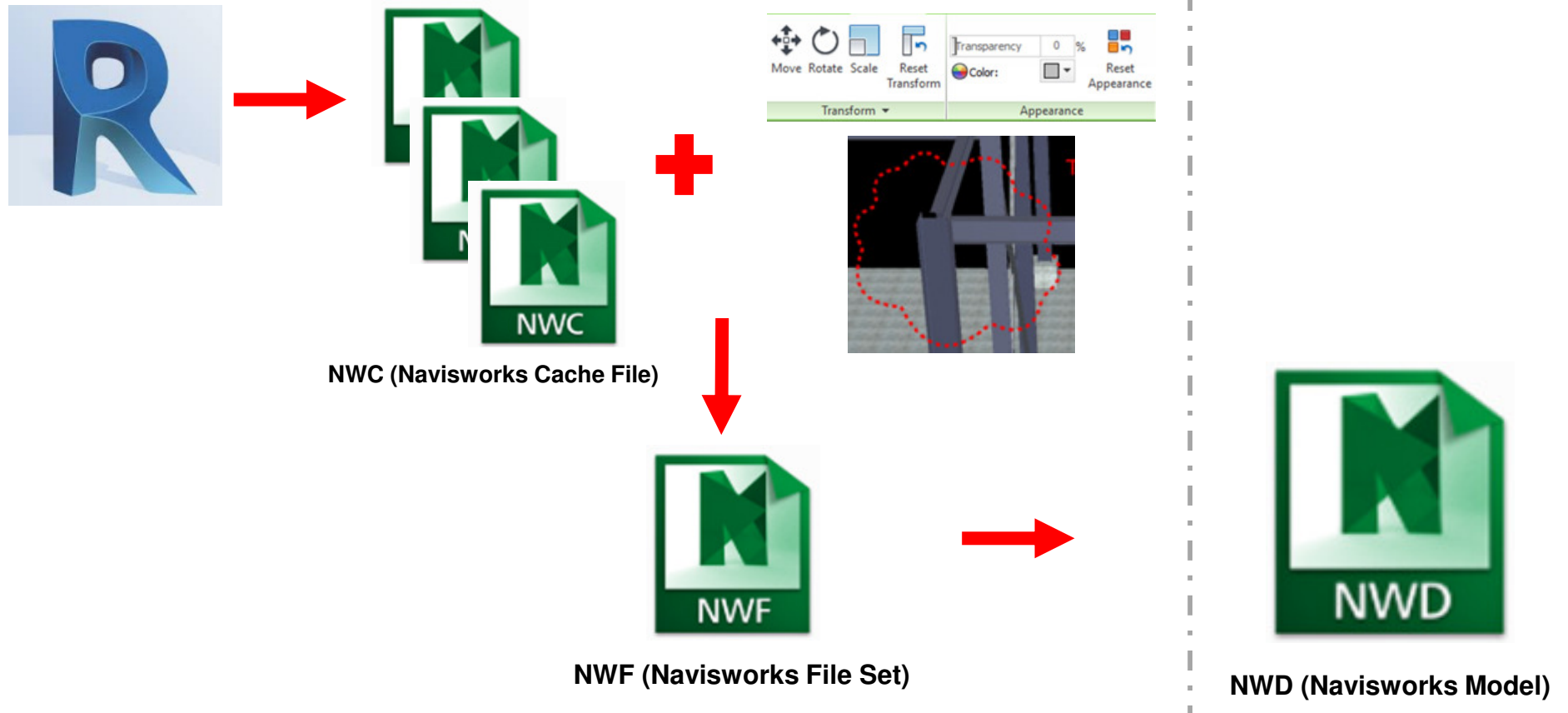
NWF (Navisworks File Set)

- contain links to the original native files (as listed on the Selection Tree) together with Autodesk Navisworks-specific data, such as review markups
- no model geometry is saved

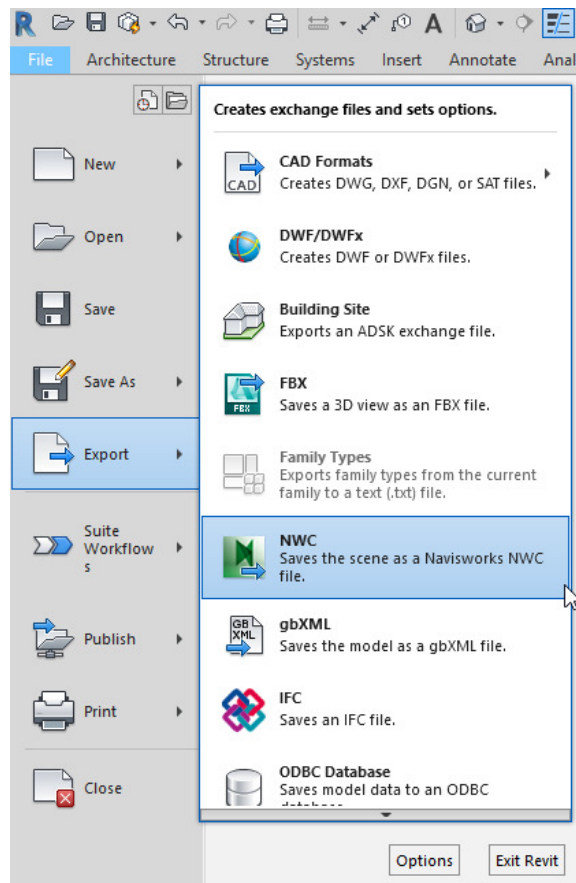
NWD (Navisworks Model)

- contain all model geometry with Autodesk Navisworks-specific data, such as review markups

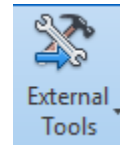
▪ Navisworks file types



■ Export from Revit to Navisworks (NWC)



Add-Ins



Navisworks 2018

Navisworks SwitchBack 2018

Autodesk Navisworks NWC Export Utility

Download free Navisworks 3D viewer

The distributable NWC file exporter enables project teams using Navisworks software to generate whole-project models for simulation and analysis. Team members can generate the optimised NWC file directly from design applications without the need for a licensed seat of Navisworks. The NWC exporter works with a range of products, including AutoCAD and Revit software-based products, as well as 3ds Max, Bentley MicroStation and Graphisoft ArchiCAD software. The NWC file format supports transfer of both object geometry and associated metadata.

Follow these steps to install the Navisworks NWC exporter:

1. Download Autodesk Navisworks NWC File Export Utility

2019: [NavisworksExporters2019.exe](#)

2018: [NavisworksExporters2018.exe](#)

2017: [NavisworksExporters2017.exe](#)

2016: [NavisworksExporters2016.exe](#)

2015: [NavisworksExporters2015.exe](#)

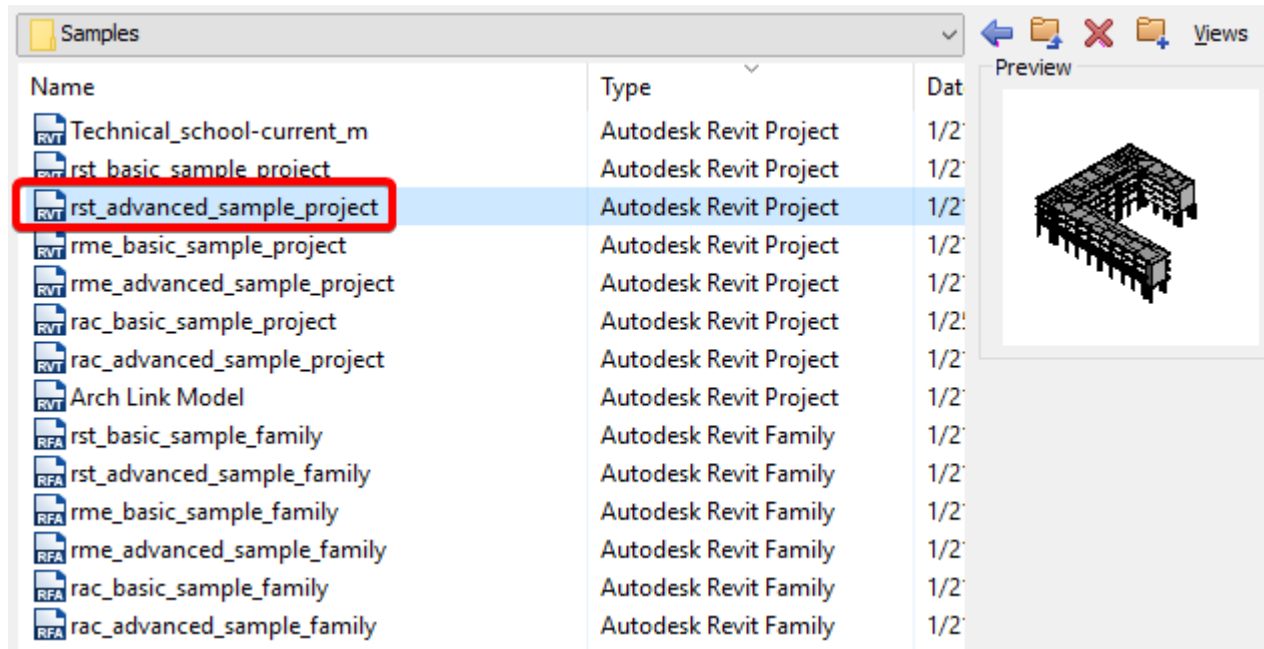
2014: [NavisworksExporters2014.exe](#)

2013: [NavisworksExporters2013.exe](#)

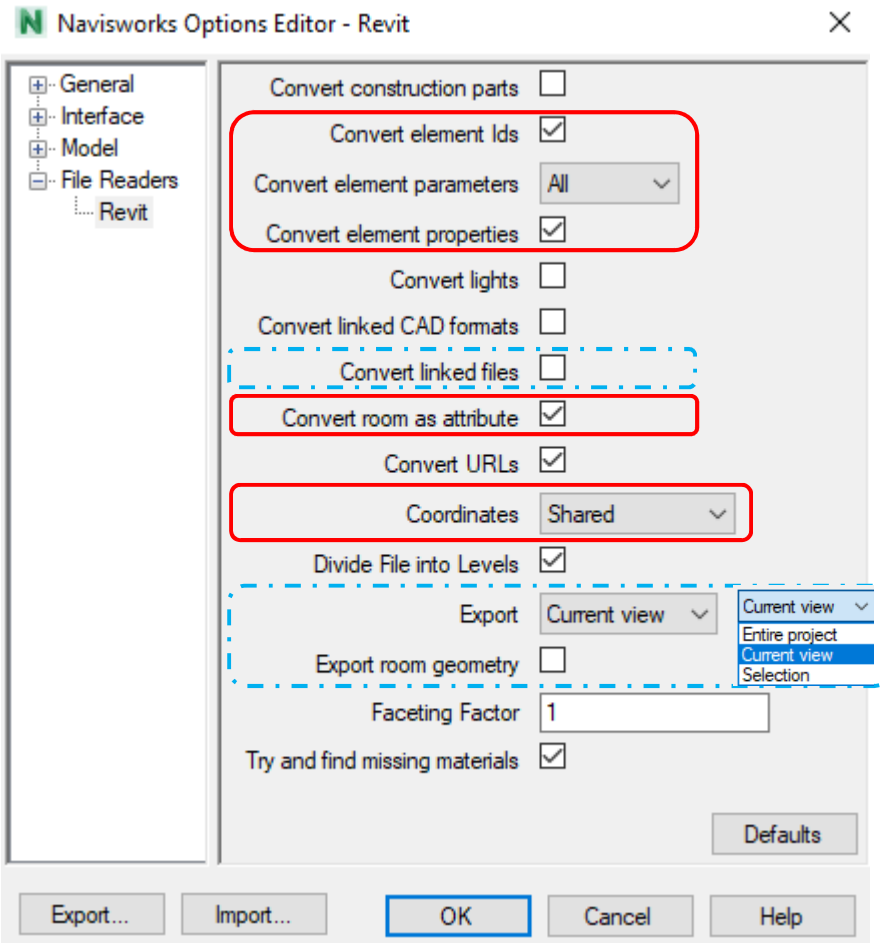
<https://www.autodesk.co.uk/products/navisworks/autodesk-navisworks-nwc-export-utility>

▪ Export from Revit to Navisworks (NWC)

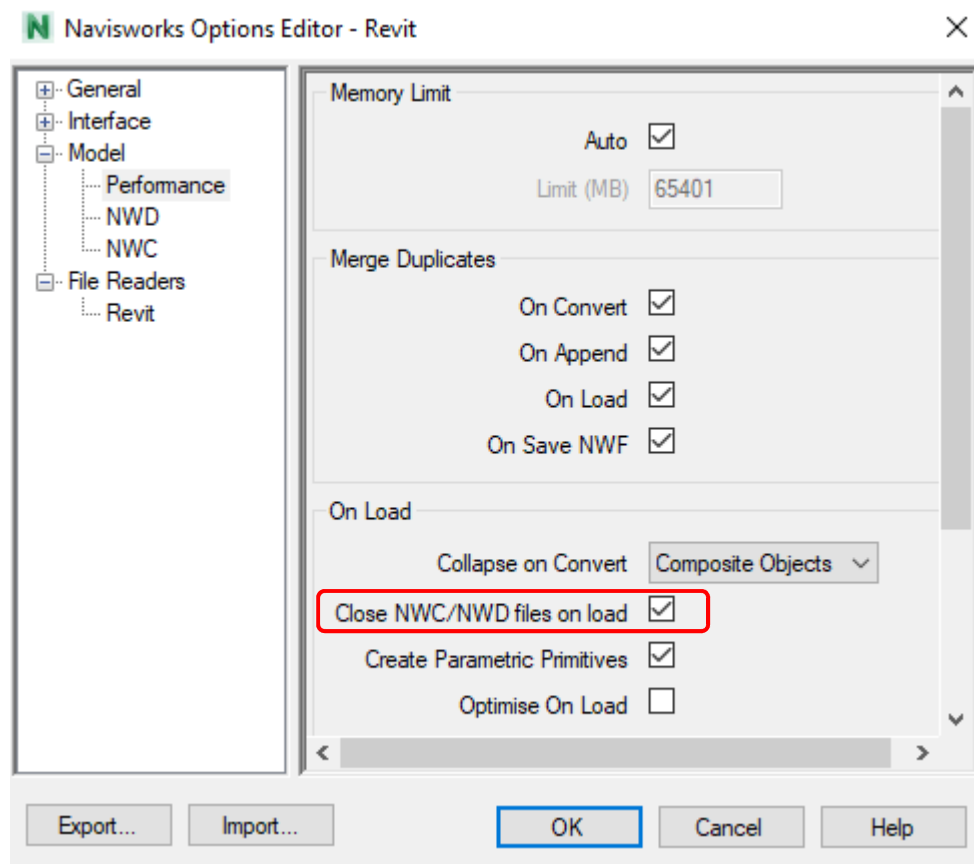
C:\Program Files\Autodesk\Revit 2018\Samples



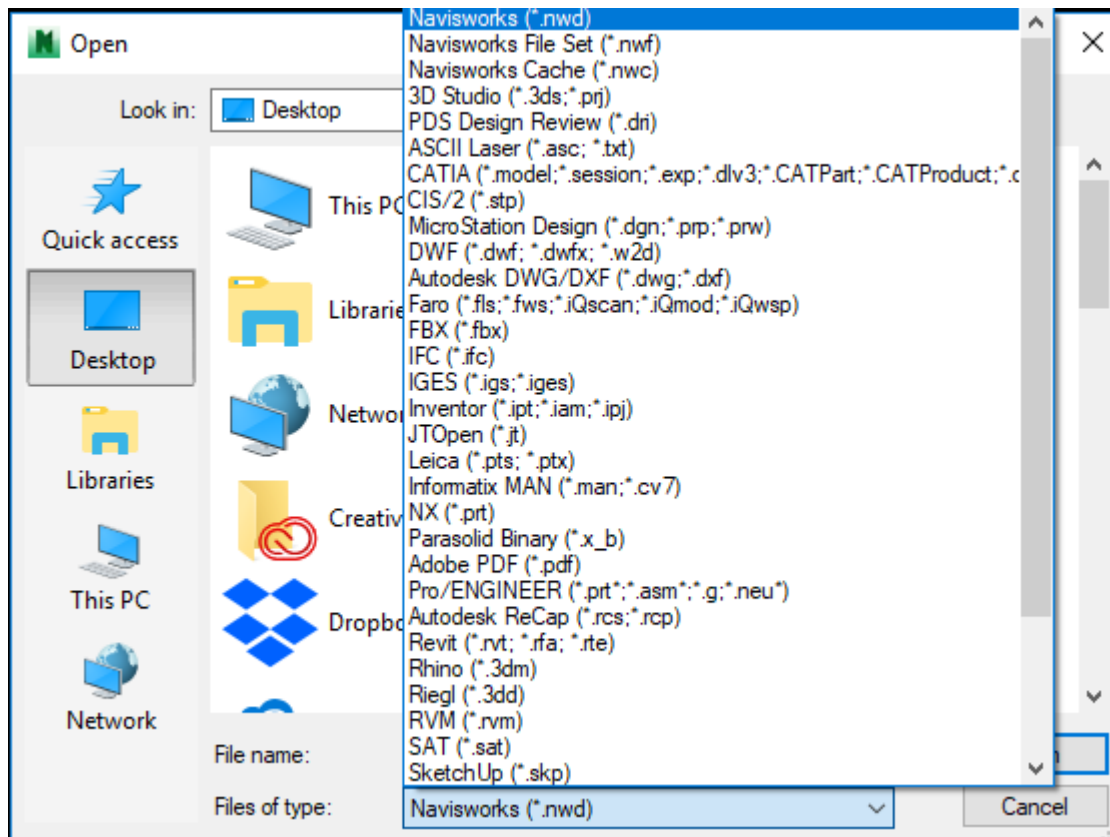
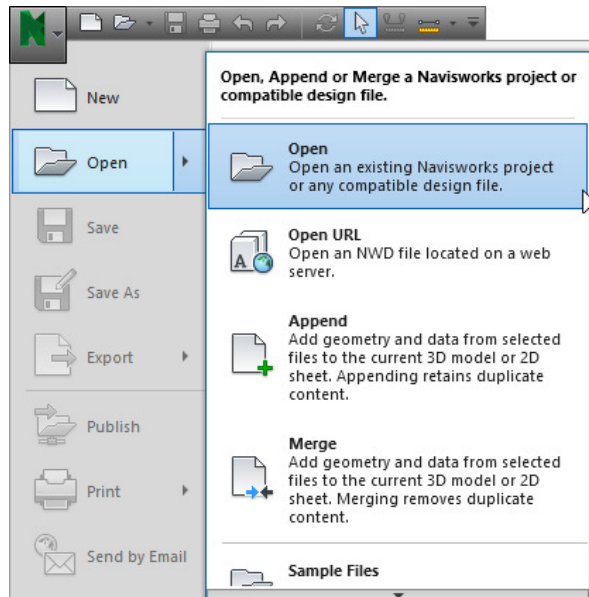
■ Export from Revit to Navisworks (NWC)



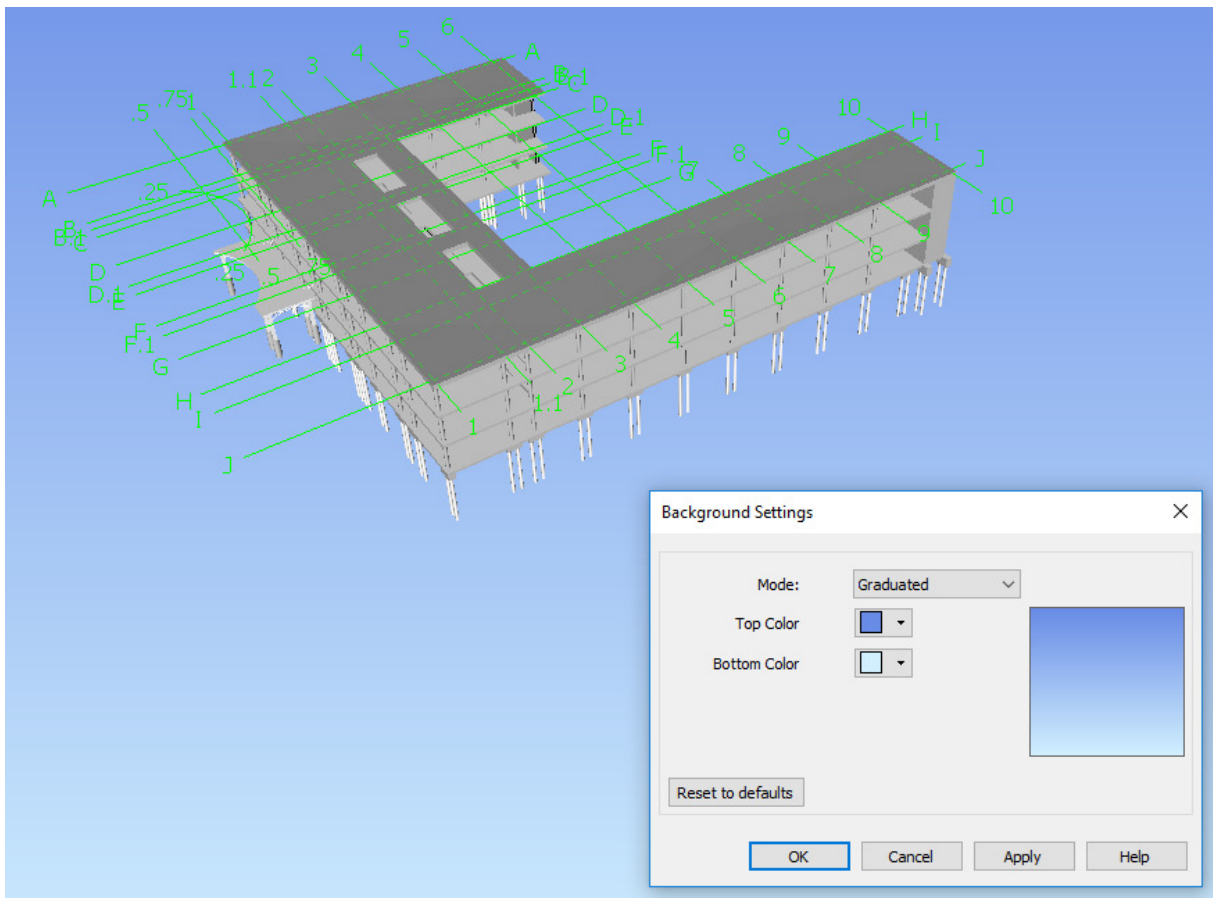
▪ Export from Revit to Navisworks (NWC)



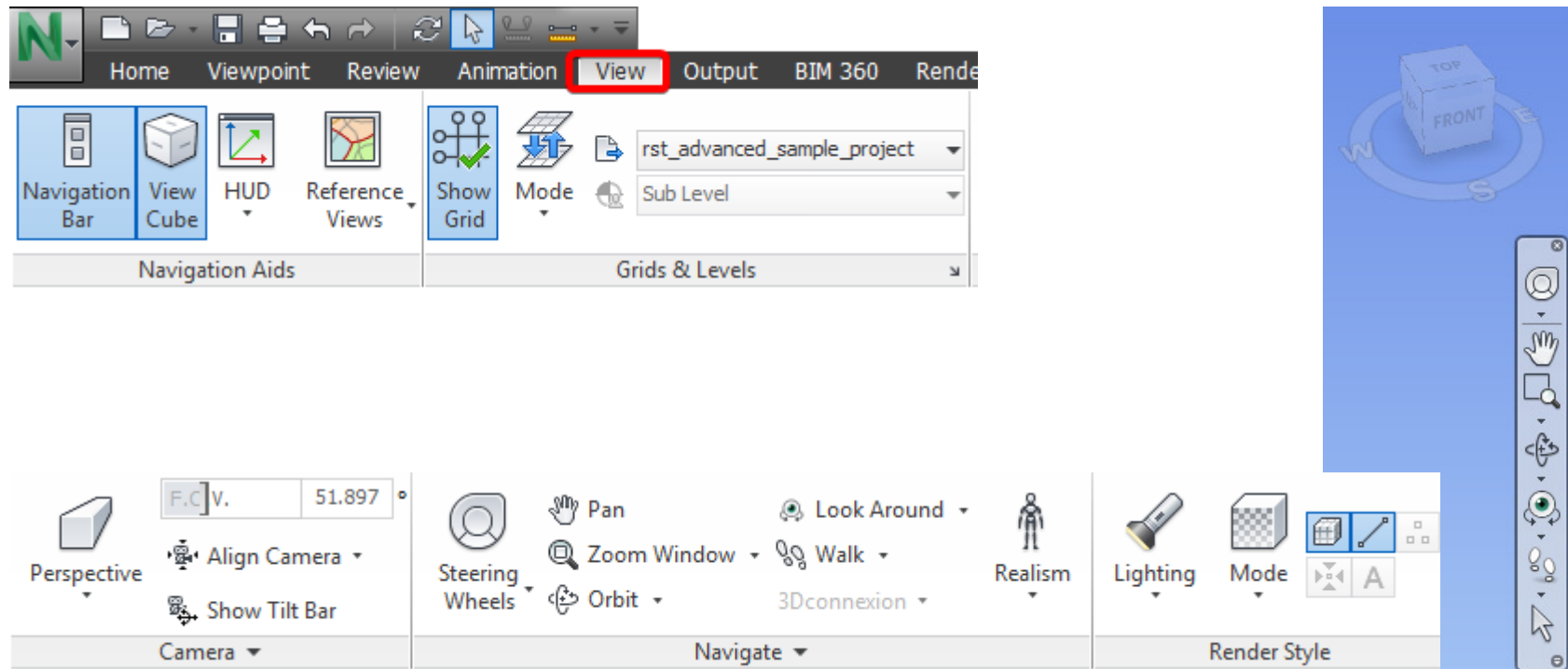
■ Open File



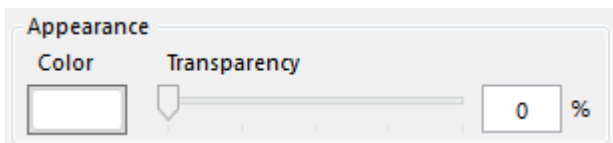
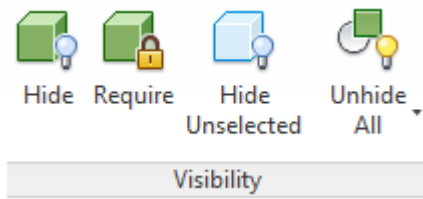
■ Background Setting



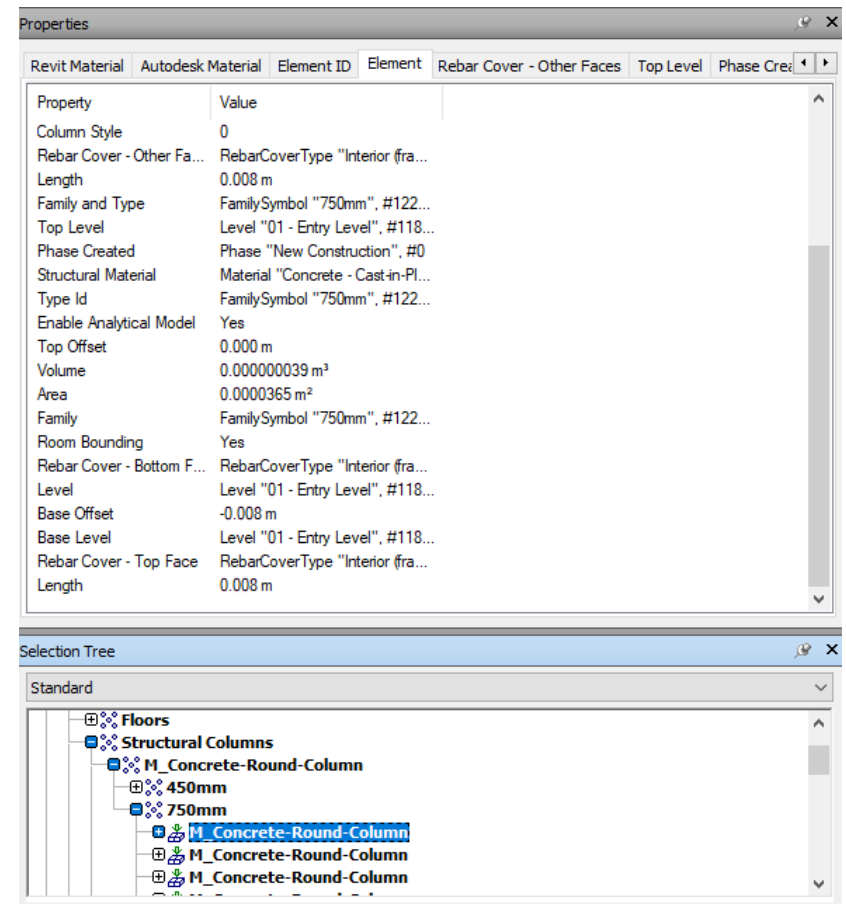
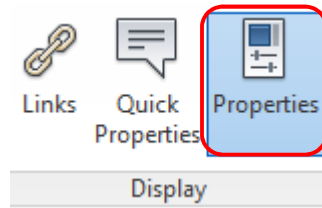
■ Navigate 3D Model



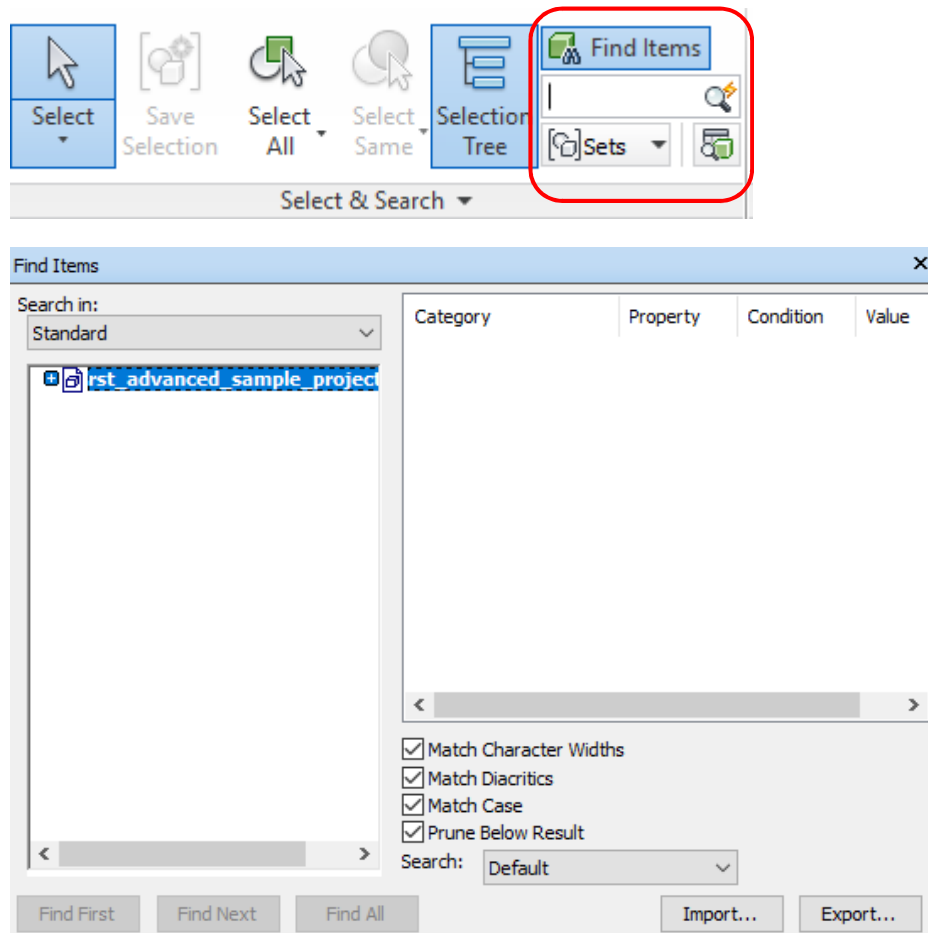
■ Dealing with Objects



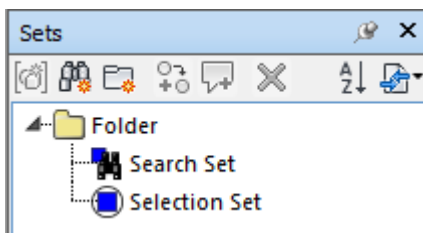
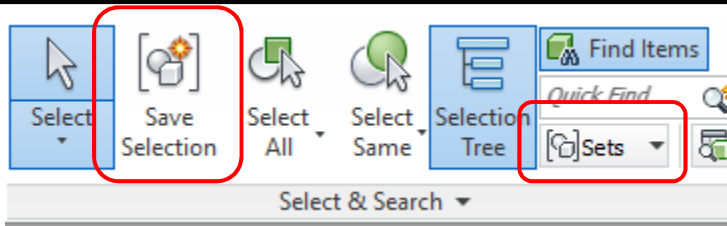
■ Dealing with Objects



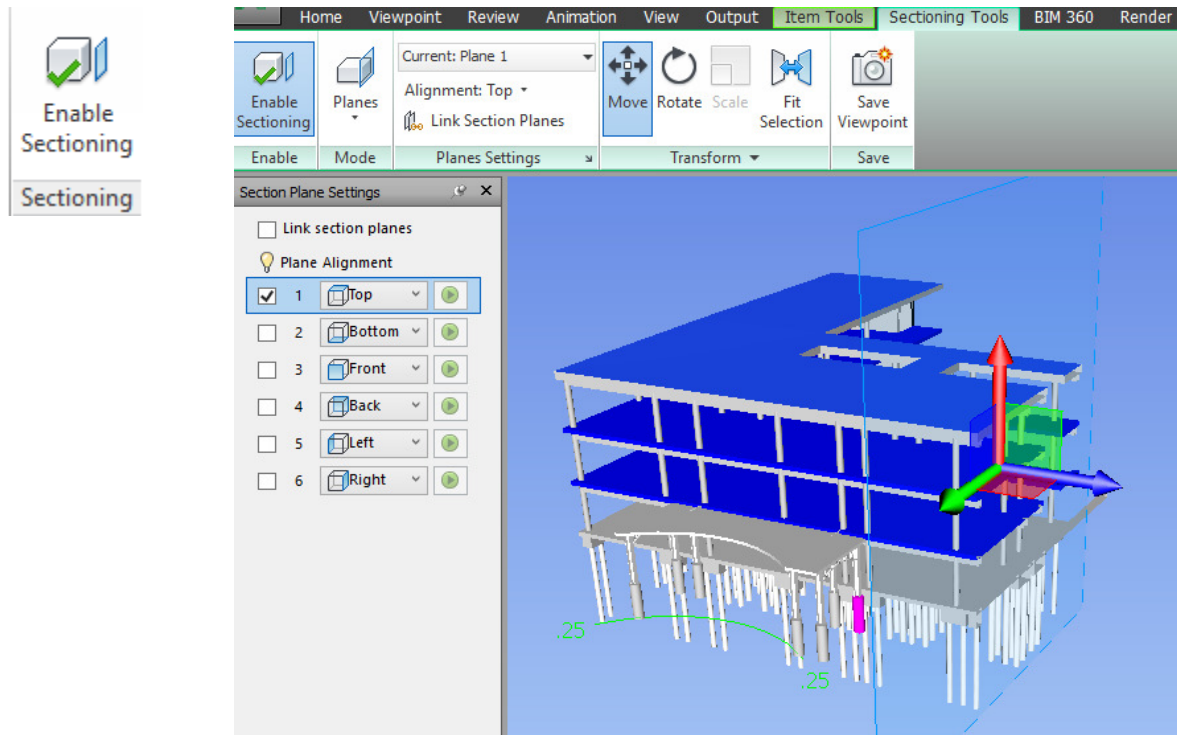
■ Dealing with Objects



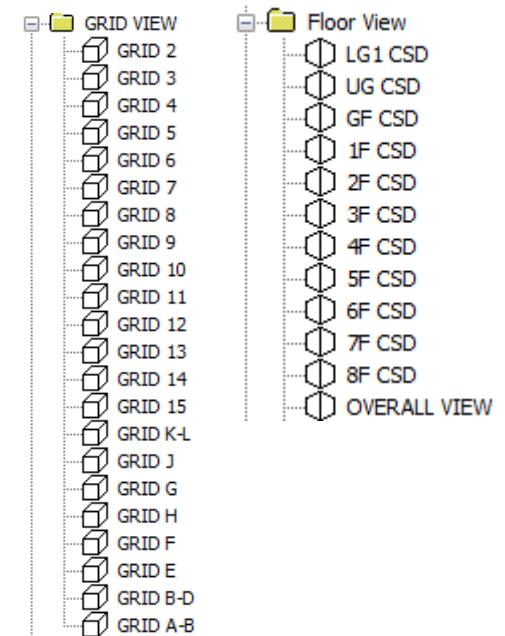
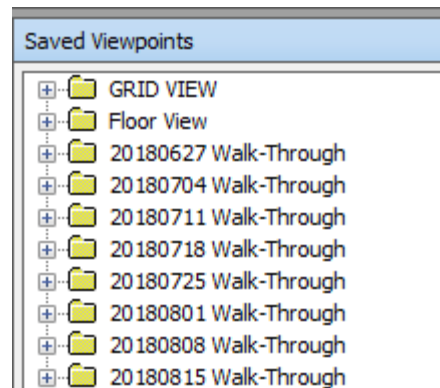
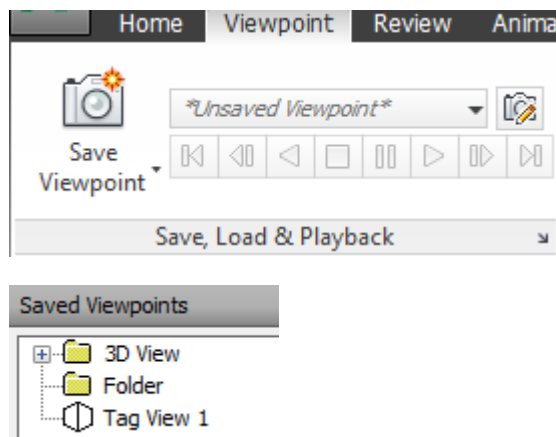
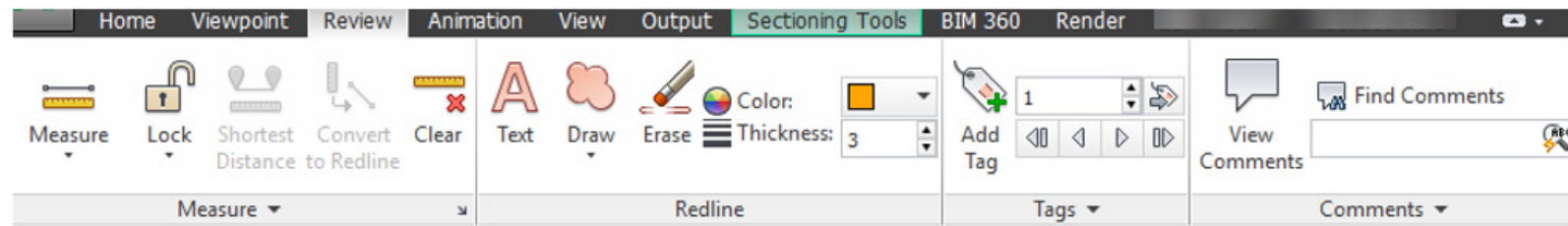
▪ Selection



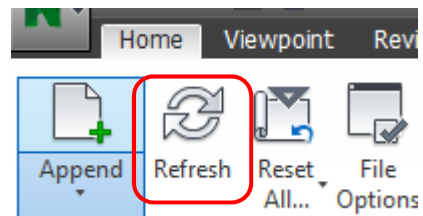
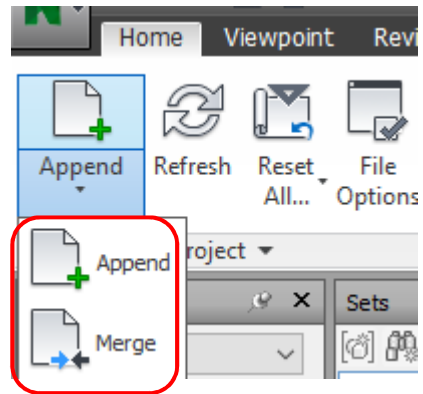
■ Section View



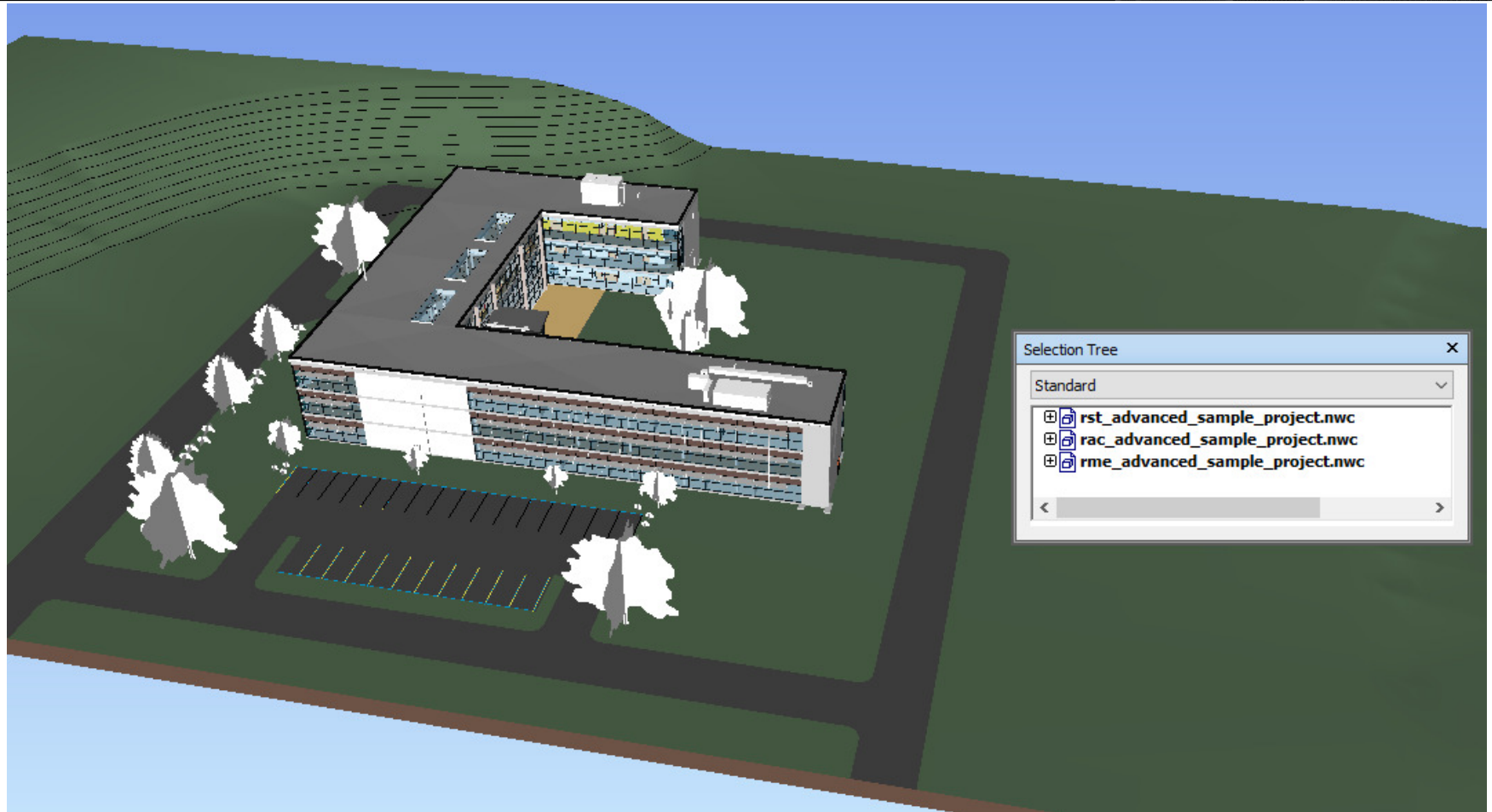
▪ Mark-up



▪ Save NWF



■ Combine Models



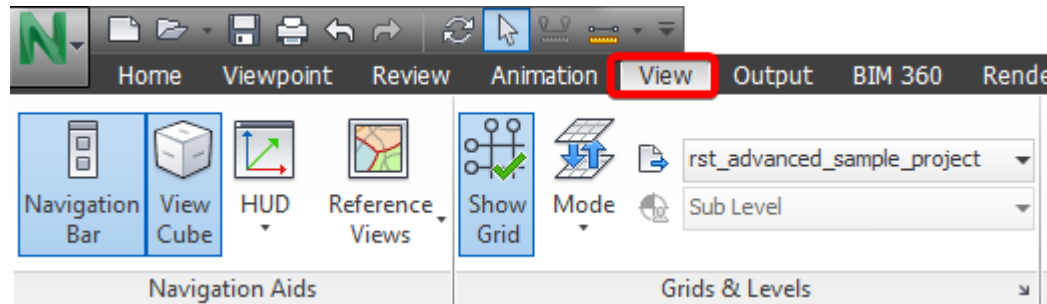
■ Combine Models

<multiple> ▾

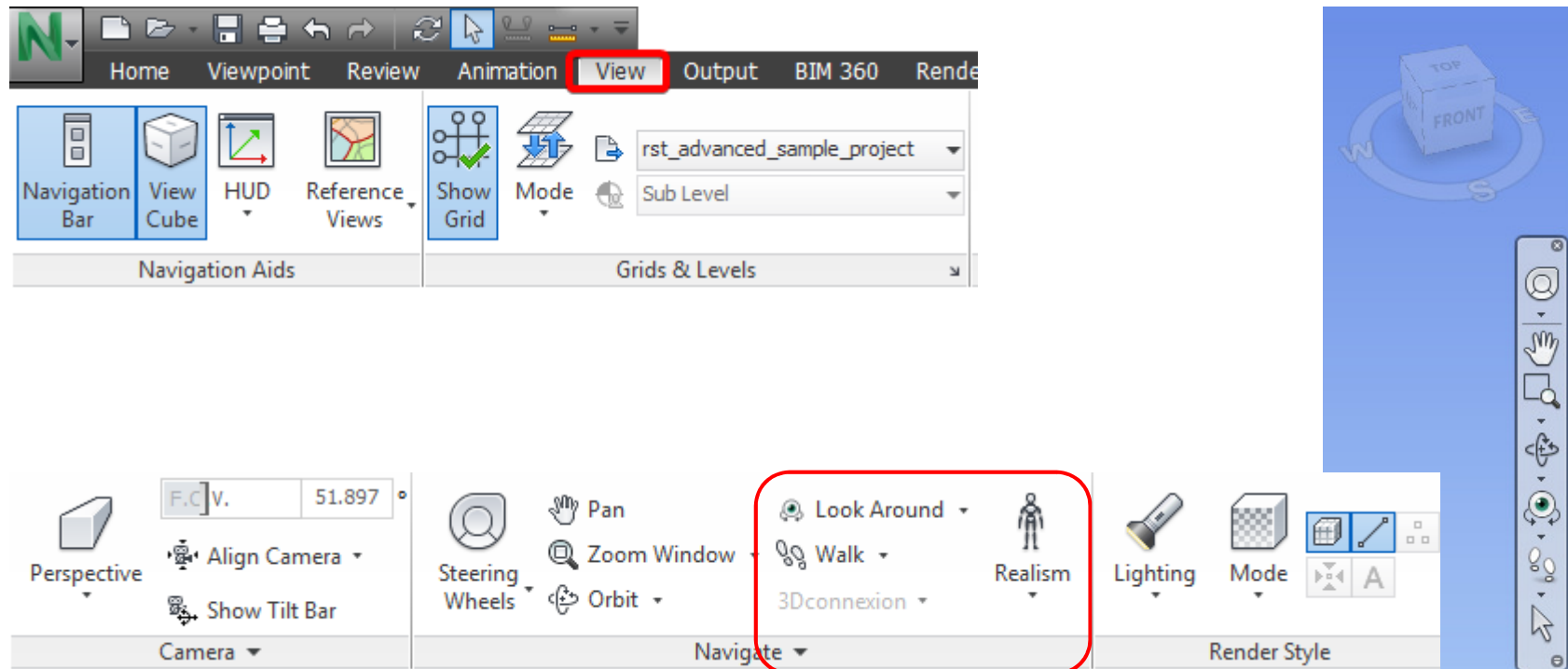
- ☐ Architecture
- ☐ Structure
- ☒ Mechanical
- ☒ Electrical
- ☒ Piping

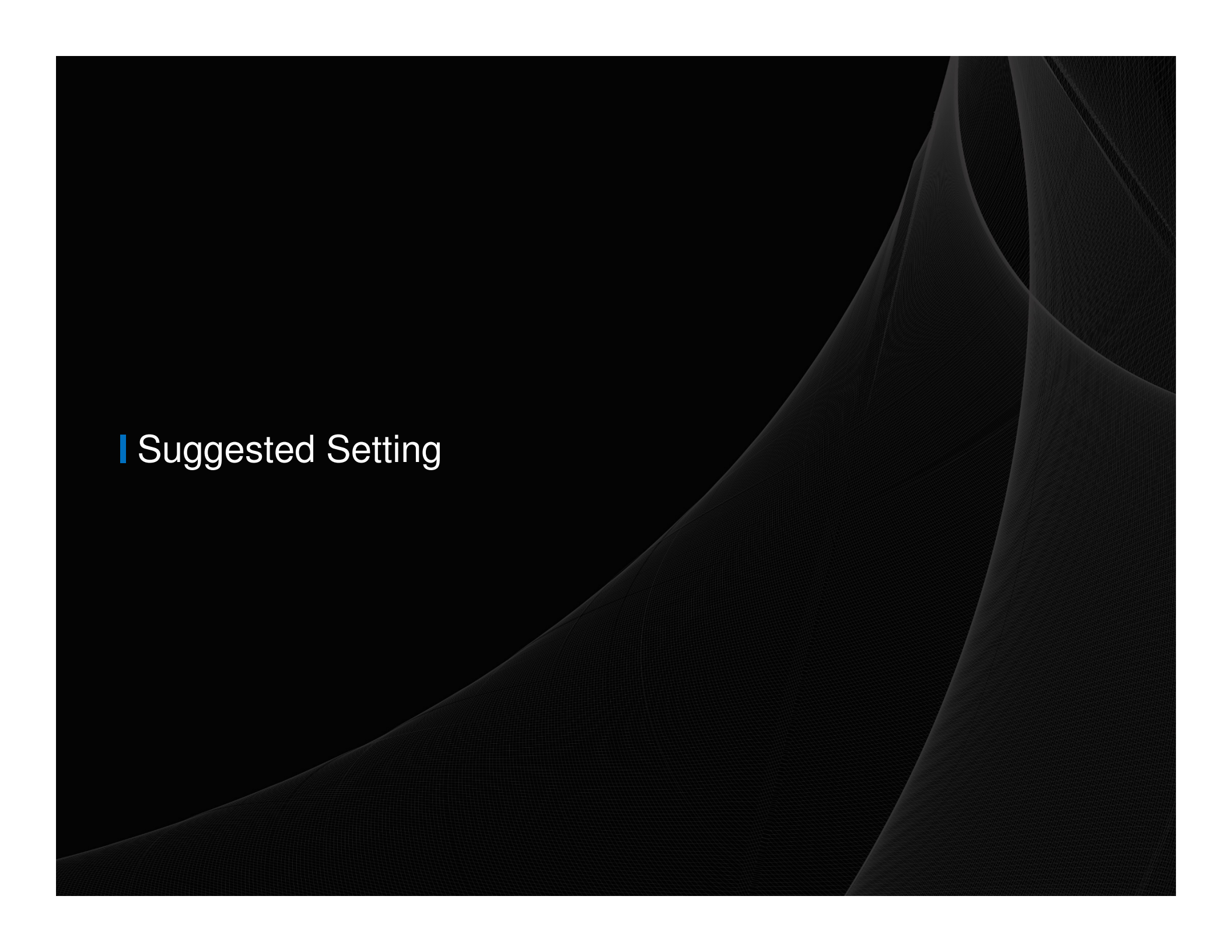
Visibility	
☒	Cable Tray Fittings
☒	Cable Trays
☒	Communication Devices
☒	Conduit Fittings
☒	Conduits
☒	Data Devices
☐	Detail Items
☒	Duct Accessories
☒	Duct Fittings
☒	Duct Insulations
☒	Duct Linings
☒	Duct Placeholders
☒	Ducts
☒	Electrical Equipment
☒	Electrical Fixtures
☒	Fire Alarm Devices
☒	Flex Ducts
☒	Flex Pipes
☐	Generic Models
☒	Lighting Devices
☒	Lighting Fixtures
☐	Lines
☐	Mass
☒	Mechanical Equipment
☒	MEP Fabrication Containment
☒	MEP Fabrication Ductwork
☒	MEP Fabrication Hangers
☒	MEP Fabrication Pipework
☒	Nurse Call Devices
☐	Parts
☒	Pipe Accessories
☒	Pipe Fittings
☒	Pipe Insulations
☒	Pipe Placeholders
☒	Pipes
☒	Plumbing Fixtures
☐	Raster Images
☒	Security Devices
☒	Sprinklers
☒	Telephone Devices
☒	Wires

▪ Render Style



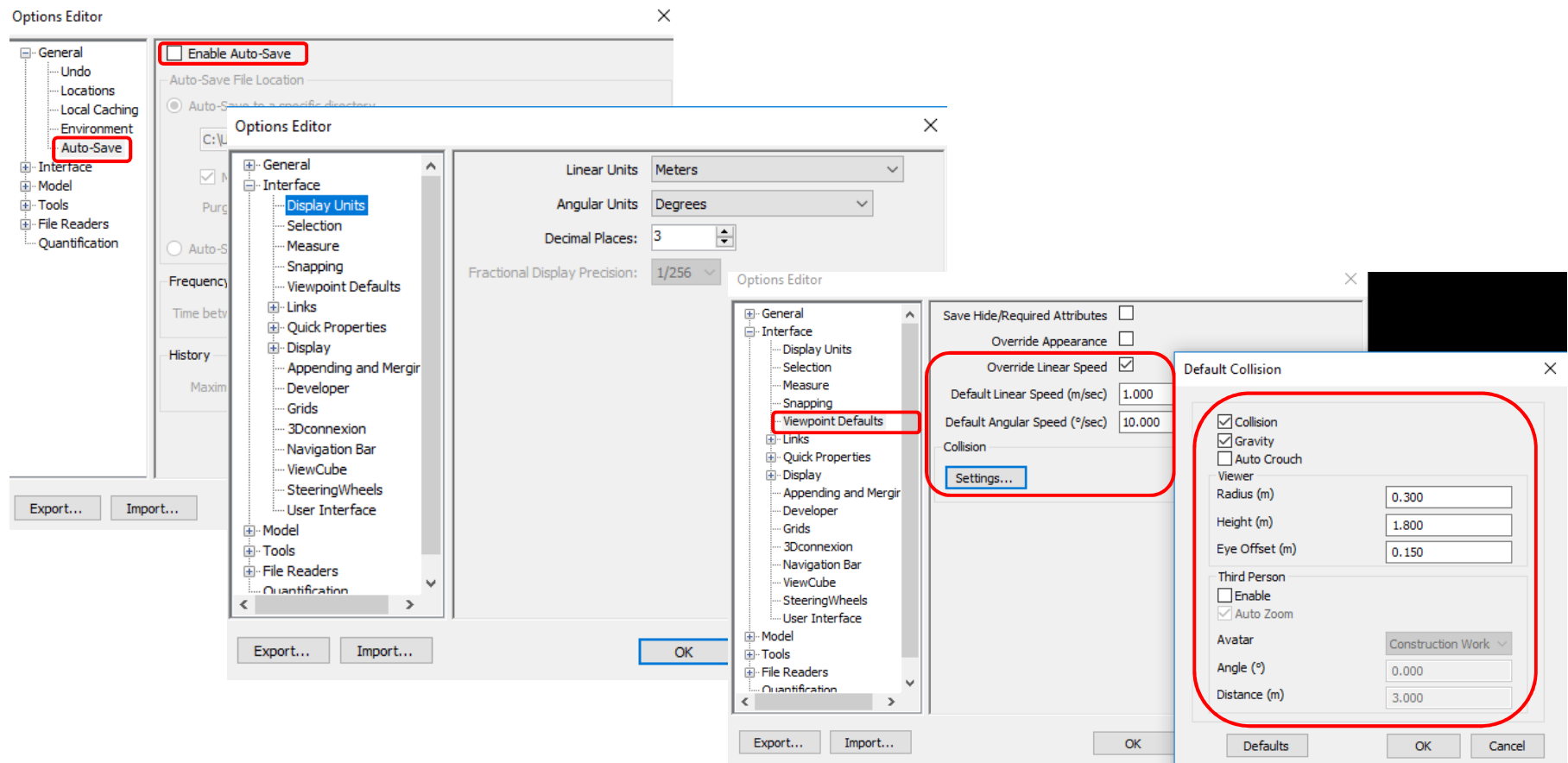
■ Navigate 3D Model



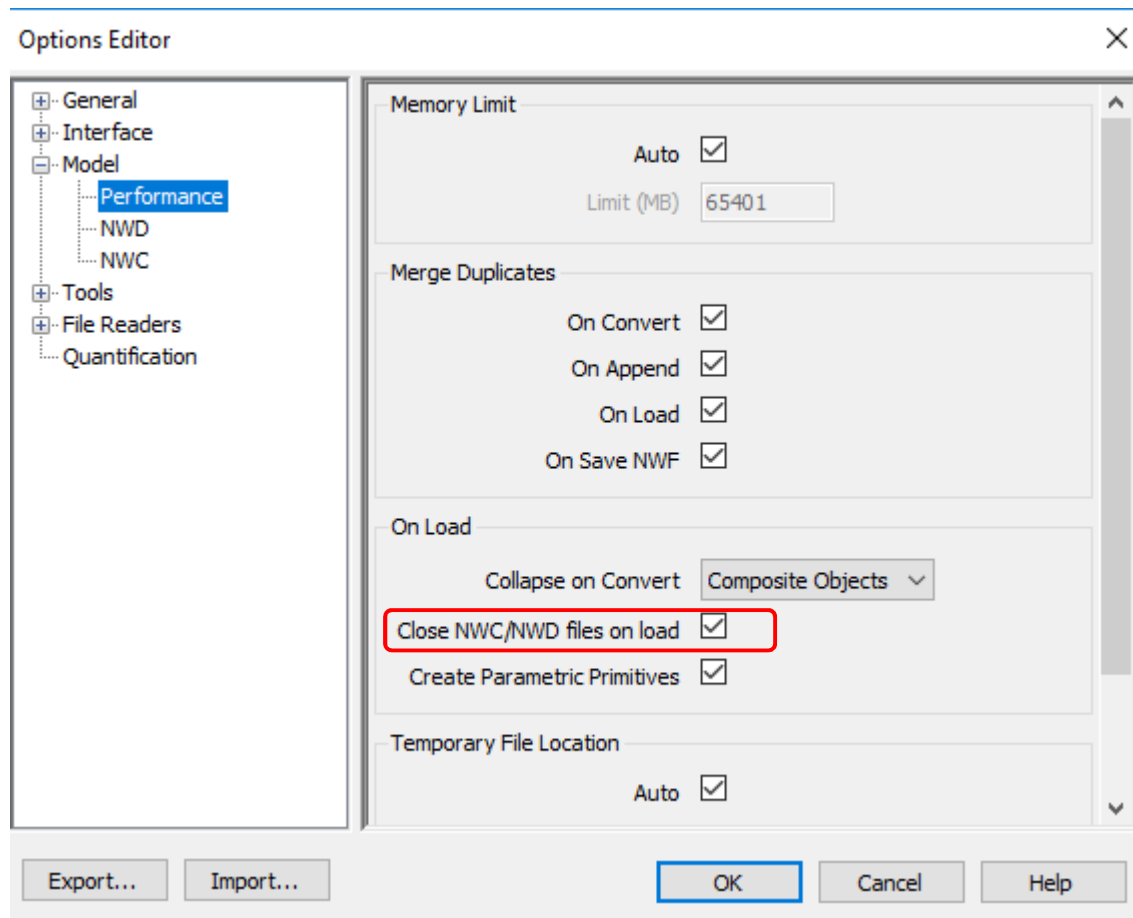


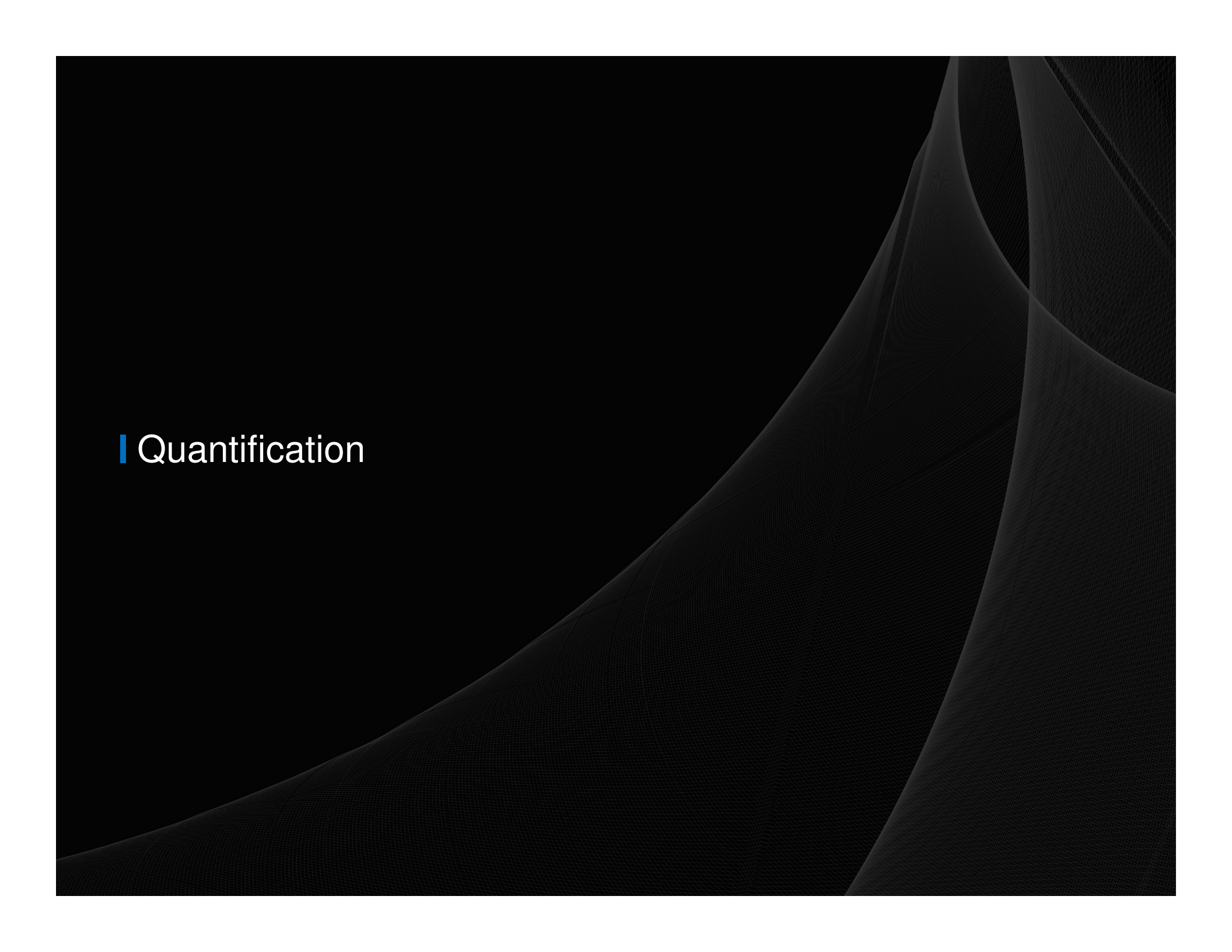
| Suggested Setting

■ Navisworks Settings



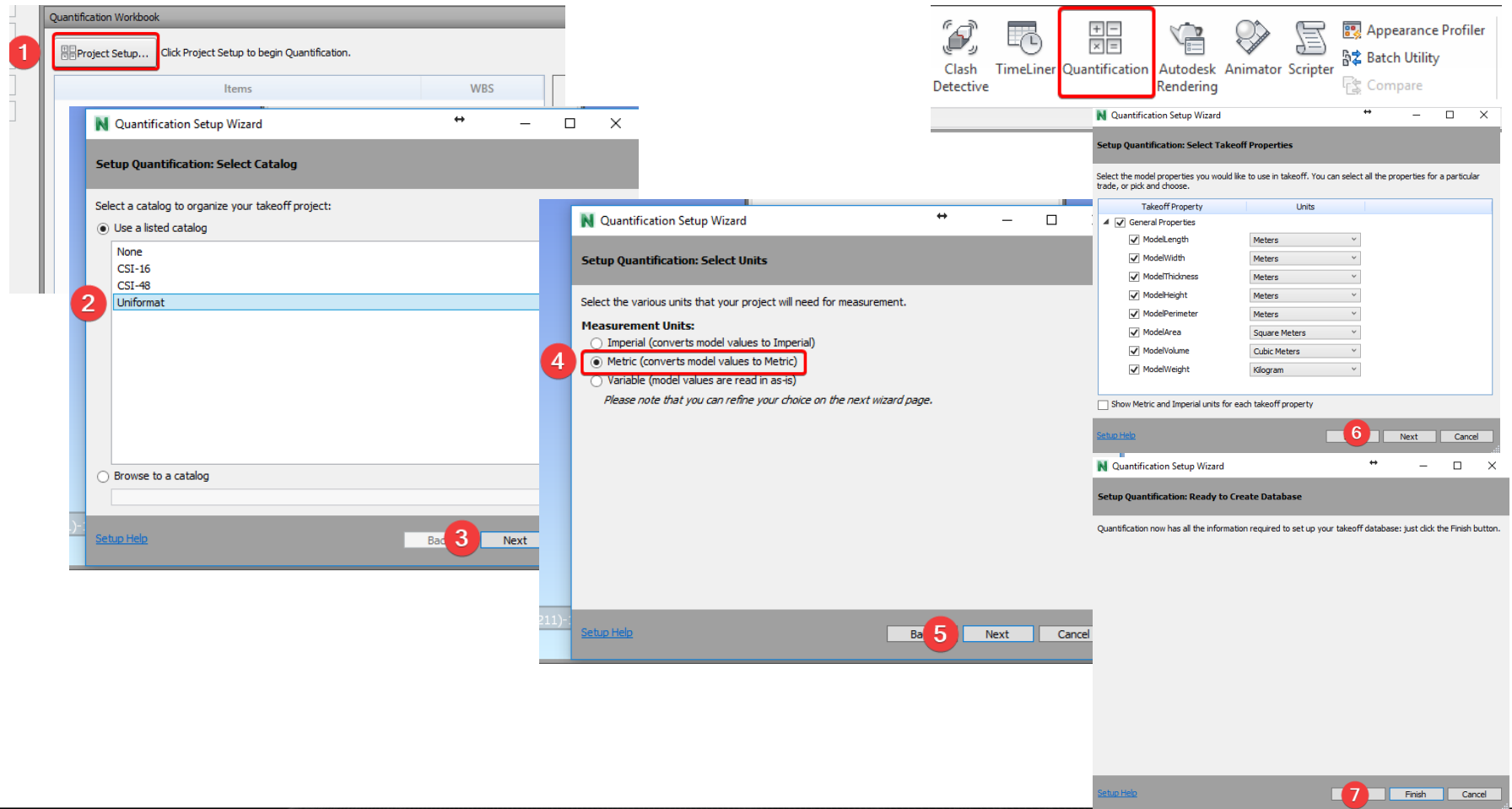
■ Navisworks Settings





I Quantification

■ Setting up workbook



■ Dragging items to the workbook

Quantification Workbook

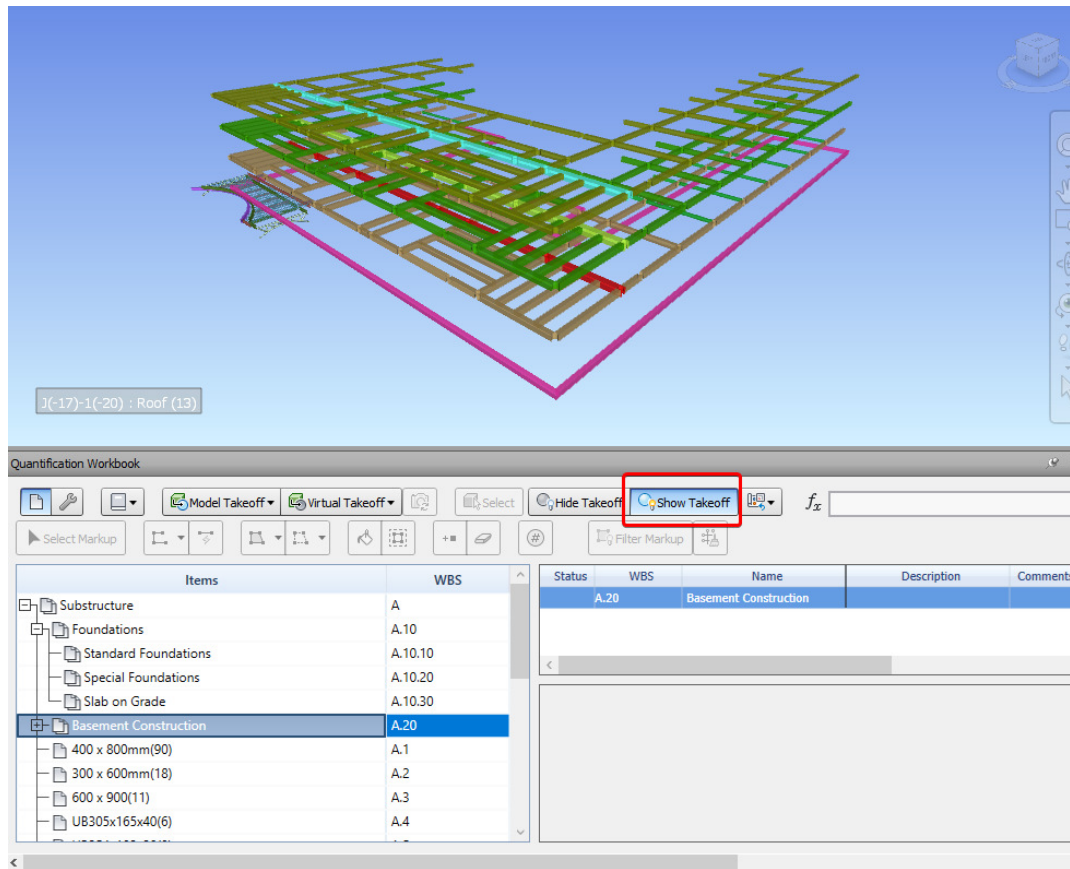
Model Takeoff Virtual Takeoff Select Hide Takeoff Show Takeoff f_x Change Analysis Update

Select Markup Filter Markup

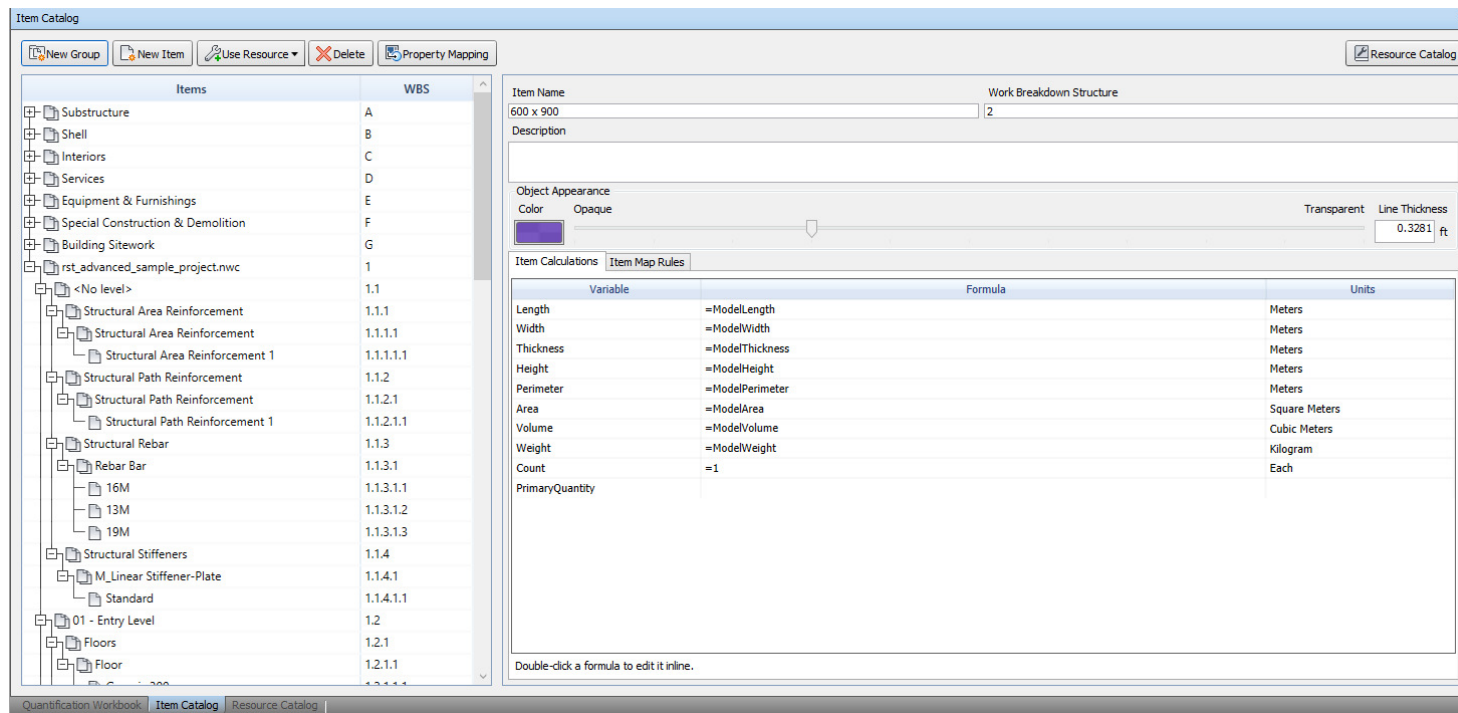
Items	WBS	Status	WBS	Name	Description	Comments	Length	Width	Thickness	Height
Substructure	A		A.10.10	Standard Found						
Foundations	A.10		A.10.10.1	400 x 800mm			516.706 m	0.000 m	0.000 m	0.000 m
Standard Foundations	A.10.10		A.10.10.2	300 x 600mm			93.558 m	0.000 m	0.000 m	0.000 m
400 x 800mm(90)	A.10.10.1		A.10.10.3	600 x 900			52.629 m	0.000 m	0.000 m	0.000 m
300 x 600mm(18)	A.10.10.2									
600 x 900(11)	A.10.10.3									
UB305x165x40(6)	A.10.10.4									
UB254x102x28(8)	A.10.10.5									
HSS114.3X8.6(26)	A.10.10.6									
400 x 800mm(108)	A.10.10.7									
600 x 900(11)	A.10.10.8									
400 x 800mm(108)	A.10.10.9									
600 x 900(11)	A.10.10.10									

Status	WBS	Object	Viewpoint	Comments	ModelLength	ModelWidth	ModelThickness	ModelHeight
	A.10.10.1.1	M Concrete-Rectangular Beam			7.315 m			
	A.10.10.1.2	M Concrete-Rectangular Beam			3.251 m			
	A.10.10.1.3	M Concrete-Rectangular Beam			6.299 m			
	A.10.10.1.4	M Concrete-Rectangular Beam			4.479 m			
	A.10.10.1.5	M Concrete-Rectangular Beam			1.820 m			
	A.10.10.1.6	M Concrete-Rectangular Beam			6.299 m			
	A.10.10.1.7	M Concrete-Rectangular Beam			1.943 m			
	A.10.10.1.8	M Concrete-Rectangular Beam			4.356 m			

■ Taking off the entire model



■ Taking off the entire model



■ Exporting the takeoff

Quantification Workbook

Model Takeoff Virtual Takeoff Select Hide Takeoff Show Takeoff f_x Change Analysis Update

Select Markup Filter Markup

Items WBS

- 600 x 900(11) 1.3.3.1.3
 - UB-Universal Beams 1.3.3.2
 - UB305x165x40(6) 1.3.3.2.1
 - UB254x102x28(8) 1.3.3.2.2
 - M_HSS Round 1.3.3.3
 - HSS114.3X8.6(26) 1.3.3.3.1
- 03 - Floor 1.4
 - Floors 1.4.1
 - Floor 1.4.1.1
 - Generic Concrete 300mm(1) 1.4.1.1.1
 - Structural Columns 1.4.2
 - M_Concrete-Round-Column 1.4.2.1
 - 450mm(63) 1.4.2.1.1
 - Structural Framing 1.4.3
 - M_Concrete-Rectangular Beam 1.4.3.1
 - 400 x 800mm(108) 1.4.3.1.1
 - 600 x 900(11) 1.4.3.1.2
- Roof 1.5
 - Floors 1.5.1
 - Floor 1.5.1.1
 - Concrete Deck - Tapered Insulation(1) 1.5.1.1.1
 - Structural Framing 1.5.2
 - M_Concrete-Rectangular Beam 1.5.2.1
 - 400 x 800mm(108) 1.5.2.1.1
 - 600 x 900(11) 1.5.2.1.2

Status WBS/RBS Name Description Comments Length

1.5.2.1.2	600 x 900				52.629 m
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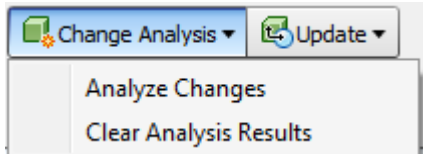
Import Catalog...
Export Catalog to XML...
Export Quantities to Excel...
Export Selected Quantities to Excel...

Status WBS Object Viewpoint Comments ModelLength ModelWidth ModelThickness ModelHeight

1.5.2.1.2.1	M_Concrete-Rectangular Be...				7.315 m		
1.5.2.1.2.2	M_Concrete-Rectangular Be...				3.251 m		
1.5.2.1.2.3	M_Concrete-Rectangular Be...				6.299 m		
1.5.2.1.2.4	M_Concrete-Rectangular Be...				4.479 m		
1.5.2.1.2.5	M_Concrete-Rectangular Be...				1.820 m		
1.5.2.1.2.6	M_Concrete-Rectangular Be...				6.299 m		
1.5.2.1.2.7	M_Concrete-Rectangular Be...				1.943 m		
1.5.2.1.2.8	M_Concrete-Rectangular Be...				4.356 m		
1.5.2.1.2.9	M_Concrete-Rectangular Be...				6.299 m		
1.5.2.1.2.10	M_Concrete-Rectangular Be...				3.251 m		
1.5.2.1.2.11	M_Concrete-Rectangular Be...				7.315 m		

Quantification Workbook Item Catalog Resource Catalog

■ Analysis

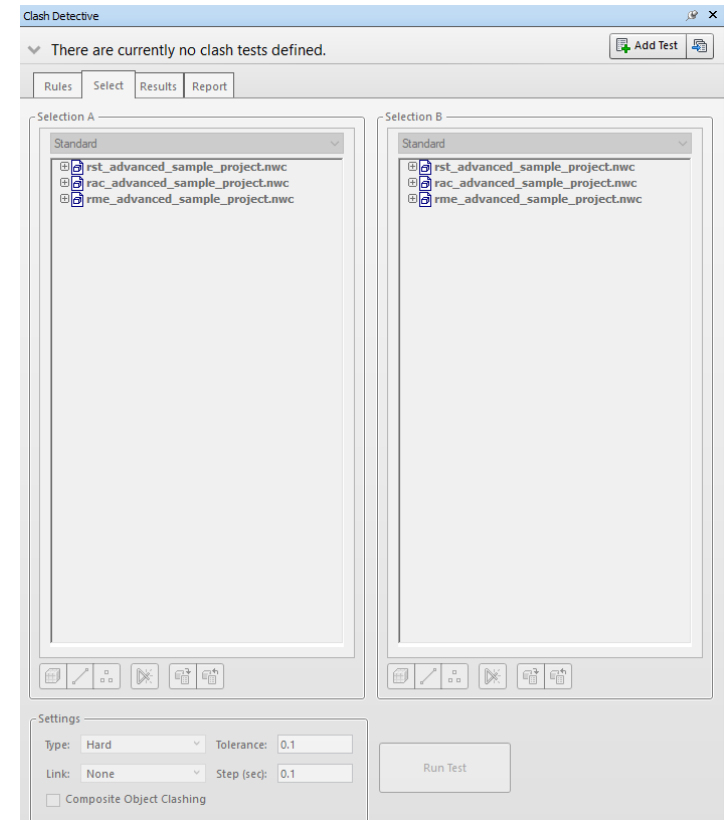
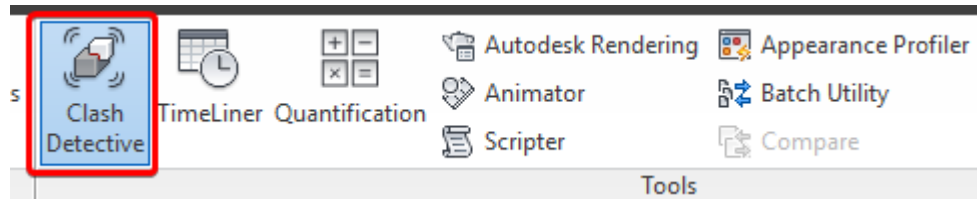


WBS	Status	Viewpoint	Object	LengthParameter	WidthParameter	ThicknessParameter	HeightParameter
C.10.10.1.1			Basic Wall	15.000 m	1.000 m		
C.10.10.1.2			Basic Wall	9.667 m	0.984 m		
C.10.10.1.3			Basic Wall	15.136 m	0.984 m		
C.10.10.1.4			Basic Wall	45.500 m	0.984 m		
C.10.10.1.5			Basic Wall	38.153 m	0.984 m		
C.10.10.1.6			Basic Wall	21.000 m	0.656 m		
C.10.10.1.7			Basic Wall	45.500 m	0.656 m		
C.10.10.1.8			Basic Wall	21.000 m	0.722 m		
C.10.10.1.9			Basic Wall	55.500 m	0.722 m		

Action	How Indicated	Icon	When Shown
Override	Green light in Status column		When a formula has been overridden and Change Analysis has not been run. Hover the icon to see a tooltip.
Change	Blue light in Status column		Where a model object has changed and differs from the associated takeoff item in Quantification Workbook. Hover the icon to see a tooltip.
Error	Red light in Status column		Where there are computation errors with the formula or model item. Hover the icon to see a tooltip.
Delete	Black light in Status column		Where a takeoff's model item has been deleted. Hover the icon to see a tooltip.

| Clash Detection

■ Clash Detection



■ Clash Detection

Clash Detective

Column VS Duct

Last Run: Monday, December 10, 2018 12:13:05 PM
Clashes - Total: 23 (Open: 23 Closed: 0)

Name	Status	Clashes	New	Active	Reviewed
Column VS Duct	Done	23	23	0	0

Add Test Reset All Compact All Delete All Update All

Rules Select Results Report

New Group Assign

None Re-run Test

Name	Status	Level	Grid Int...	Found
Clash1	New	03 - Flo...	I-3	12:13:05 10-12-2018
Clash2	New	02 - Flo...	I-3	12:13:05 10-12-2018
Clash3	New	03 - Flo...	I-3	12:13:05 10-12-2018
Clash4	New	01 - Entr...	A-5	12:13:05 10-12-2018
Clash5	New	01 - Entr...	A-5	12:13:05 10-12-2018
Clash6	New	01 - Entr...	I-1.1	12:13:05 10-12-2018
Clash7	New	03 - Flo...	A-5	12:13:05 10-12-2018
Clash8	New	01 - Entr...	D.1-1.1	12:13:05 10-12-2018
Clash9	New	02 - Flo...	A-4	12:13:05 10-12-2018
Clash10	New	02 - Flo...	A-5	12:13:05 10-12-2018
Clash11	New	01 - Entr...	E-2	12:13:05 10-12-2018
Clash12	New	01 - Entr...	C-3	12:13:05 10-12-2018
Clash13	New	01 - Entr...	B-5	12:13:05 10-12-2018
Clash14	New	01 - Entr...	D-1.1	12:13:05 10-12-2018
Clash15	New	03 - Flo...	A-5	12:13:05 10-12-2018
Clash16	New	03 - Flo...	C-2	12:13:05 10-12-2018
Clash17	New	03 - Flo...	H-1.1	12:13:05 10-12-2018
Clash18	New	01 - Entr...	B-4	12:13:05 10-12-2018
Clash19	New	03 - Flo...	C-2	12:13:05 10-12-2018
Clash20	New	02 - Flo...	A-5	12:13:05 10-12-2018
Clash21	New	02 - Flo...	A-4	12:13:05 10-12-2018
Clash22	New	01 - Entr...	I-1.1	12:13:05 10-12-2018

Highlighting

Item 1 Item 2

Use item colors

Highlight all clashes

Isolation

Dim Other Hide Other

Transparent dimming

Auto reveal

Viewpoint

Auto-update

Animate transitions

Focus on Clash

Simulation

Show simulation

View in Context

All

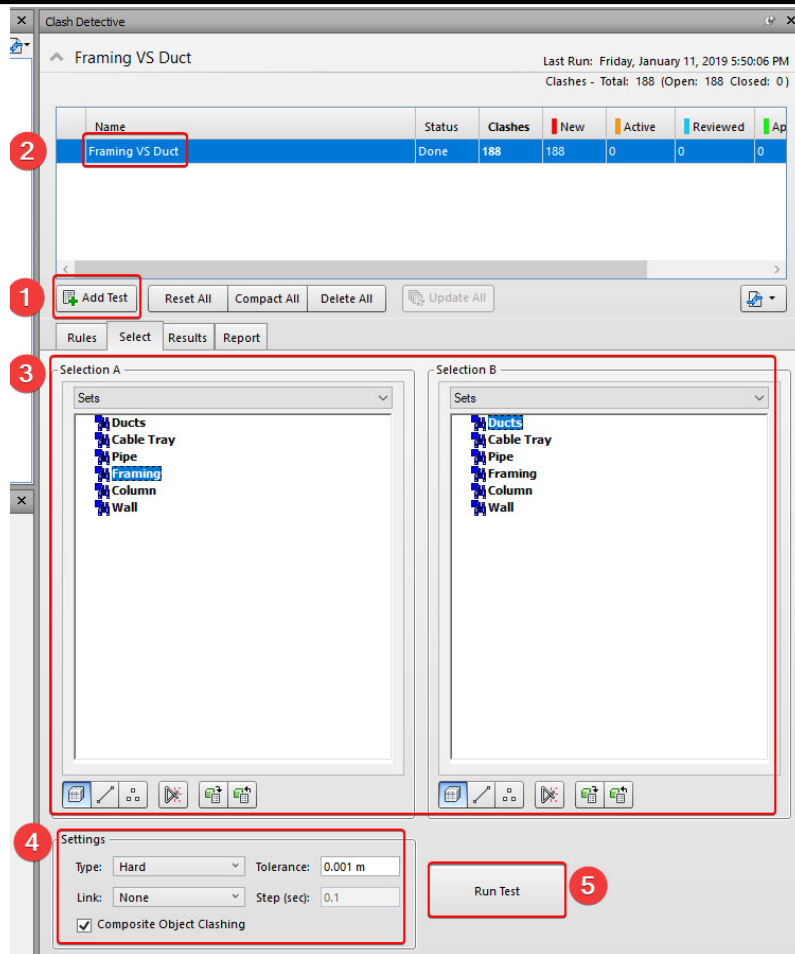
View

■ Clash Detection

Clash Detective								
Framing VS Duct			Last Run: Friday, January 11, 2019 5:50:06 PM					
			Clashes - Total: 188 (Open: 188 Closed: 0)					
	Name	Status	Clashes	New	Active	Reviewed	Approved	Resolved
	Framing VS Duct	Done	188	188	0	0	0	0

- New** - a clash found for the first time in the current run of the test
- Active** - a clash found in a previous run of the test and not resolved
- Reviewed** - a clash previously found and marked by somebody as reviewed
- Approved** - a clash previously found and approved by someone
- Resolved** - a clash found in a previous run of the test and not found in the current run of the test or marked by somebody as resolved

■ Clash Detection



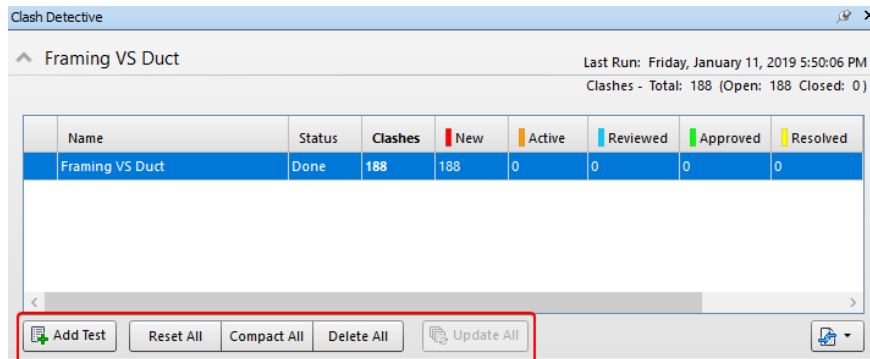
•Hard:
Detecting actual intersections between geometry

•Hard (Conservative)
Performing with a conservative intersection method

•Clearance
Checking for geometry within a specific distance (tolerance) from other geometry

•Duplicates
Detecting for duplicate geometry

■ Clash Detection



- **Add Test:**
Adding a new test
- **Reset All:**
Resetting all tests. In other words, this will make the clash test status New
- **Compact All**
Removing all “Resolved” clash results from the tests to create smaller files
- **Delete All:**
Deleting all tests
- **Run All:**
Running all tests

■ Clash Detection

Rules Select Results Report

Ignore Clashes Between

- ☐ Items in same layer
- ☐ Items in same group/block/cell
- ☐ Items in same file
- ☐ Items with coincident snap points

New Edit Delete

Rules Editor

Rule name

New Rule

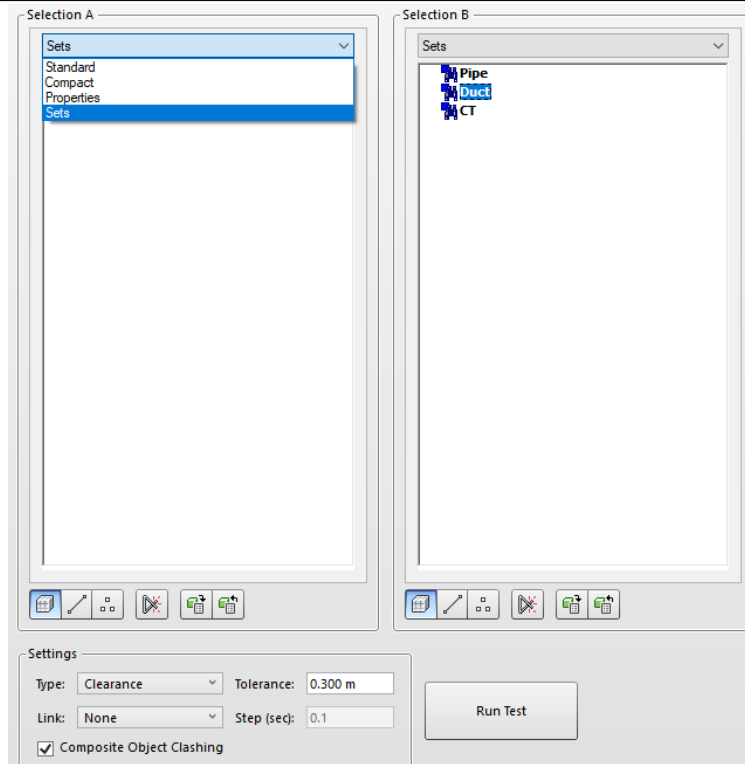
Rule Templates

- Items in same layer
- Items in same group/block/cell
- Items in same file
- Items with coincident snap points
- Insulation Thickness
- Same Property Value
- Same Selection Set
- Specified Selection Sets
- Specified Properties with the Same Value

Rule description (click on an underlined value to edit it)

OK Cancel

■ Clash Detection



- Surface
- Line
- Points
- Self intersect
- Current Selection to Clash Selection
- Select in Scene (Shown in Selection Tree)

■ Clash Detection

Rules Select Results Report

New Group [New] [Find] [Assign] [Re-run Test]

Name	Status	Level	Grid Int...	Found	Approved By	Approved	Description	Assigned To	Distance
Clash1	New	01 - Entr...	F-1.1	17:50:06 11-01-2019			Hard		-0.376 m
Clash2	New	02 - Flo...	I-5	17:50:06 11-01-2019			Hard		-0.331 m
Clash3	New	01 - Entr...	F.1-3(-2)	17:50:06 11-01-2019			Hard		-0.325 m
Clash4	New	02 - Flo...	G(-1)-1.1	17:50:06 11-01-2019			Hard		-0.325 m
Clash5	New	01 - Entr...	B-1.1	17:50:06 11-01-2019			Hard		-0.322 m
Clash6	New	01 - Entr...	D-1.1	17:50:06 11-01-2019			Hard		-0.307 m
Clash7	New	01 - Entr...	I-6(1)	17:50:06 11-01-2019			Hard		-0.297 m
Clash8	New	01 - Entr...	D-1.1	17:50:06 11-01-2019			Hard		-0.296 m
Clash9	New	02 - Flo...	B-5(-3)	17:50:06 11-01-2019			Hard		-0.287 m
Clash10	New	01 - Entr...	B(1)-1	17:50:06 11-01-2019			Hard		-0.283 m
Clash11	New	01 - Entr...	H-1.1(-3)	17:50:06 11-01-2019			Hard		-0.282 m
Clash12	New	02 - Flo...	C-1.1	17:50:06 11-01-2019			Hard		-0.278 m
Clash13	New	01 - Entr...	C-1.1	17:50:06 11-01-2019			Hard		-0.271 m
Clash14	New	02 - Flo...	E(2)-1.1	17:50:06 11-01-2019			Hard		-0.271 m
Clash15	New	01 - Entr...	B-3	17:50:06 11-01-2019			Hard		-0.270 m
Clash16	New	02 - Flo...	F.1-3	17:50:06 11-01-2019			Hard		-0.270 m
Clash17	New	02 - Flo...	H-1.1	17:50:06 11-01-2019			Hard		-0.264 m
Clash18	New	01 - Entr...	A(-2)-1	17:50:06 11-01-2019			Hard		-0.258 m
Clash19	New	01 - Entr...	I-1.1	17:50:06 11-01-2019			Hard		-0.256 m
Clash20	New	01 - Entr...	H-1(2)	17:50:06 11-01-2019			Hard		-0.256 m
Clash21	New	01 - Entr...	F.1-1.1	17:50:06 11-01-2019			Hard		-0.255 m

Highlighting: Item 1 (Red) Item 2 (Green) Use item colors Highlight all clashes

Isolation: Dim Other Hide Other Transparent dimming Auto reveal

Viewpoint: Auto-update Animate transitions Focus on Clash

Simulation: Show simulation

View in Context: All View

Items

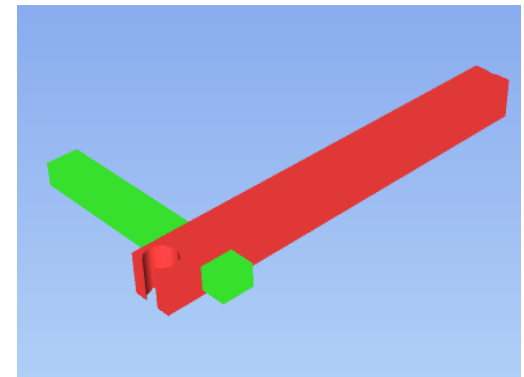
Item 1: M_Concrete-Rectangular Beam

Item 2: Rectangular Duct

Item 1 Tree: rst_advanced_sample_project.nwc > 02 - Floor > Structural Framing > M_Concrete-Rectangular Beam > 600 x 900 > M_Concrete-Rectangular Beam

Item 2 Tree: rst_advanced_sample_project.nwc > Level 1 > Ducts > Rectangular Duct > Mitered Elbows / Taps > Rectangular Duct

- Comment
- Status
- Assigned To



■ Clash Detection

Clash Detective

^ 0101_ARC WALL VS ARC WALL ⚠

Last Run: Monday, June 11, 2018 10:44:00 PM
Clashes - Total: 137 (Open: 119 Closed: 18)

Name	Status	Clashes	New	Active	Reviewed	Approved	Resolved
⚠ 0101_ARC WALL VS ARC WALL	Old	137	0	0	119	0	18
⚠ 0102_ARC WALL VS ARC FLOOR	Old	1118	0	0	1000	0	118
⚠ 0103_ARC WALL VS CEILING	Old	0	0	0	0	0	0
⚠ 0104_ARC WALL VS HEADROOM	Old	316	0	0	85	0	231
⚠ 0105_ARC WALL VS DOOR	Old	57	0	0	30	0	27
⚠ 0106_ARC WALL VS CURTAIN WALL	Old	71	0	0	47	0	24
⚠ 0107_ARC WALL VS WINDOW	Old	1	0	0	1	0	0
⚠ 0108_ARC WALL VS STR WALL	Old	137	0	0	132	0	5
⚠ 0109_ARC WALL VS STR FLOOR	Old	1118	0	0	1000	0	118
⚠ 0110_ARC WALL VS STR FOUNDATION	Old	0	0	0	0	0	0
⚠ 0111_ARC WALL VS COLUMN	Old	125	0	0	120	0	5
⚠ 0112_ARC WALL VS BEAM	Old	409	0	0	363	0	46
⚠ 0113_ARC WALL VS STAIR	Old	20	0	0	14	0	6
⚠ 0202_ARC FLOOR VS ARC FLOOR	Old	68	0	0	39	0	29
⚠ 0205_ARC FLOOR VS DOOR	Old	432	0	0	204	0	228
⚠ 0206_ARC FLOOR VS CURTAIN WALL	Old	48	0	0	22	0	26
⚠ 0207_ARC FLOOR VS WINDOW	Old	0	0	0	0	0	0
⚠ 0208_ARC FLOOR VS STR WALL	Old	908	0	0	366	0	542
⚠ 0209_ARC FLOOR VS STR FLOOR	Old	68	0	0	39	0	29
⚠ 0210_ARC FLOOR VS STR FOUNDATION	Old	0	0	0	0	0	0
⚠ 0211_ARC FLOOR VS COLUMN	Old	192	0	0	135	0	57
⚠ 0212_ARC FLOOR VS BEAM	Old	40	0	0	40	0	0
⚠ 0213_ARC FLOOR VS STAIR	Old	34	0	0	32	0	2

Add Test
 Reset All
 Compact All
 Delete All
 Update All

■ Clash Detection

Column VS Duct Clash

Tolerance: 0.005m
 Self Intersect: 0
 Self Intersect: 0
 Total: 23
 New: 23
 Active: 0
 Reviewed: 0
 Approved: 0
 Resolved: 0
 Type: Hard
 Status: OK

Clash1
 Name: Clash1
 Distance: m
 Description: Hard
 Status: New
 Clash Point: 15.766m, 7.106m, 10.113m
 Grid Location: I-3 : 03 - Floor

Item 1
 Item Name: Concrete - Cast-in-Place Concrete - 28 MPa
 Item Type: Solid

Item 2
 Item Name: Rectangular Duct
 Item Type: Line

Clash2
 Name: Clash2
 Distance: m
 Description: Hard
 Status: New
 Clash Point: 15.709m, 7.474m, 6.771m
 Grid Location: I-3 : 02 - Floor

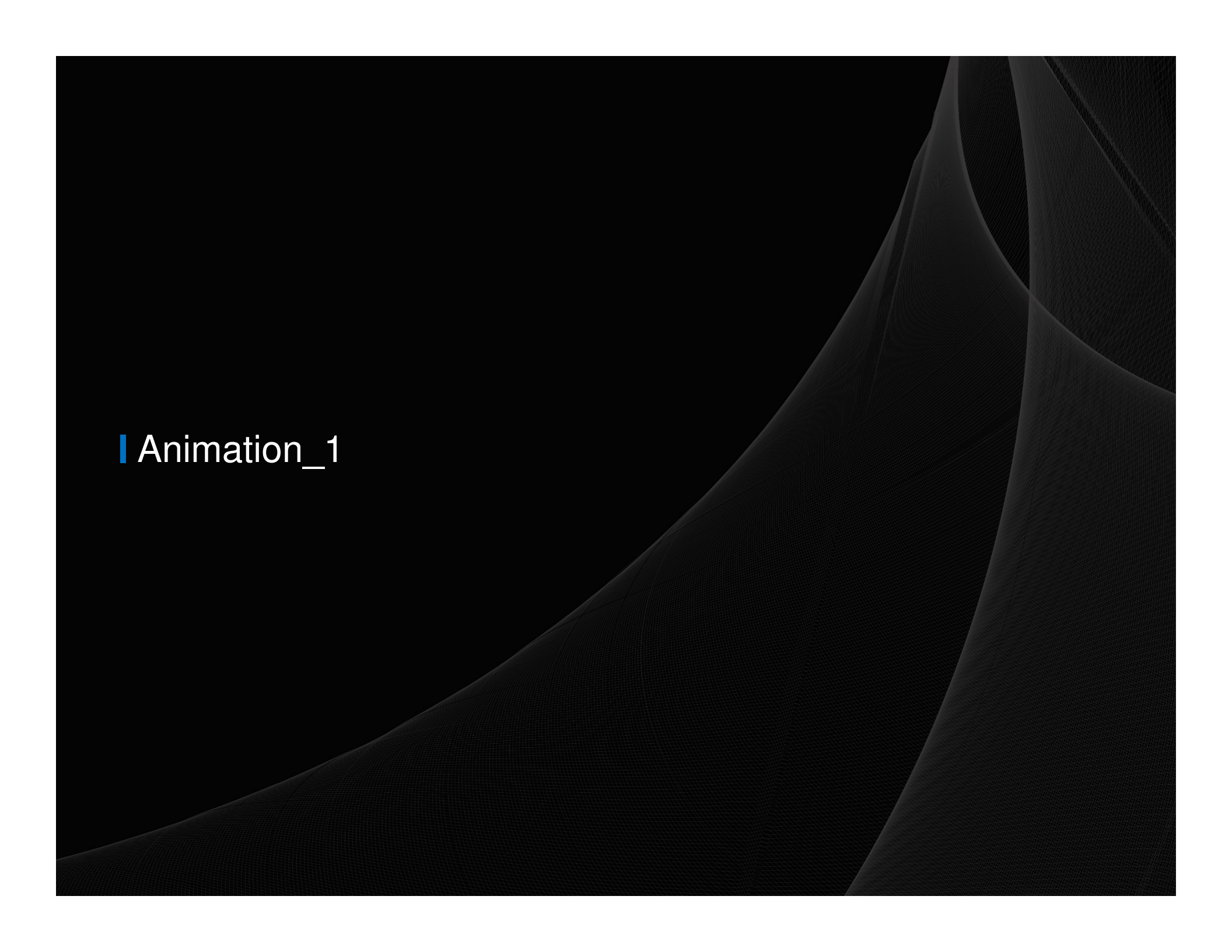
Item 1
 Item Name: Concrete - Cast-in-Place Concrete - 28 MPa
 Item Type: Solid

Item 2
 Item Name: Rectangular Duct
 Item Type: Line

Clash3
 Name: Clash3
 Distance: m
 Description: Hard
 Status: New
 Clash Point: 15.834m, 7.168m, 10.588m
 Grid Location: I-3 : 03 - Floor

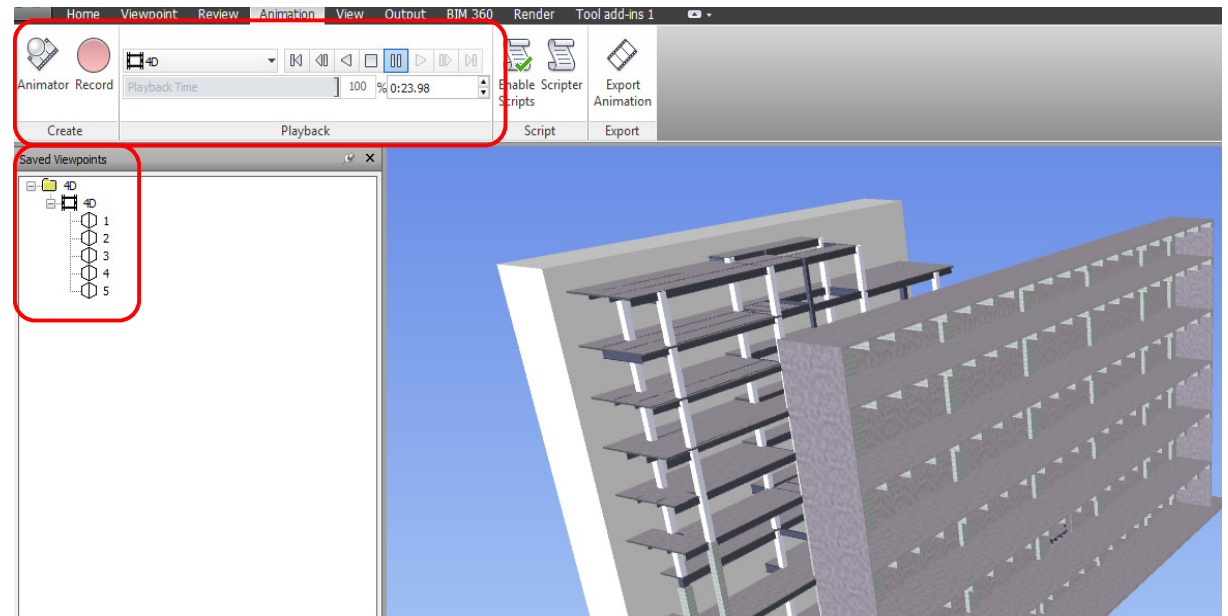
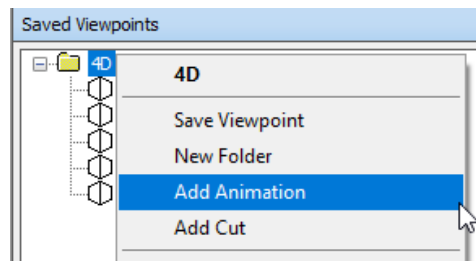
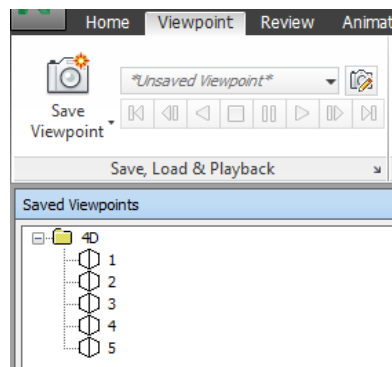
Item 1
 Item Name: Concrete - Cast-in-Place Concrete

	01_ARC WALL	02_ARC FLOOR	03_CEILING	04_HEADROOM	05_DOOR	06_CURTAIN WALL	07_WINDOW	08_STR WALL	09_STR FLOOR	10_STR FOUNDATION	11_COLUMN	12_BEAM	13_STAIRCASE	14_DUCT	15_PIPE	16_CT	17_TRK
	(A) ARC/STR/MEP Issues																
01_ARC WALL	0	0	0	0	54	-	0	2	0	-	0	0	0	38	109	2	6
02_ARC FLOOR	-	0	-	-	14	-	0	0	0	-	0	0	0	0	0	0	2
03_CEILING	-	-	-	-	-	-	0	-	-	-	-	-	-	-	-	-	-
04_HEADROOM	-	-	-	-	23	-	-	-	-	-	-	-	-	15	7	0	8
05_DOOR	-	-	-	-	4	-	0	16	0	-	4	6	3	6	27	1	3
06_CURTAIN WALL	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
07_WINDOW	-	-	-	-	-	-	0	0	0	-	0	0	0	0	0	0	0
08_STR WALL	-	-	-	-	-	-	0	0	0	-	0	0	0	5	5	1	0
09_STR FLOOR	-	-	-	-	-	-	-	0	0	-	0	0	1	13	3	0	1
10_STR FOUNDATION	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
11_COLUMN	-	-	-	-	-	-	-	-	-	-	0	0	0	0	0	0	0
12_BEAM	-	-	-	-	-	-	-	-	-	-	1	0	3	93	0	0	0
13_STAIRCASE	-	-	-	-	-	-	-	-	-	-	0	0	1	0	0	0	0
14_DUCT	-	-	-	-	-	-	-	-	-	-	-	-	53	117	1	10	10
15_PIPE	-	-	-	-	-	-	-	-	-	-	-	-	-	599	1	8	8
16_CT	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	0	0
17_TRK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0
	Arch. Self-clash																
	Stru. Self-clash																
	MEP. Self-clash																
	Arch & Stru. Clash																
	Arch. & MEP clash (Door)																
	Stru. (Walls) & MEP clash																
	Stru. (Slabs) & MEP clash																
	Stru. (Beams) & MEP clash																
	Stru. (Columns) & MEP clash																
	(A)Sum up																
	1051																



| Animation_1

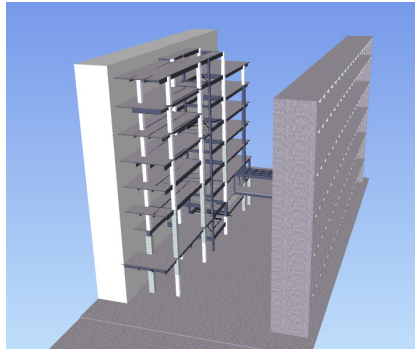
■ Animation_1





| 4D Construction Sequence

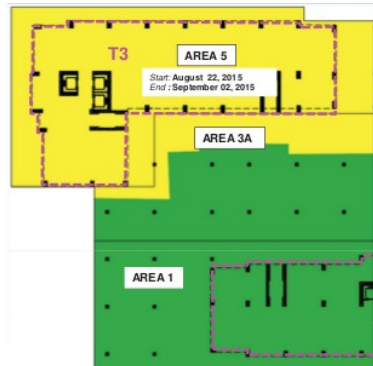
■ 4D Construction Sequence



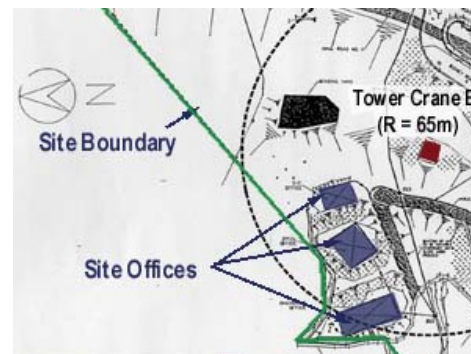
3D Model
(New Construction/ Existing Building...)



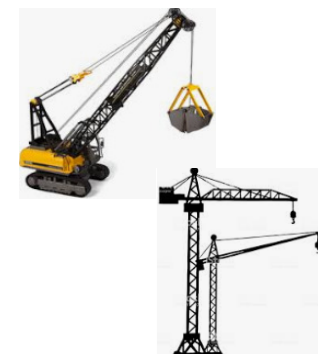
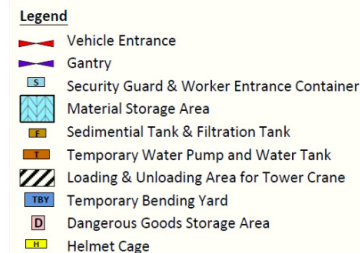
Construction Program/ Master Program



Construction Zoning Plan

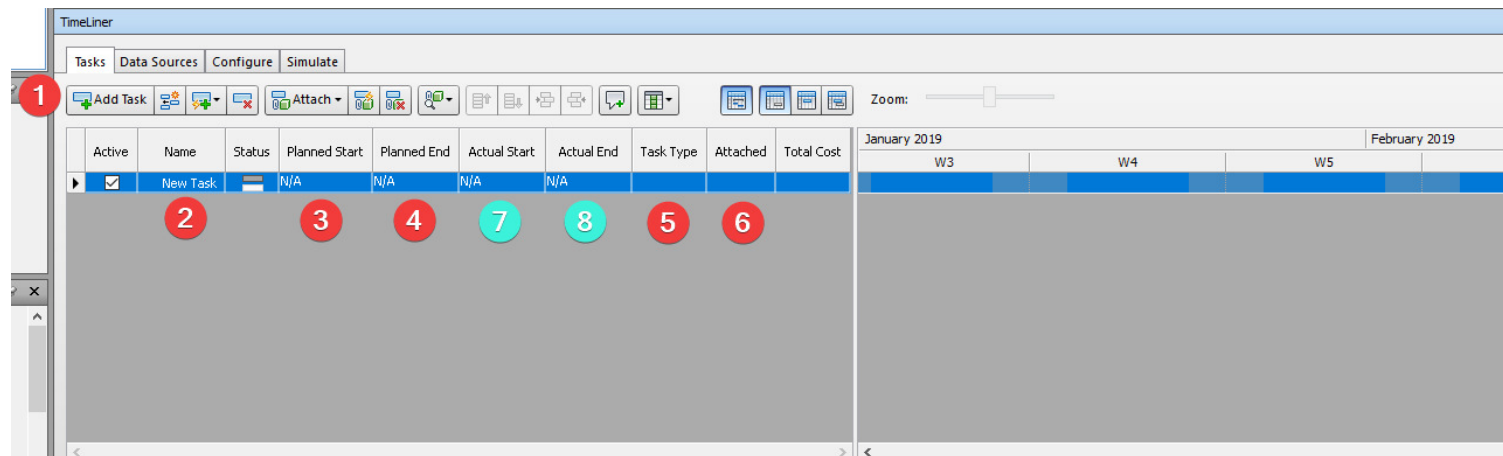
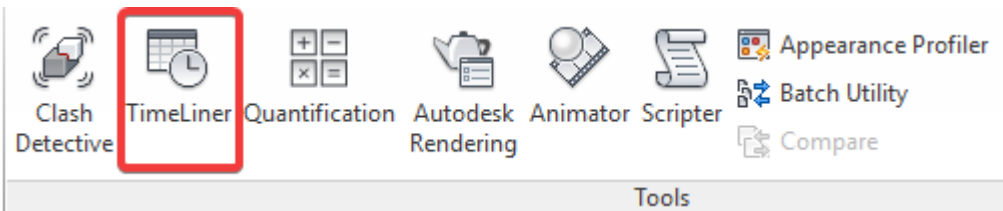


Site Layout Plan

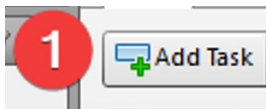


Construction Equipment/ vehicle

Work with TimeLiner



■ Work with TimeLiner

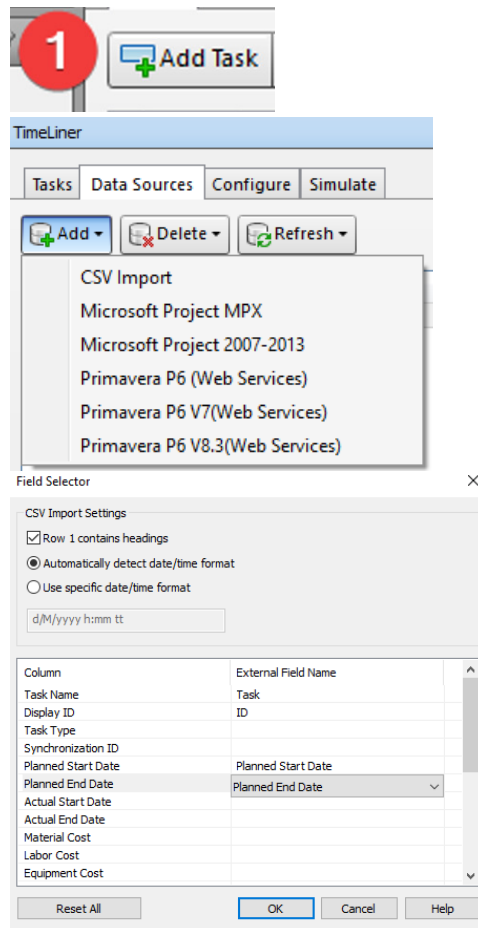


TimeLiner

Tasks | Data Sources | Configure | Simulate

Active	Name	Status	Planned Start	Planned End	Actual Start	Actual End	Task Type	Attached	Total Cost	Jan 26, 19	Jan 27, 19	Jan 28
										AM	PM	AM
☒	G/F		15/1/2019	21/1/2019	N/A	N/A	Construct	Explicit Selection				
☒	M/F		18/1/2019	28/1/2019	N/A	N/A	Construct	Explicit Selection				
☒	1/F		28/1/2019	4/2/2019	N/A	N/A	Construct	Explicit Selection				
☐												

- **Work with Master Program/ Construction Schedule**



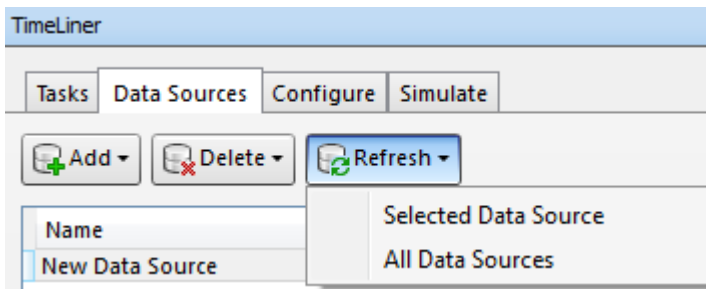
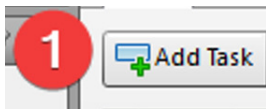
TimeLiner

Tasks | Data Sources | Configure | Simulate

+ Add Task Attach [Icons]

Active	Name	Status	Planned Start	Planned End	Actual Start	Actual End
☒	New Data Source (Root)	[Icon]	1/12/2018	25/5/2019	N/A	N/A
☒	Existing	[Icon]	1/12/2018	1/12/2018	N/A	N/A
☒	1F	[Icon]	1/1/2019	15/1/2019	N/A	N/A
☒	Link Bridge	[Icon]	17/1/2019	24/1/2019	N/A	N/A
☒	2F	[Icon]	26/1/2019	9/2/2019	N/A	N/A
☒	Roof of Link Bridge	[Icon]	11/2/2019	18/2/2019	N/A	N/A
☒	3F	[Icon]	20/2/2019	6/3/2019	N/A	N/A
☒	4F	[Icon]	8/3/2019	22/3/2019	N/A	N/A
☒	5F	[Icon]	24/3/2019	7/4/2019	N/A	N/A
☒	6F	[Icon]	9/4/2019	23/4/2019	N/A	N/A
☒	7F	[Icon]	25/4/2019	9/5/2019	N/A	N/A
☒	RF	[Icon]	11/5/2019	25/5/2019	N/A	N/A

■ Work with TimeLiner



N Refresh from Data Source



Choose how the data will be refreshed:

- ☒ **Rebuild Task Hierarchy**
Imports all task structure and data associated with the source. Existing structure and imported data are overwritten.
- ☐ **Synchronize**
Updates task data from the source. Existing structure is maintained.

OK

Cancel

■ Work with TimeLiner

Task Type

5

TimeLiner

Tasks Data Sources **Configure** Simulate

Add Delete Appearance Definitions...

Name	Start Appearance	End Appearance	Early Appearance	Late Appearance	Simulation Start Appearance
Construct	Green (90% Transparent)	Model Appearance	None	None	None
Demolish	Red (90% Transparent)	Hide	None	None	Model Appearance
Temporary	Yellow (90% Transparent)	Hide	None	None	None

1

2

TimeLiner

Tasks Data Sources Configure **Simulate**

Add Delete Appearance Definitions...

Name	Start Appearance	End Appearance	Early Appearance	Late Appearance	Simulation Start Appearance
Construct	Green (90% Transparent)	Model Appearance	None	None	None
Demolish	Red (90% Transparent)	Hide	None	None	Model Appearance
Temporary	Yellow (90% Transparent)	Hide	None	None	None
Existing	Model Appearance	Model Appearance	None	None	None

■ Work with TimeLiner

Friday 3:28:21 PM 18/1/2019 Day=49 Week=7

The screenshot displays the Autodesk Navisworks TimeLiner interface. On the left, a 3D model of a bridge structure is shown with green vertical bars representing construction progress. On the right, the TimeLiner window is open, showing a Gantt chart and a table of tasks.

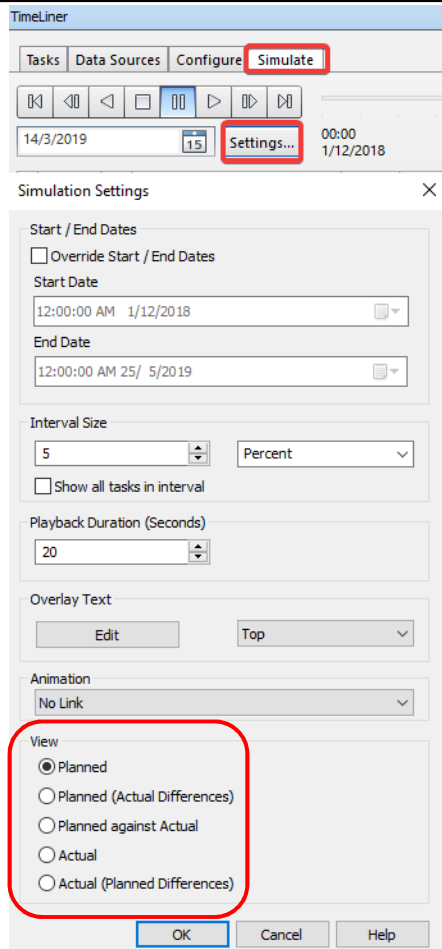
TimeLiner Window:

- Buttons: Tasks, Data Sources, Configure, **Simulate** (highlighted in red).
- Timeline: 18/1/2019, 15, Settings..., 00:00, 1/12/2018.
- Table:

	Name	Status	Planned Start	Planned End	Actual
27.8%	New Data Source (Root)		1/12/2018	25/5/2019	N/A
23.5%	Link Bridge		17/1/2019	24/1/2019	N/A
80.91%	2/F		18/1/2019	18/1/2019	N/A

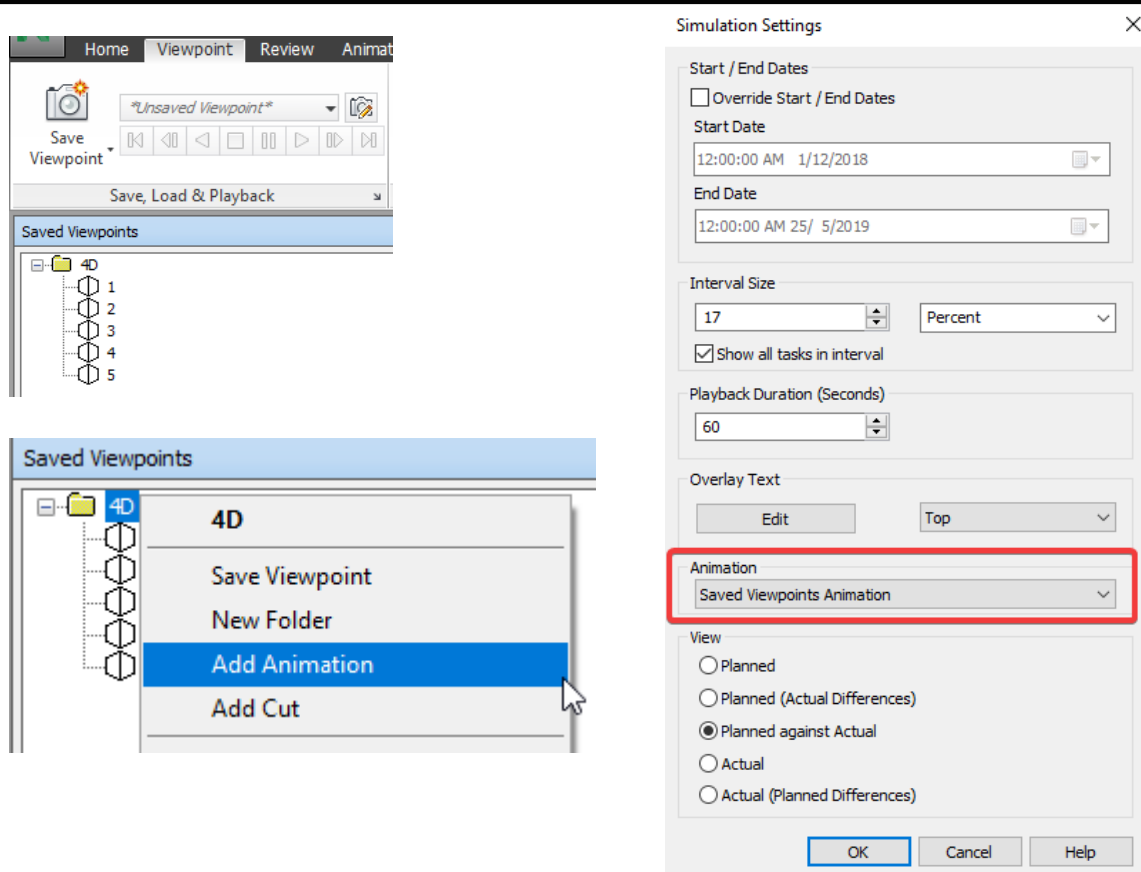
Below the table is a calendar view for January 2019, showing days 19, 20, 21, 22, 23, and 24.

■ Work with TimeLiner

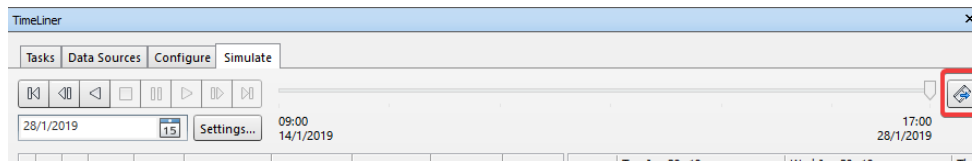


- Planned and Actual show according to the dates.
- Planned (Actual Differences) shows things at their planned dates but with color info about real late start or early finish.
- Planned against Actual uses the actual dates but includes info if something starts or finishes out of time.
- Actual (Planned Differences) shows things at their actual dates but with color info about planned early start or late finish.

■ Work with TimeLiner Animation



■ Export 4D Construction Sequence (AVI)





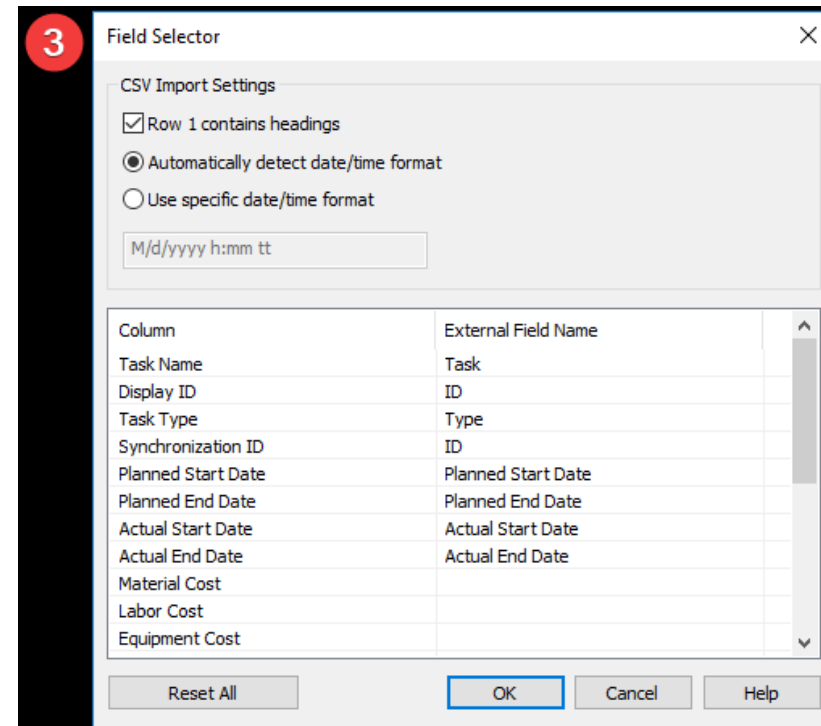
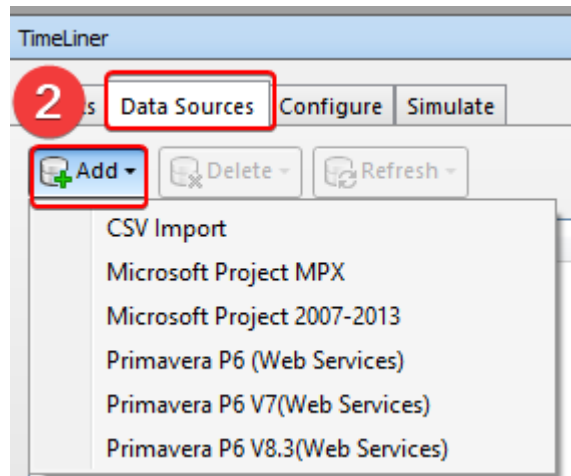
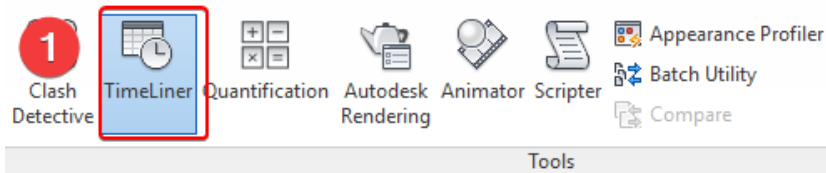
| 4D Construction Sequence_Exercise

▪ TimeLiner_Exercise

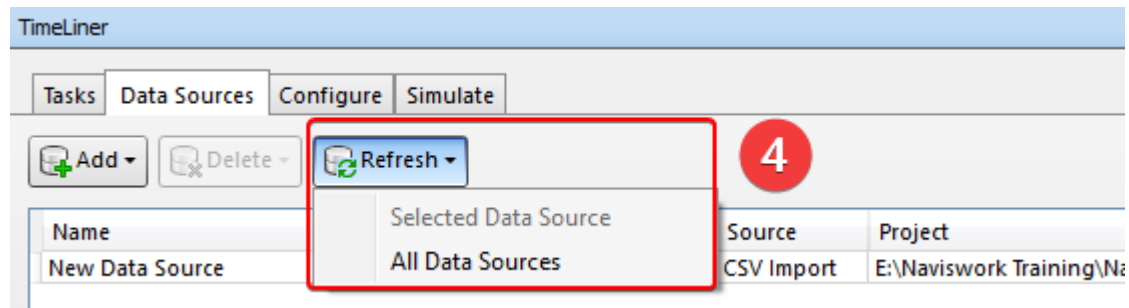
- Prepare 3D model (NWC)
- Prepare Master program by excel (XML => CSV)

ID	Task	Planned Start Date	Planned End Date	Actual Start Date	Actual End Date	Type
1	Existing	1 December 2018	1 December 2018	1 December 2018	1 December 2018	Existing
2	1F	1 January 2019	15 January 2019	27 December 2018	15 January 2019	Construct
3	Link Bridge	17 January 2019	24 January 2019	17 January 2019	24 January 2019	Construct
4	2F	26 January 2019	9 February 2019	31 January 2019	14 February 2019	Construct
5	Roof of Link Bridge	11 February 2019	18 February 2019	16 February 2019	18 February 2019	Construct
6	3F	20 February 2019	6 March 2019	20 February 2019	6 March 2019	Construct
7	4F	8 March 2019	22 March 2019	8 March 2019	22 March 2019	Construct
8	5F	24 March 2019	7 April 2019	24 March 2019	7 April 2019	Construct
9	6F	9 April 2019	23 April 2019	9 April 2019	23 April 2019	Construct
10	7F	25 April 2019	9 May 2019	25 April 2019	9 May 2019	Construct
11	RF	11 May 2019	25 May 2019	11 May 2019	25 May 2019	Construct

TimeLiner_Exercise



TimeLiner_Exercise



Refresh from Data Source



Choose how the data will be refreshed:

5

☒ Rebuild Task Hierarchy

Imports all task structure and data associated with the source. Existing structure and imported data are overwritten.

☐ Synchronize

Updates task data from the source. Existing structure is maintained.

OK

Cancel

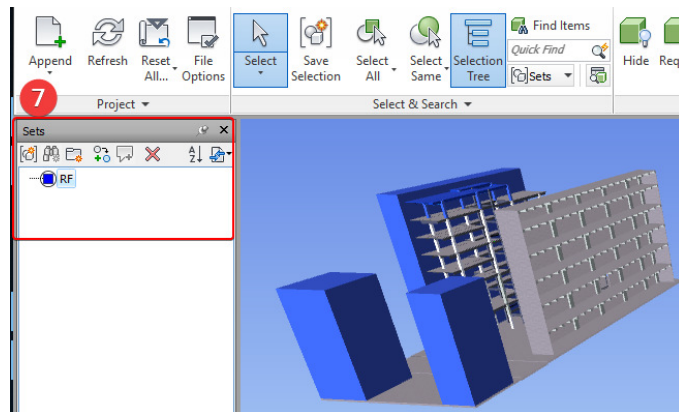
TimeLiner_Exercise

TimeLiner

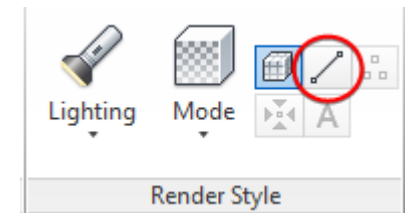
Tasks Data Sources Configure Simulate **6**

Add Task Attach Search

Active	Name	Status	Planned Start	Planned End	Actual Start	Actual End	Task Type	Attached	Total Cost
☒	New Data Source (Root)		12/1/2018	5/25/2019	12/1/2018	5/25/2019			
☒	Existing		12/1/2018	12/1/2018	12/1/2018	12/1/2018	Existing		
☒	1F		1/1/2019	1/15/2019	12/27/2018	1/15/2019	Construct		
☒	Link Bridge		1/17/2019	1/24/2019	1/17/2019	1/24/2019	Construct		
☒	2F		1/26/2019	2/9/2019	1/31/2019	2/14/2019	Construct		
☒	Roof of Link Bridge		2/11/2019	2/18/2019	2/16/2019	2/18/2019	Construct		
☒	3F		2/20/2019	3/6/2019	2/20/2019	3/6/2019	Construct		
☒	4F		3/8/2019	3/22/2019	3/8/2019	3/22/2019	Construct		
☒	5F		3/24/2019	4/7/2019	3/24/2019	4/7/2019	Construct		
☒	6F		4/9/2019	4/23/2019	4/9/2019	4/23/2019	Construct		
☒	7F		4/25/2019	5/9/2019	4/25/2019	5/9/2019	Construct		
☒	RF		5/11/2019	5/25/2019	5/11/2019	5/25/2019	Construct		



- Selection Set
- Search Set (Find item)
- Comments/ User parameters in original source (Revit)
- Selection Tree
- Quick Properties
- Hide/ Unhide
- Selection Box
- Turn off "Line" rendering



TimeLiner_Exercise

Sets

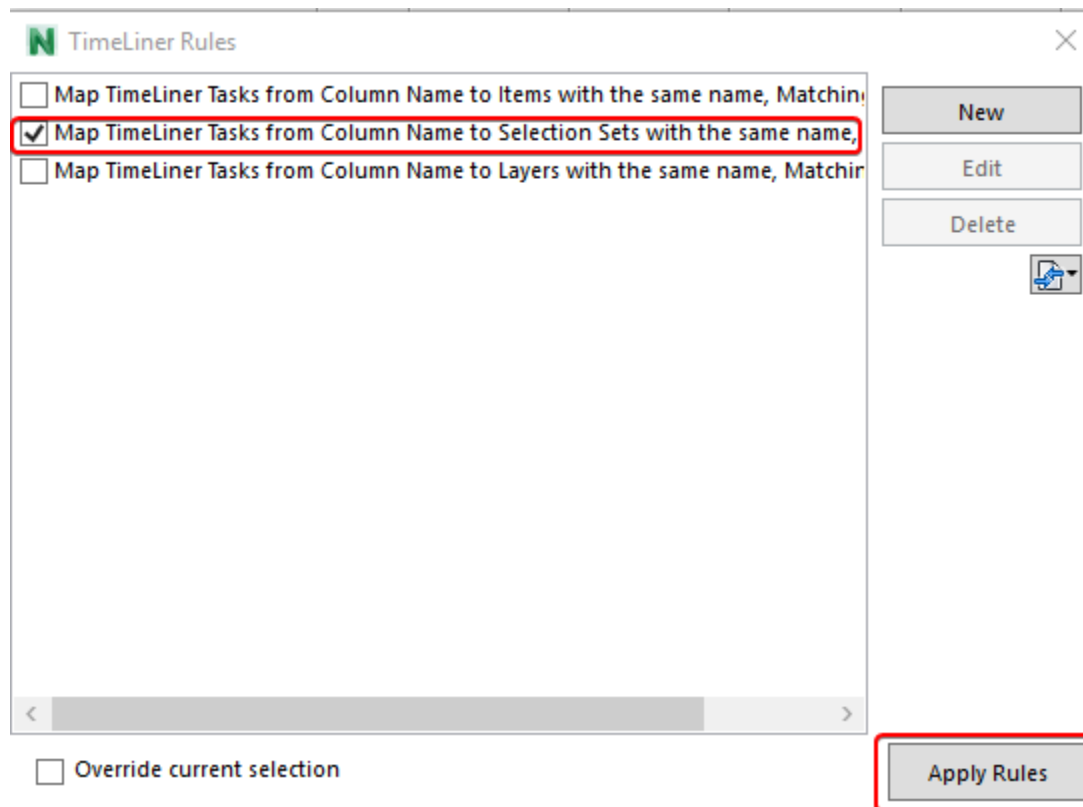
- RF
- 7F
- 6F
- 5F
- 4F
- 3F
- 2F
- 1F
- Existing
- Roof of Link Bridge
- Link Bridge

TimeLiner

Tasks | Data Sources | Configure | Simulate

Active	Name	Status	Planned Start	Planned End	Actual Start	Actual End	Task Type	Attached	Total Co
☒	New Data Source (Root)		12/1/2018	5/25/2019	12/1/2018	5/25/2019			
☒	Existing		12/1/2018	12/1/2018	12/1/2018	12/1/2018	Existing		
☒	1F		1/1/2019	1/15/2019	12/27/2018	1/15/2019	Construct		
☒	Link Bridge		1/17/2019	1/24/2019	1/17/2019	1/24/2019	Construct		
☒	2F		1/26/2019	2/9/2019	1/31/2019	2/14/2019	Construct		
☒	Roof of Link Bridge		2/11/2019	2/18/2019	2/16/2019	2/18/2019	Construct		
☒	3F		2/20/2019	3/6/2019	2/20/2019	3/6/2019	Construct		
☒	4F		3/8/2019	3/22/2019	3/8/2019	3/22/2019	Construct		
☒	5F		3/24/2019	4/7/2019	3/24/2019	4/7/2019	Construct		
☒	6F		4/9/2019	4/23/2019	4/9/2019	4/23/2019	Construct		
☒	7F		4/25/2019	5/9/2019	4/25/2019	5/9/2019	Construct		
☒	RF		5/11/2019	5/25/2019	5/11/2019	5/25/2019	Construct		

▪ TimeLiner_Exercise



TimeLiner_Exercise

TimeLiner

Tasks Data Sources Configure Simulate

Add Task

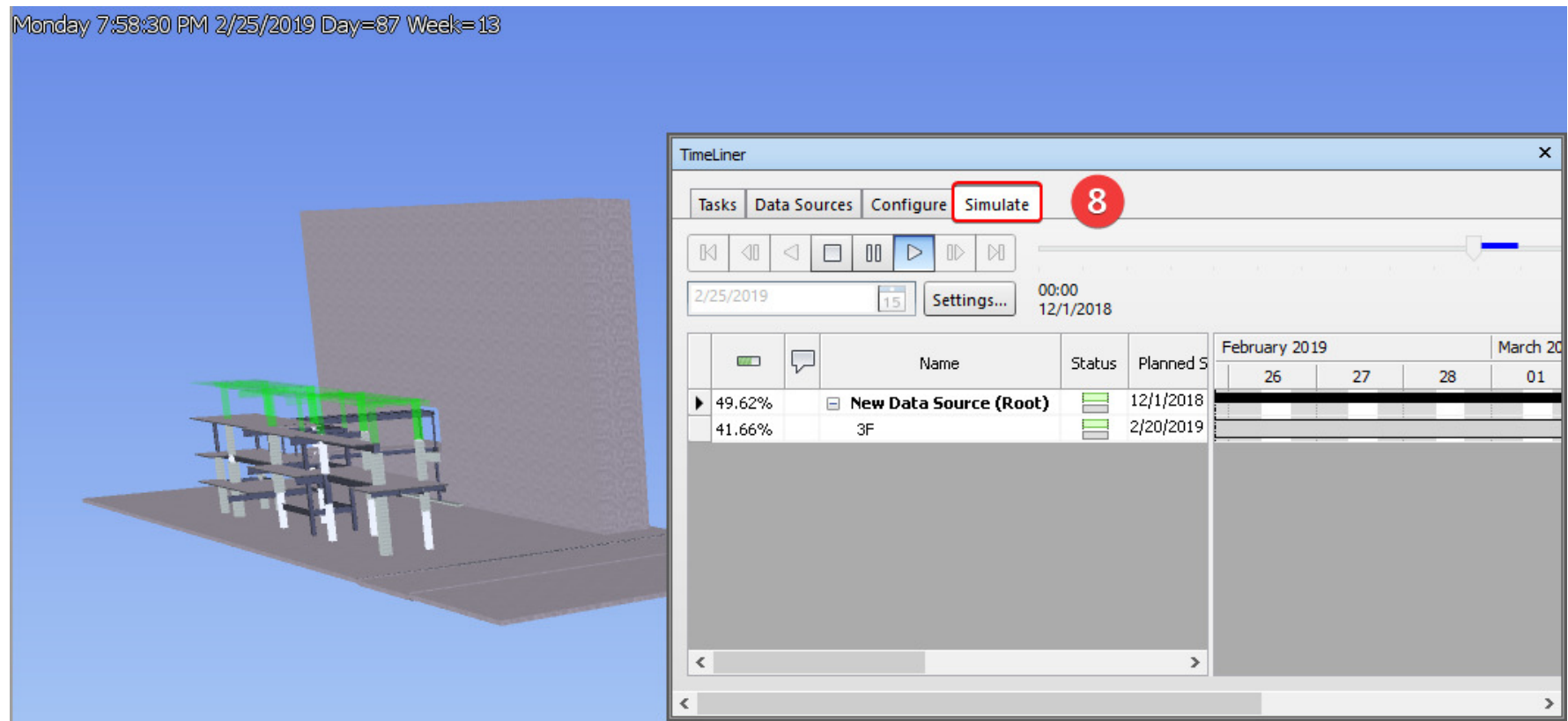
 Attach

 Zoom:

	Active	Name	Status	Planned Start	Planned End	Actual Start	Actual End	Task Type	Attached
☒		New Data Source (Root)		12/1/2018	5/25/2019	12/1/2018	5/25/2019		
☒		Existing		12/1/2018	12/1/2018	12/1/2018	12/1/2018	Existing	Sets-...
☒		1F		1/1/2019	1/15/2019	12/27/2018	1/15/2019	Construct	Sets-...
☒		Link Bridge		1/17/2019	1/24/2019	1/17/2019	1/24/2019	Construct	Sets-...
☒		2F		1/26/2019	2/9/2019	1/31/2019	2/14/2019	Construct	Sets-...
☒		Roof of Link Bridge		2/11/2019	2/18/2019	2/16/2019	2/18/2019	Construct	Sets-...
☒		3F		2/20/2019	3/6/2019	2/20/2019	3/6/2019	Construct	Sets-...
☒		4F		3/8/2019	3/22/2019	3/8/2019	3/22/2019	Construct	Sets-...
☒		5F		3/24/2019	4/7/2019	3/24/2019	4/7/2019	Construct	Sets-...
☒		6F		4/9/2019	4/23/2019	4/9/2019	4/23/2019	Construct	Sets-...
☒		7F		4/25/2019	5/9/2019	4/25/2019	5/9/2019	Construct	Sets-...
☒		RF		5/11/2019	5/25/2019	5/11/2019	5/25/2019	Construct	Sets-...

TimeLiner_Exercise

Monday 7:58:30 PM 2/25/2019 Day=87 Week=13

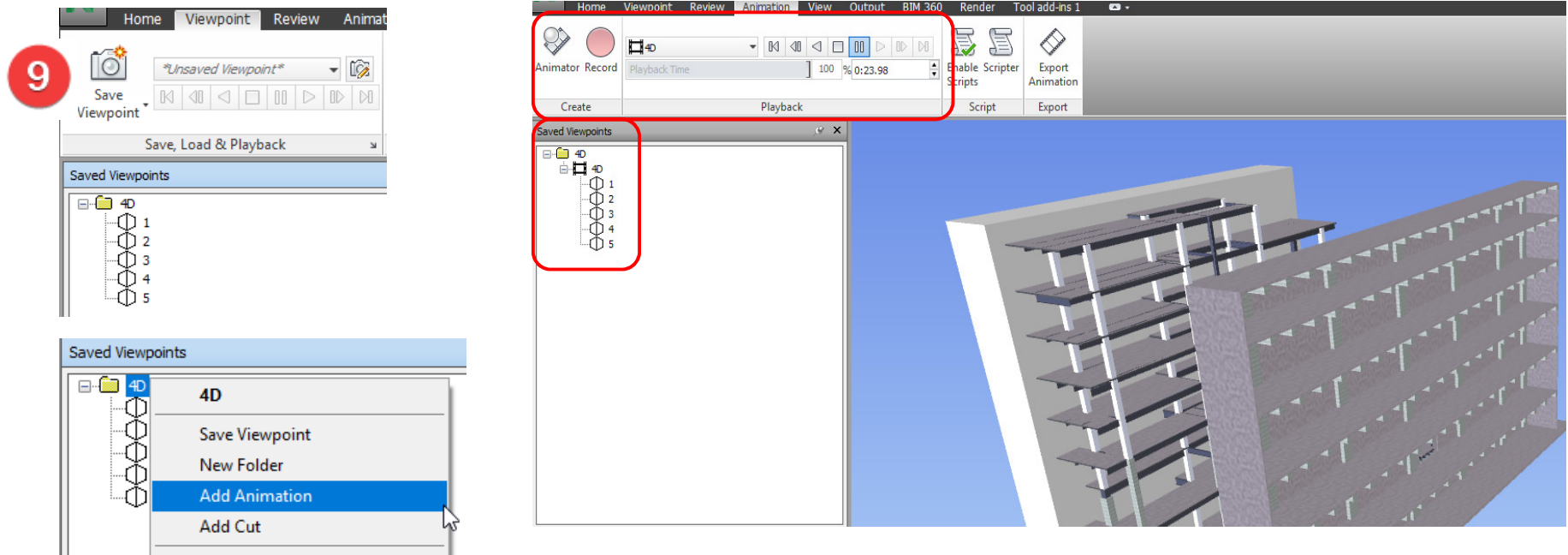


The screenshot displays the TimeLiner software interface. On the left, a 3D model of a building structure is shown. On the right, the TimeLiner window is open, featuring a tabbed interface with 'Tasks', 'Data Sources', 'Configure', and 'Simulate' (highlighted with a red box and a red circle with the number 8). Below the tabs are navigation buttons and a timeline slider. The timeline shows a date of 2/25/2019 and a time of 00:00. A table lists data sources with columns for Name, Status, and Planned S.

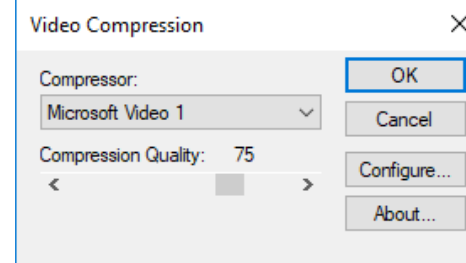
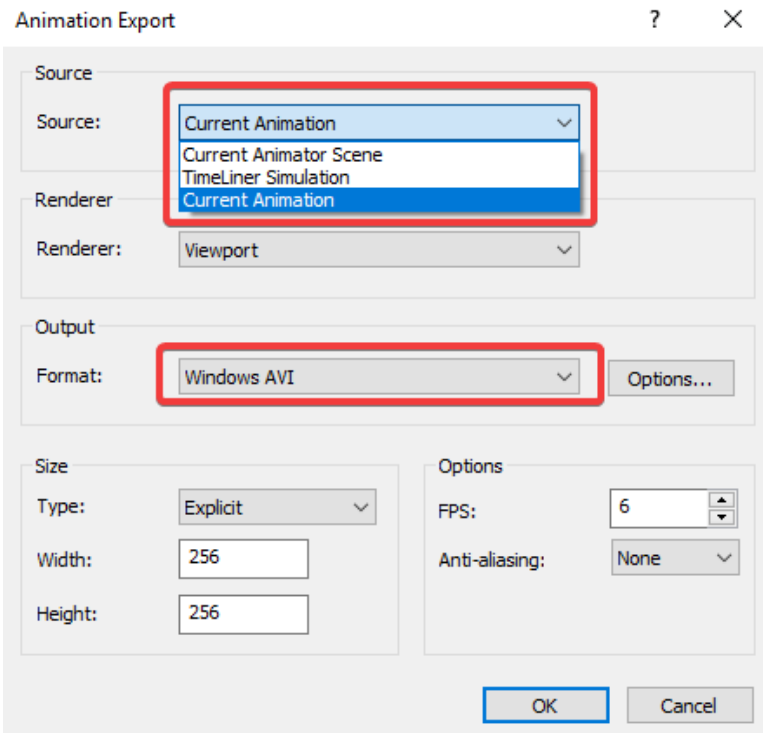
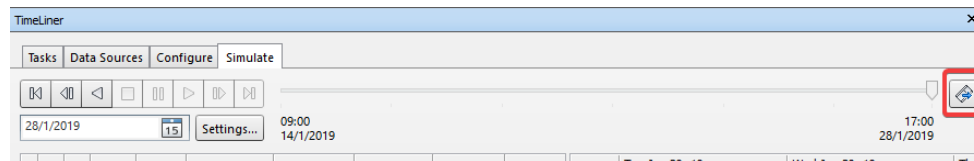
	Name	Status	Planned S
49.62%	New Data Source (Root)		12/1/2018
41.66%	3F		2/20/2019

The right side of the interface shows a calendar view for February 2019 and March 2019, with dates 26, 27, 28, and 01 visible.

■ Animation



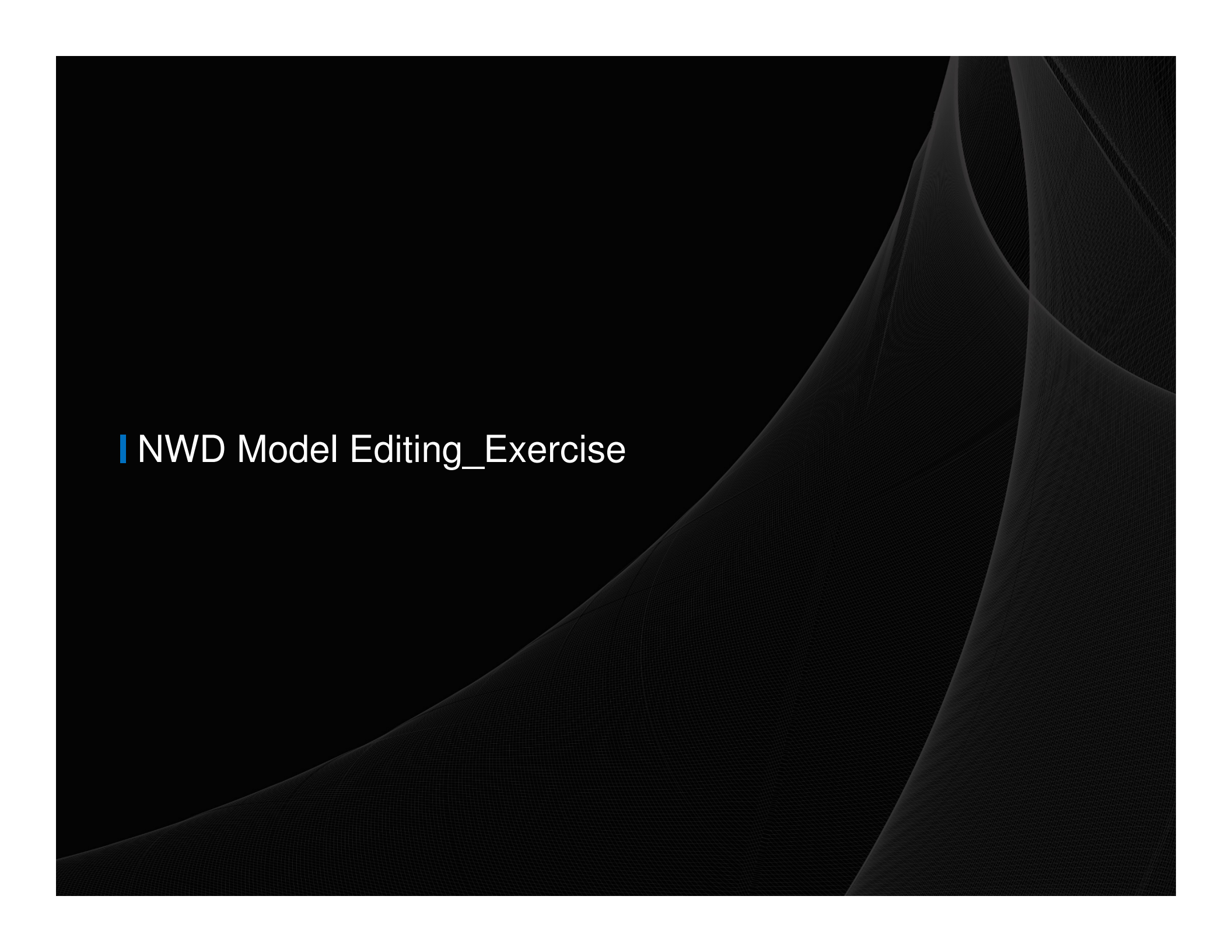
Export 4D Construction Sequence (AVI)



Term	Resolution	Lines	Pixel Dimensions
SDTV	480i	480	640×480
EDTV	480p	480	852×480
HDTV	720p	720	1280×720
HDTV	1080i	1080	1920×1080
HDTV	1080p	1080	1920×1080

FPS from 8-30

Anti-aliasing between (8x-64x)



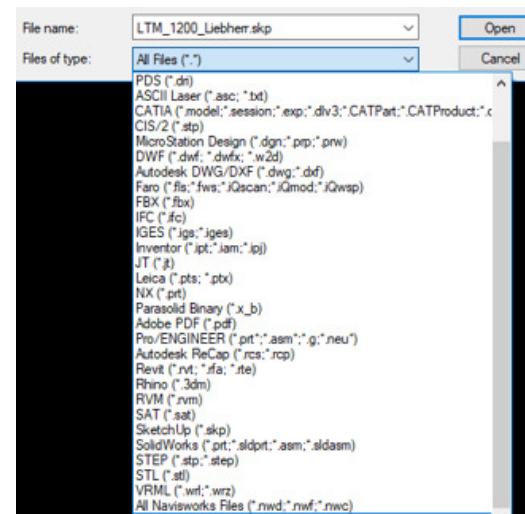
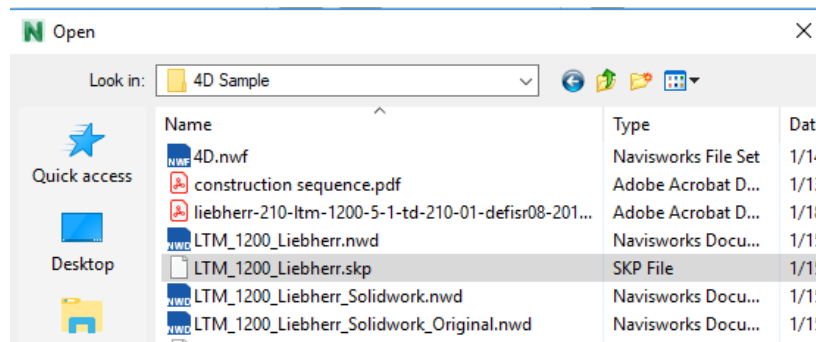
| NWD Model Editing_Exercise

▪ NWD Model Editing Exercise

LTM_1200_Liebherr.skp

SKP File

Different formats of models received



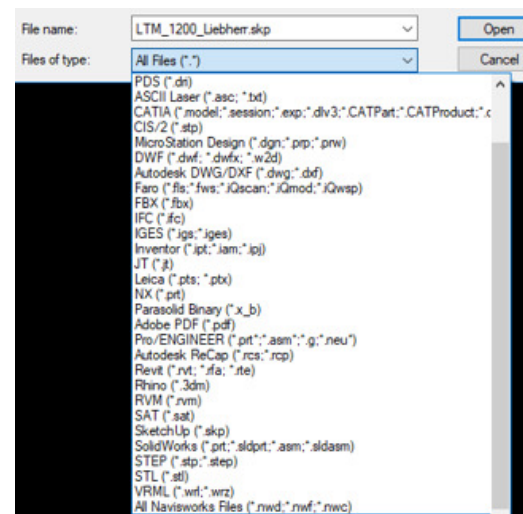
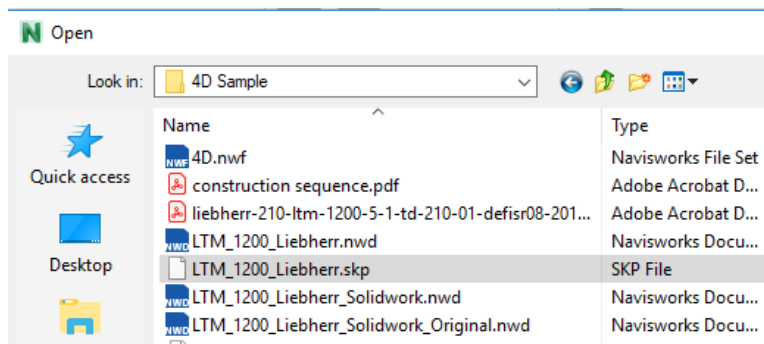
Open model in Navisworks

■ NWD Model Editing_Exercise

LTM_1200_Liebherr.skp

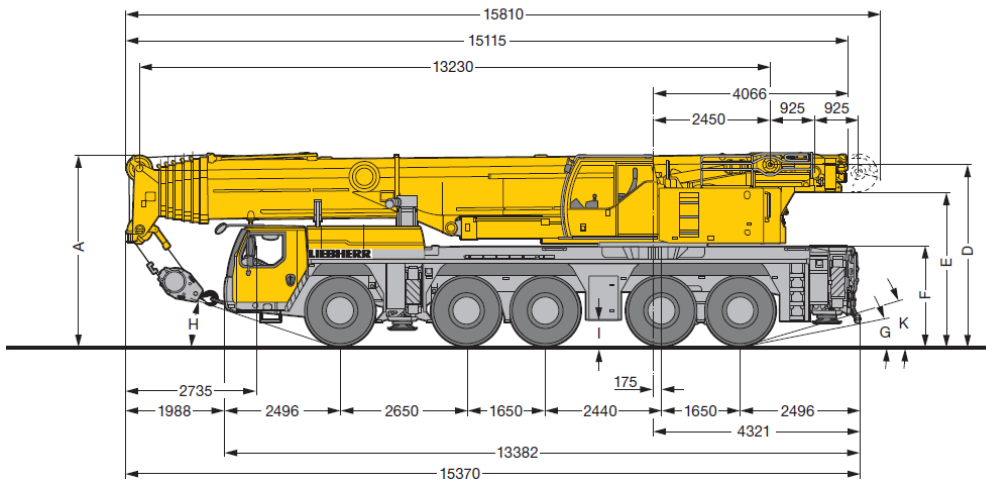
SKP File

Different formats of models received

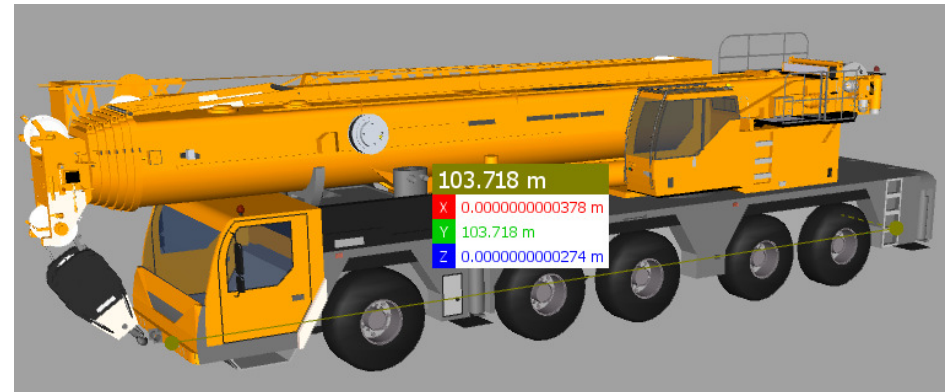
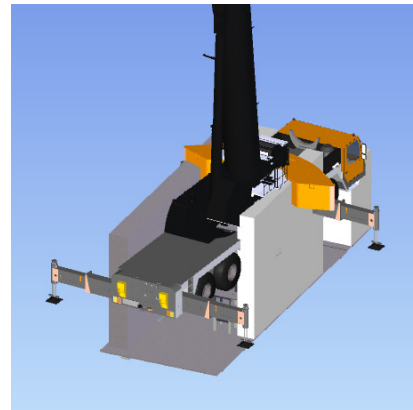


Open model in
Navisworks
(Convert to NWD Format)

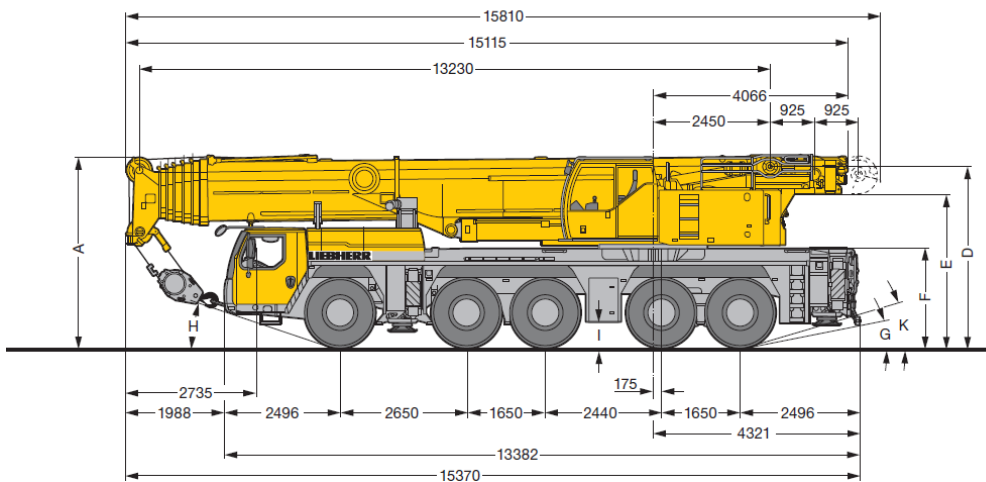
■ NWD Model Editing_Exercise



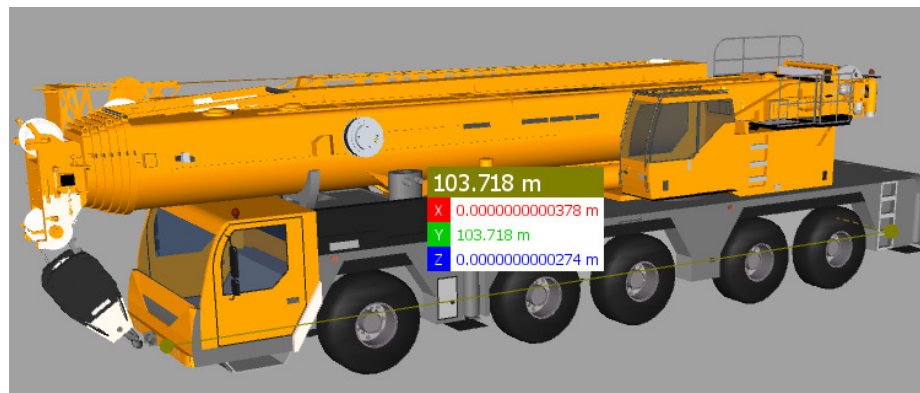
Check **SCALE!!!**



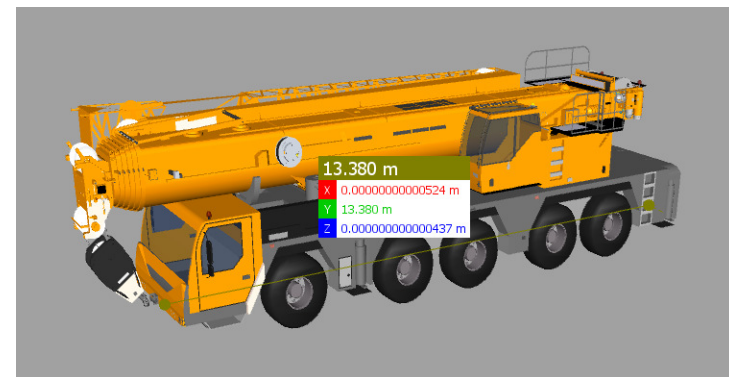
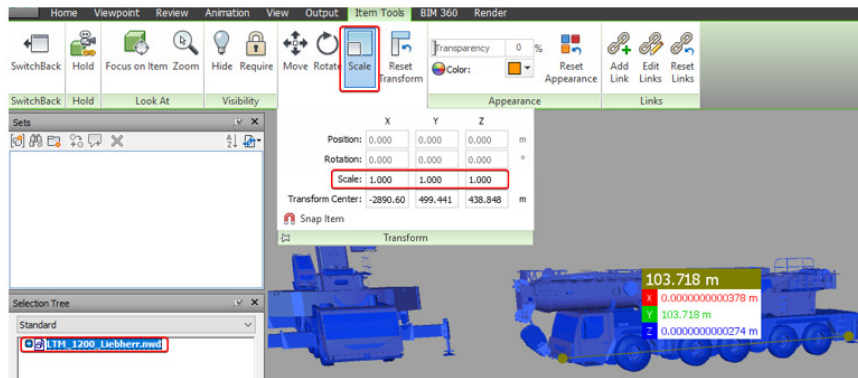
▪ NWD Model Editing_Exercise



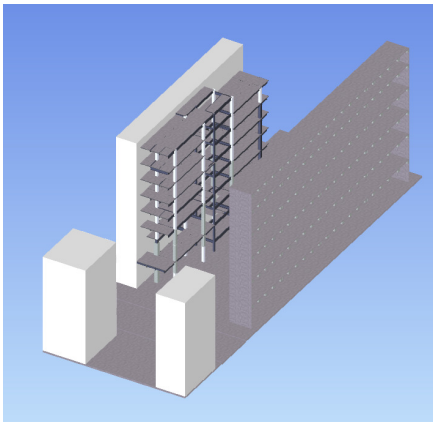
Check **SCALE!!!**



■ NWD Model Editing_Exercise



▪ NWD Model Editing_Exercise

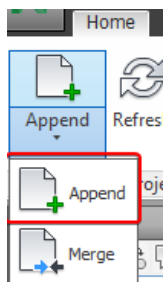


3D Model in Navisworks



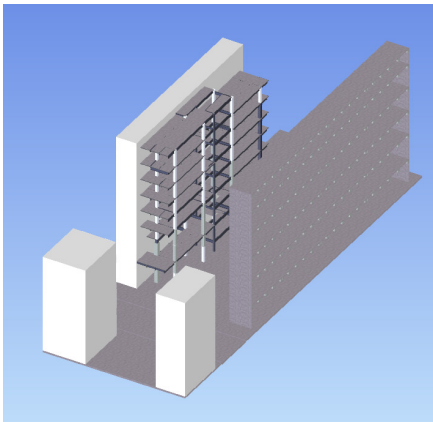
Construction Equipment/ vehicle in Navisworks

Combine models in Navisworks



Check **Location!!!**

▪ NWD Model Editing_Exercise

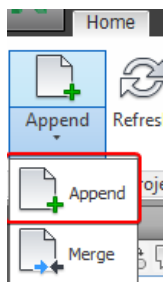


3D Model in Navisworks

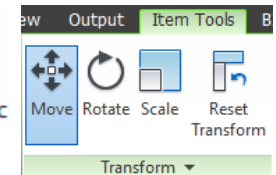
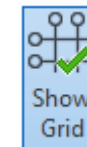


Construction Equipment/ vehicle in Navisworks

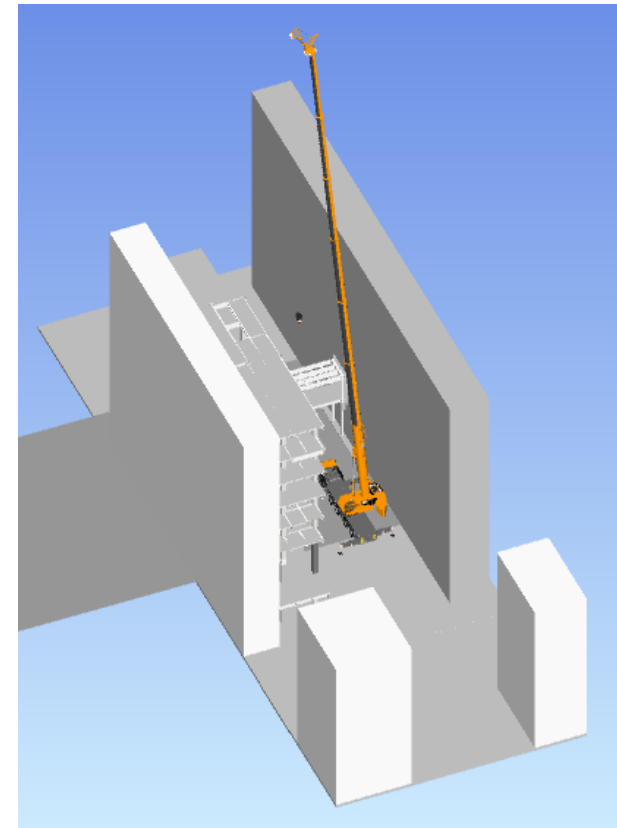
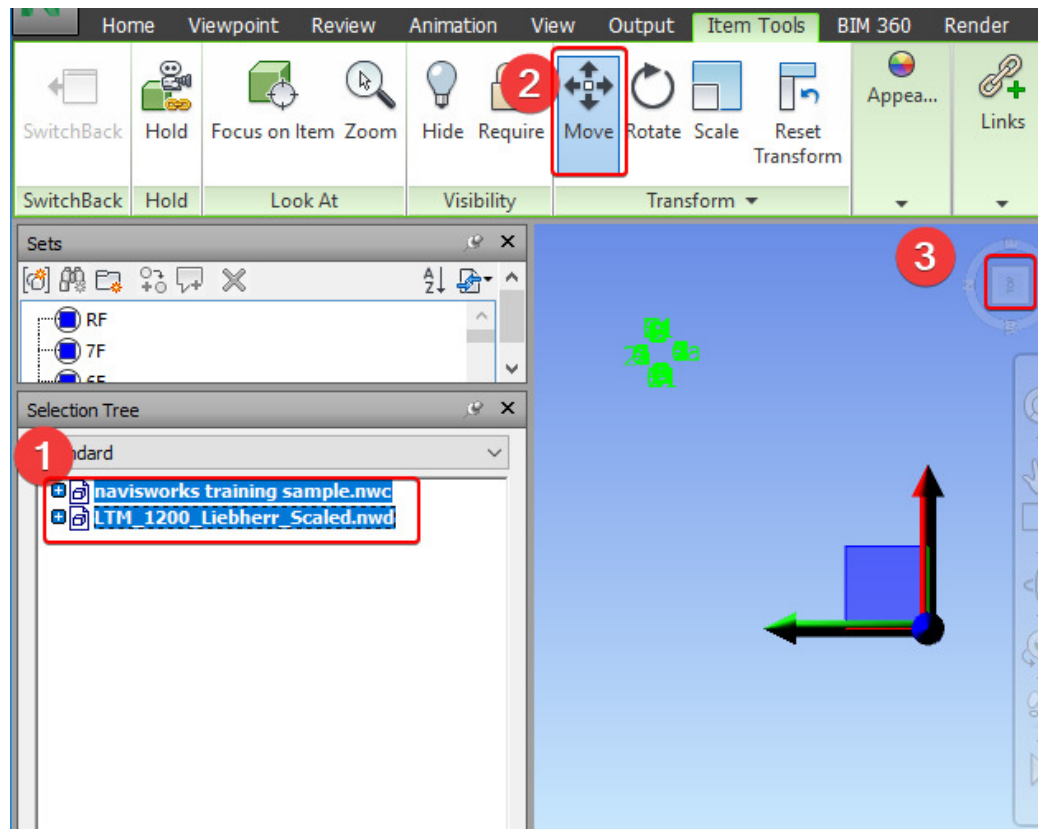
Combine models in Navisworks

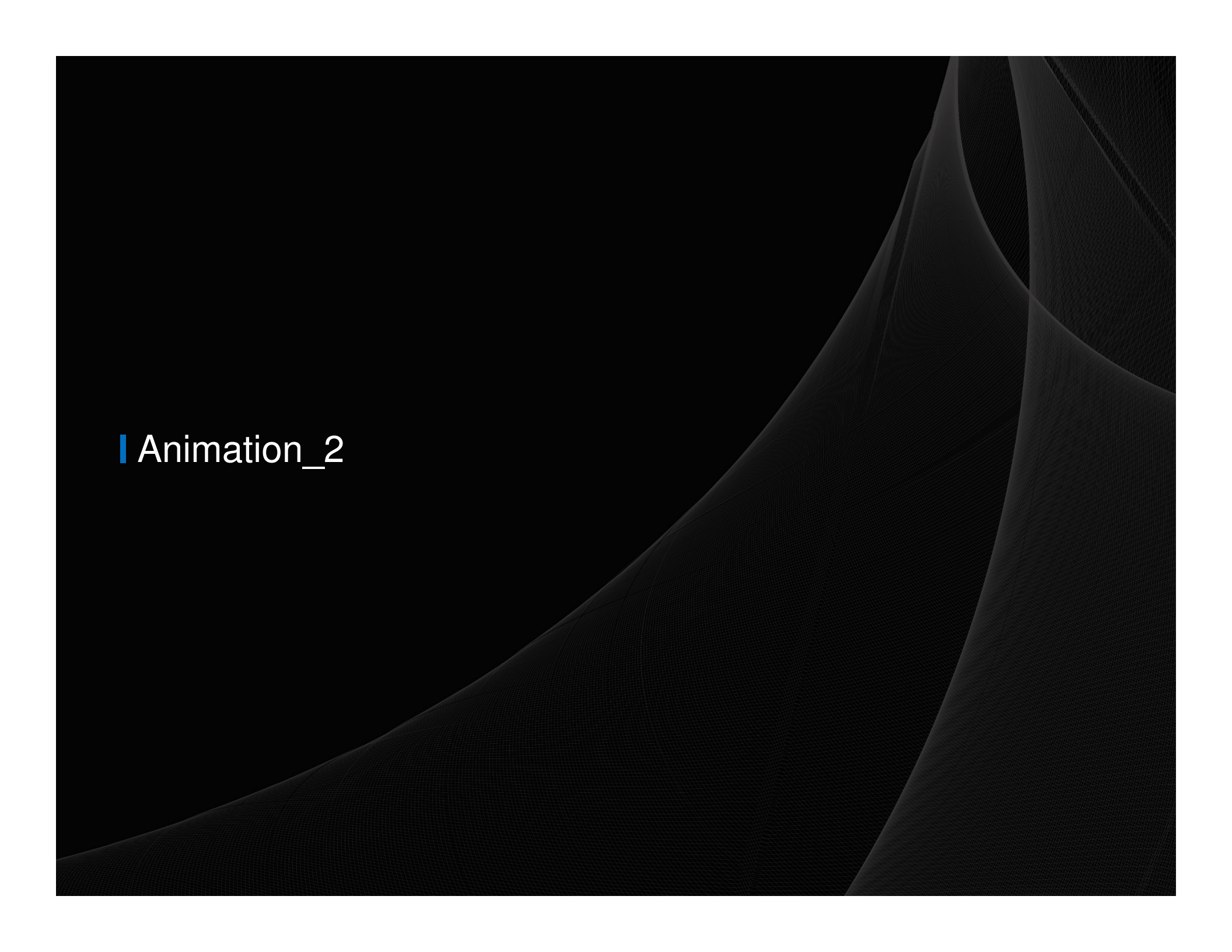


Check **Location!!!**



■ NWD Model Editing_Exercise





| Animation_2

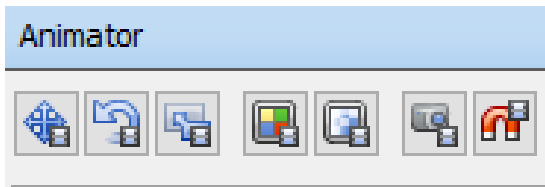
■ Animation_2

The screenshot illustrates the Animation_2 workflow in Autodesk Navisworks. The top ribbon shows the 'Animation' tab selected, with options for 'Door', playback controls, and 'Enable Scripter Scripts' and 'Export Animation' buttons. The Animators panel on the left displays a table of animation sets:

Name	Ac...	Loop	P.P.	Infi...
Crane Rotate		☒	☒	☐
Crane Upper Set 1	☒	☐	☐	☐

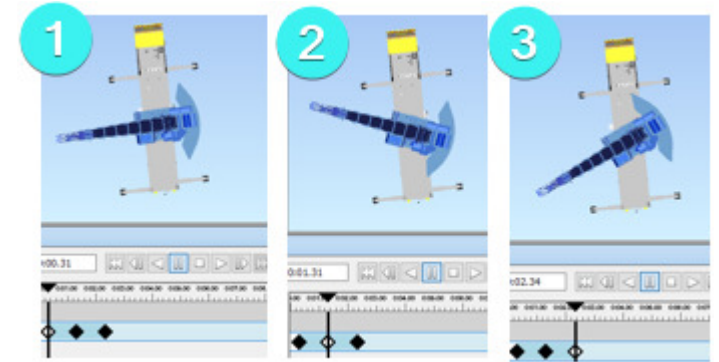
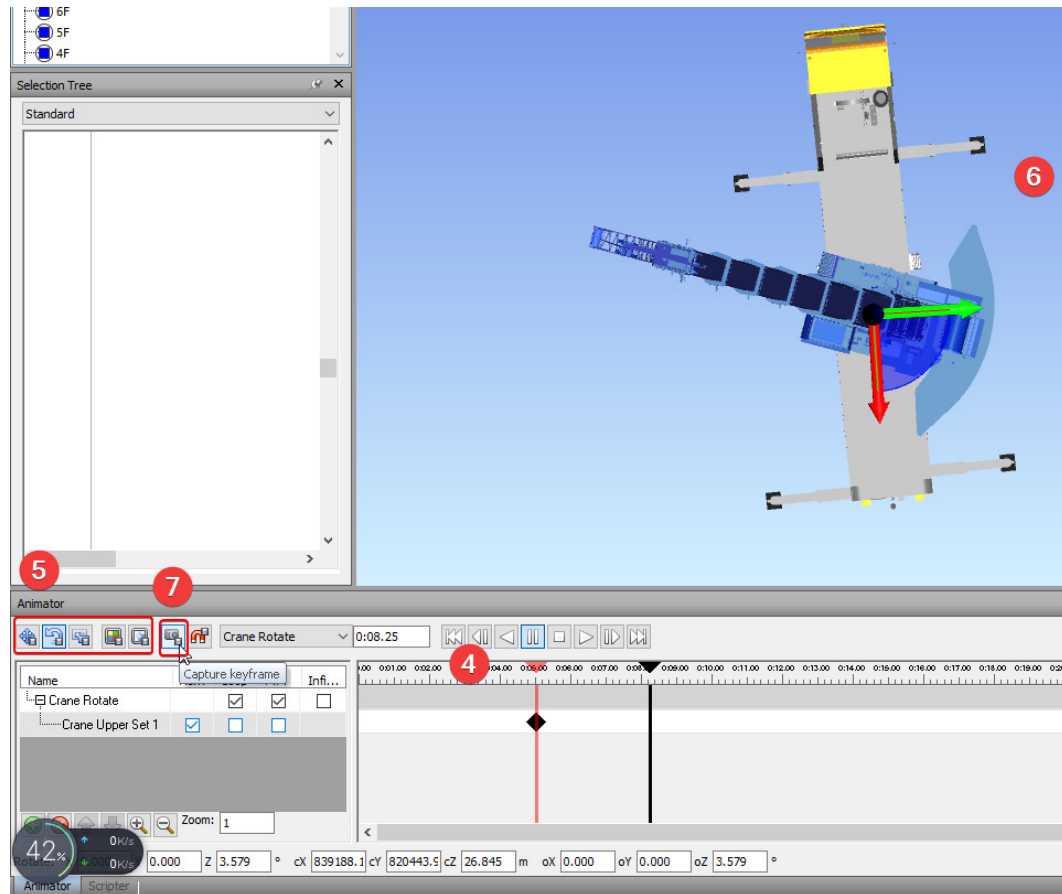
The Selection Tree on the right shows a hierarchy of elements, including 'Standard' and 'Crane Rotate'. A context menu is open over the Selection Tree, and a red arrow points to the 'Crane Upper Set 1' entry in the Animators table.

▪ Animation_2



- Capture Object Movement
- Capture Object Rotation
- Capture Scaling Changes
- Capture Color Changes
- Capture Transparency Changes

■ Animation_2



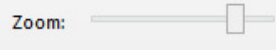
Name	Active	Loop	P.P.	Infinite
Crane Rotate	☒	☐	☐	☒
Move Forward	☒	☐	☐	☐
Crane Upper Set 1	☒	☒	☒	☐

▪ Attach with TimeLiner

TimeLiner

Tasks Data Sources Configure Simulate



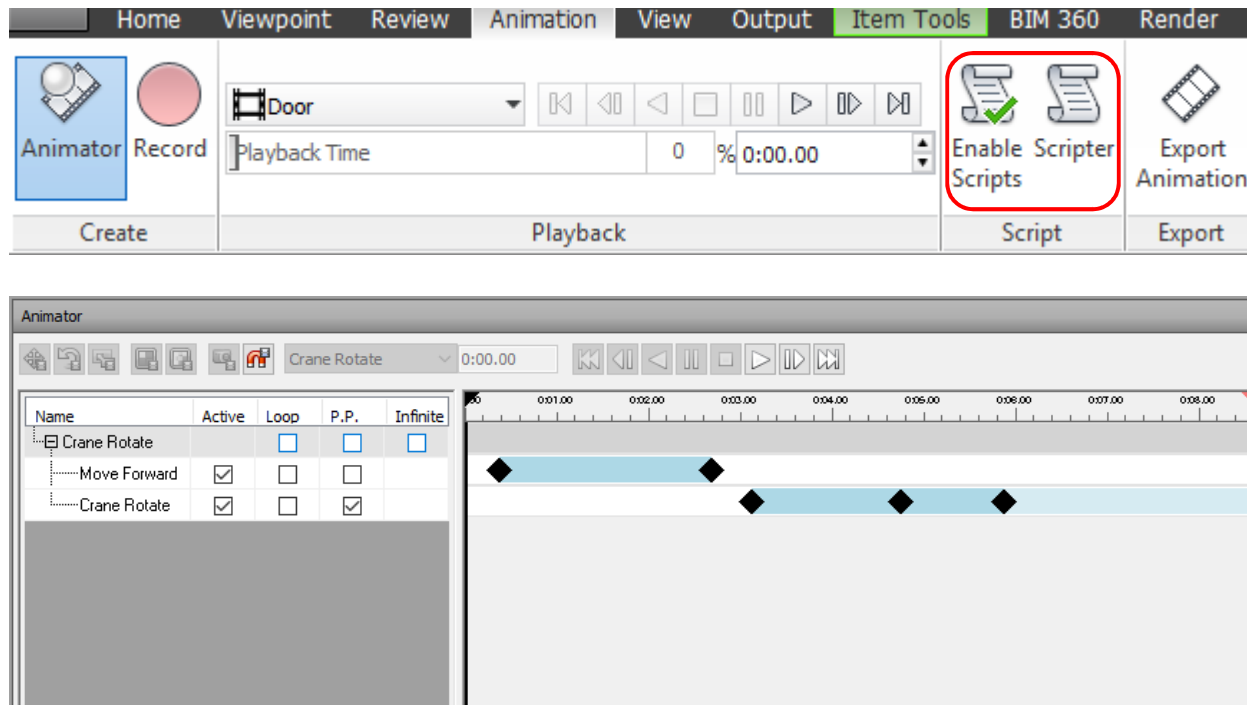


Active	Name	Status	Planned Start	Planned End	Actual Start	Actual End	Task Type	Attached	Animation	Animation Behav
☒	Roof of Link Bridge		2/11/2019	2/18/2019	2/16/2019	2/18/2019	Construct	 Sets->Roof o...		Scale
☒	3F		2/20/2019	3/6/2019	2/20/2019	3/6/2019	Construct	 Sets->3F		Scale
☒	4F		3/8/2019	3/22/2019	3/8/2019	3/22/2019	Construct	 Sets->4F		Scale
☒	5F		3/24/2019	4/7/2019	3/24/2019	4/7/2019	Construct	 Sets->5F		Scale
☒	6F		4/9/2019	4/23/2019	4/9/2019	4/23/2019	Construct	 Sets->6F		Scale
☒	7F		4/25/2019	5/9/2019	4/25/2019	5/9/2019	Construct	 Sets->7F		Scale
☒	RF		5/11/2019	5/25/2019	5/11/2019	5/25/2019	Construct	 Sets->RF		Scale
☒	Crane		12/16/2018	12/17/2018	N/A	N/A	Construct	Explicit Selection	Crane Rotate	Scale

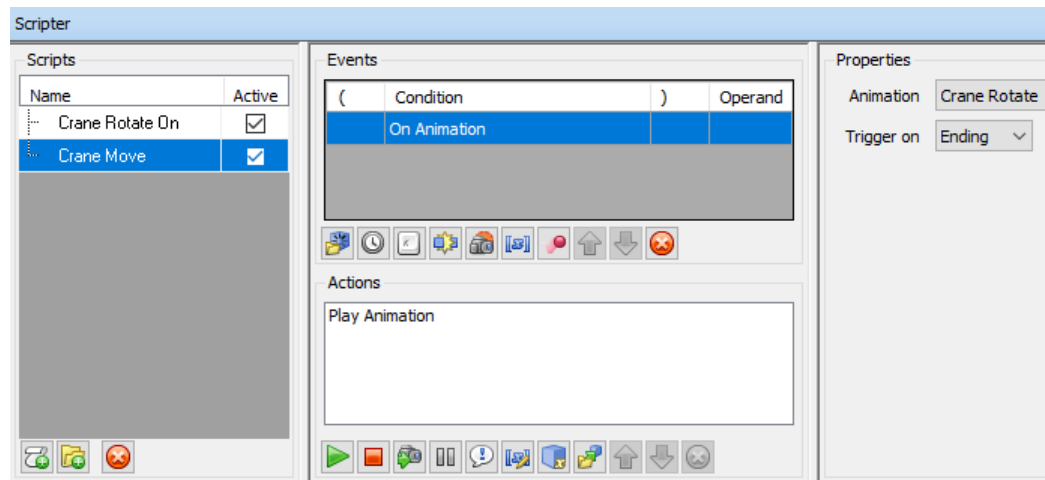
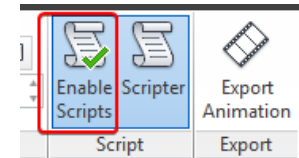
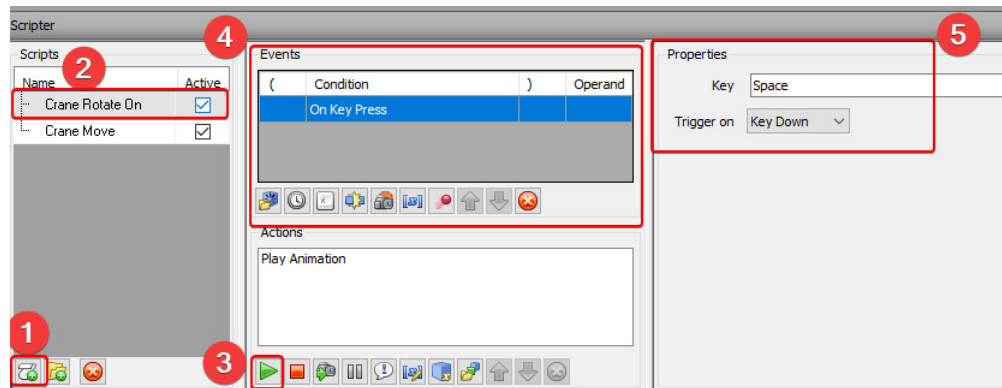
TimeLiner Animator Scripter

Crane Rotate
Crane Rotate\Move Forward
Crane Rotate\Crane Upper Set 1

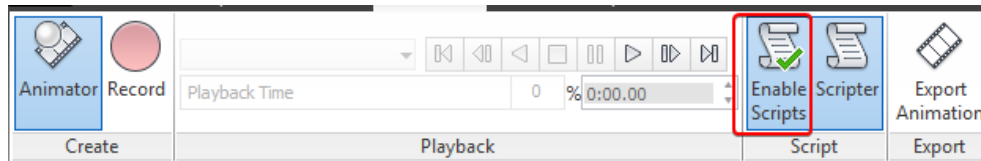
■ Animation_3

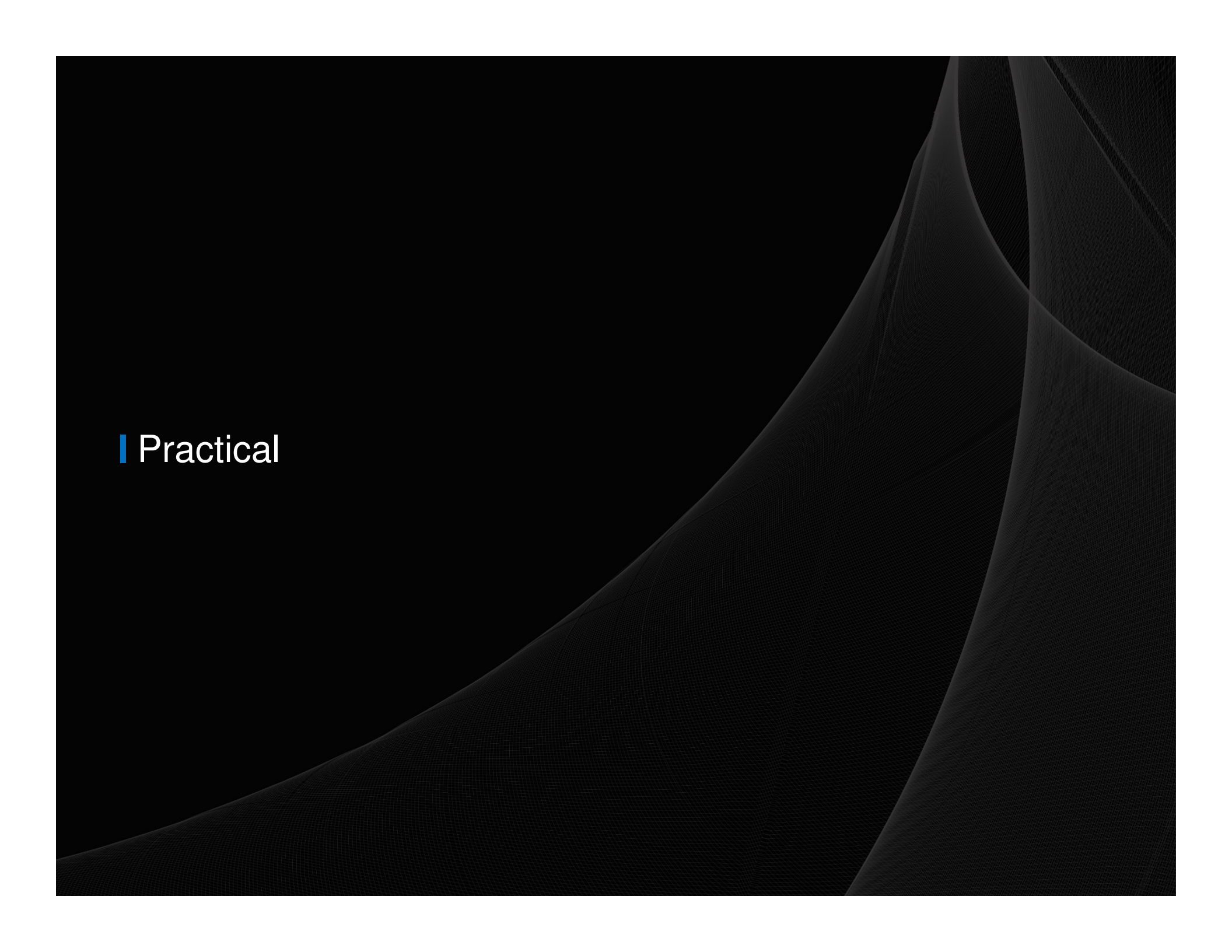


■ Animation_3



■ Animation_3





| Practical

Exercise

The screenshot illustrates the steps to find and select structural framing elements in Autodesk Navisworks. The interface shows the 'Item Tools' ribbon with the 'Find Items' button highlighted (1). The 'Find Items' dialog box is open, showing the search results for 'Standard' (2). The search criteria are set to 'Element Category = Structural Framing' (3). The 'Find All' button is highlighted (4). The 'Sets' panel on the left shows the 'STR Framing' set selected (5).

Find Items Dialog Box:

Category	Property	Condition	Value
Element	Category	=	Structural Framing

Sets Panel:

- STR Framing
- STR Column
- Pipe
- Duct
- Cable Tray

■ Appearance Profiler

The screenshot displays the Autodesk Navisworks interface with the Appearance Profiler tool open. The tool is used to manage the appearance of model elements. The 'Color Override.dat' file is highlighted in the file list. The 'Appearance Profiler' dialog shows a list of selected elements (STR Framing, STR Column, Pipe, Duct) and their corresponding colors. The 'Add' button is highlighted with a red circle and the number 4, and the 'Run' button is highlighted with a red circle and the number 5.

File List:

Name	Date modified	Type	Size
Color Override.dat	12/10/2018 9:55 AM	DAT File	2 KB
Master View Points	12/3/2018 9:41 AM	XML Document	10 KB
Master	11/29/2018 6:21 PM	Navisworks File Set	3 KB
rac_advanced_sample_project	11/29/2018 5:41 PM	Navisworks Cache	3,296 KB
rac_advanced_sample_project	1/21/2017 4:26 AM	Autodesk Revit Pr...	15,096 KB
rme From Combined	12/3/2018 10:09 AM	Navisworks Cache	4,629 KB
rme_advanced_sample_project	12/3/2018 10:08 AM	Navisworks Cache	3,001 KB
rme_advanced_sample_project	12/3/2018 12:38 PM	Autodesk Revit Pr...	32,988 KB
rst_advanced_sample_project	11/29/2018 1:30 PM	Navisworks Cache	15,164 KB
rst_advanced_sample_project	1/21/2017 4:26 AM	Autodesk Revit Pr...	15,016 KB

Appearance Profiler Dialog:

Selector:

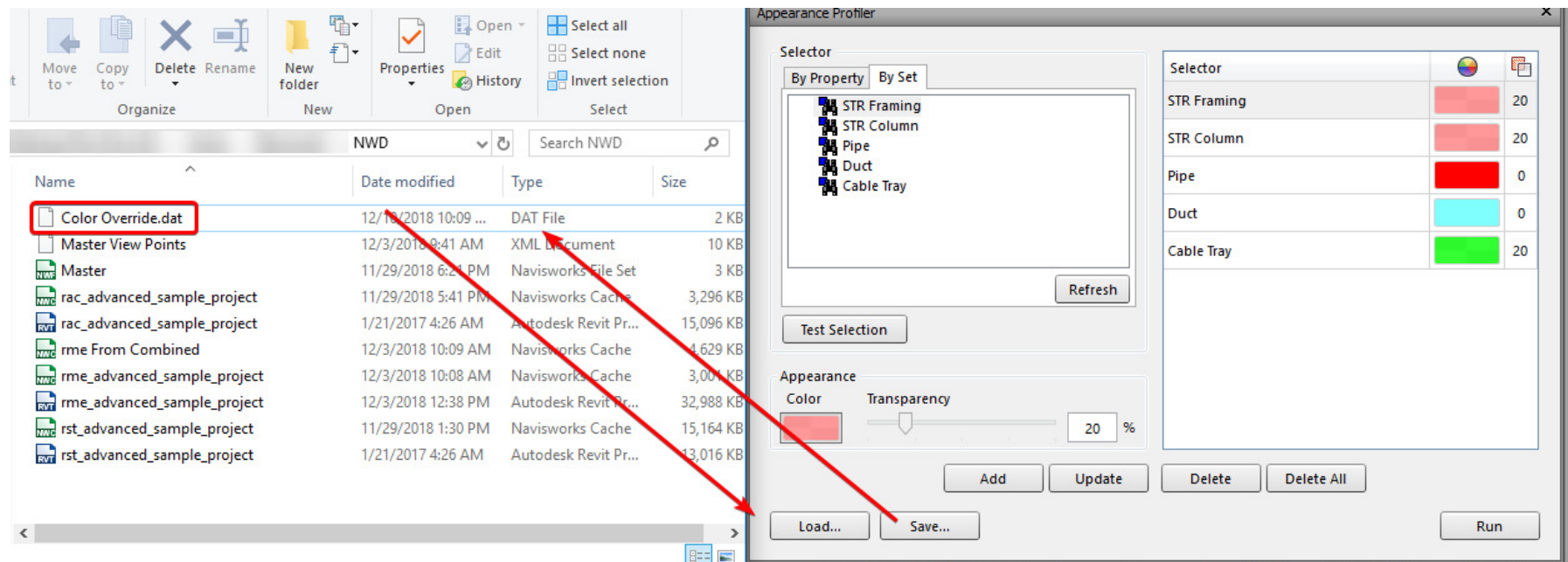
Selector	Color	Count
STR Framing	Red	20
STR Column	Green	0
Pipe	Orange	0
Duct	Blue	0

Appearance:

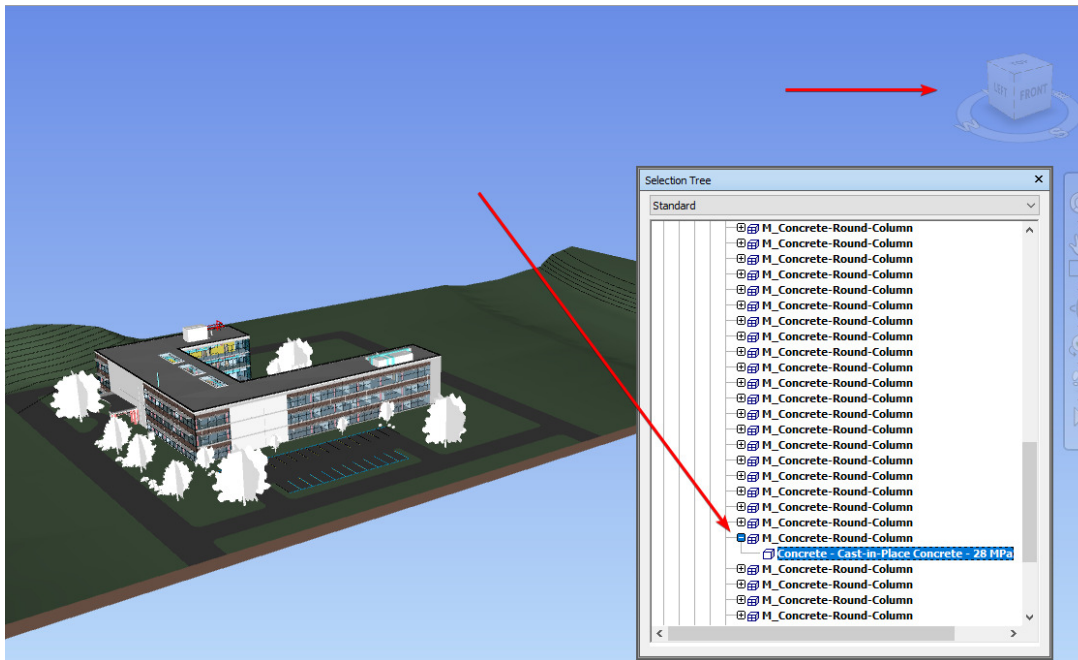
Color: [Red] Transparency: 20 %

Buttons: Add, Update, Delete, Delete All, Load..., Save..., Run

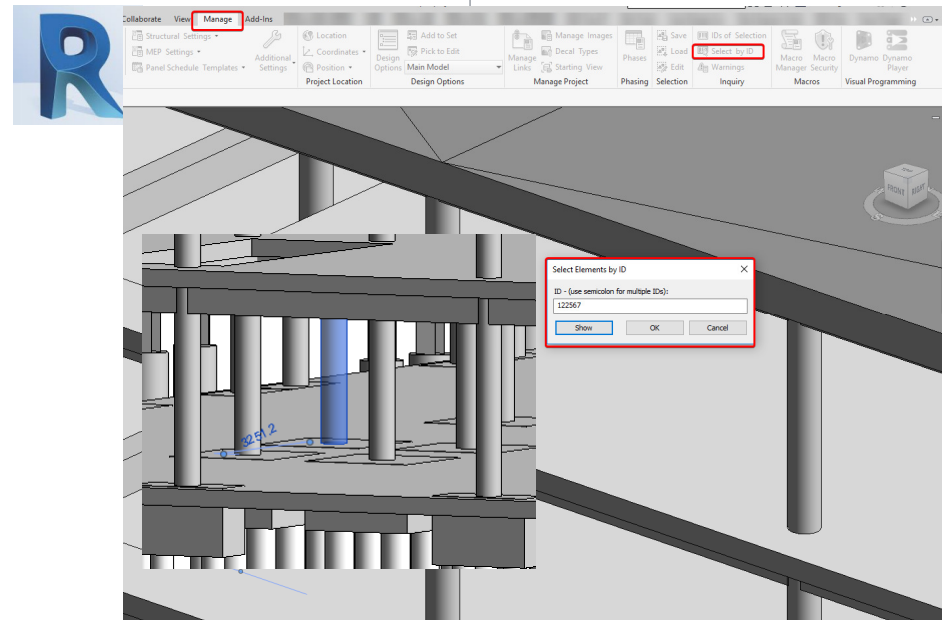
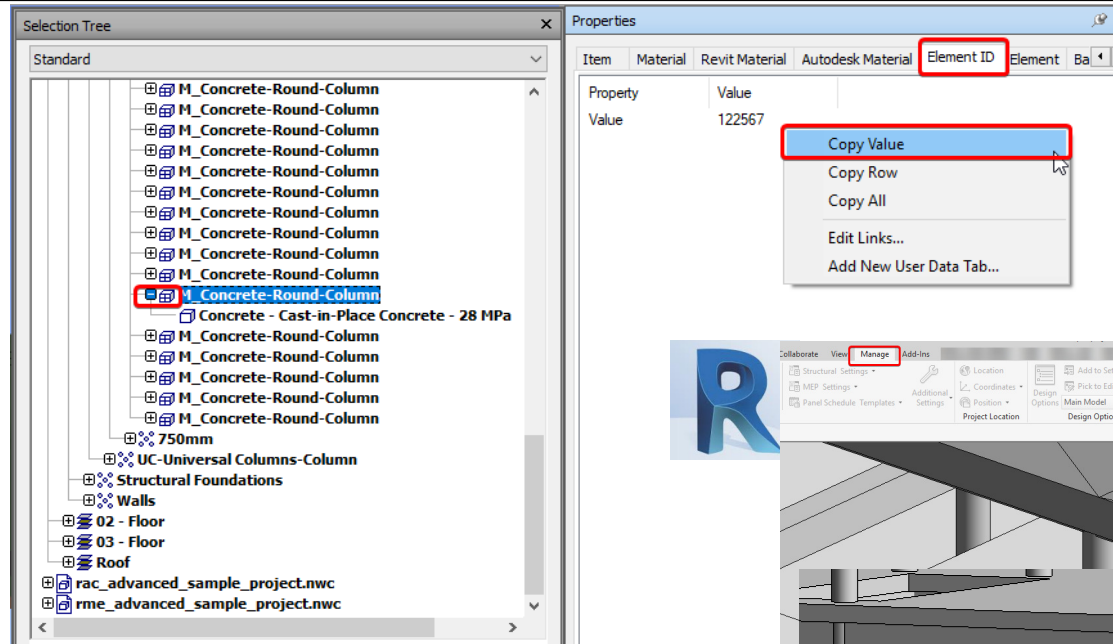
■ Appearance Profiler



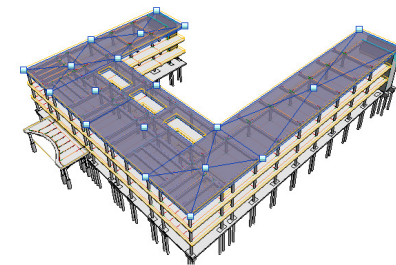
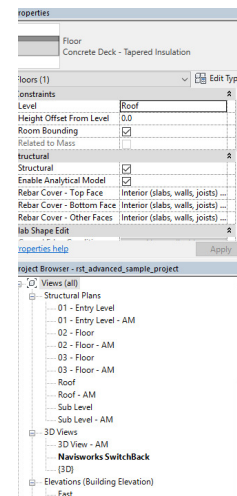
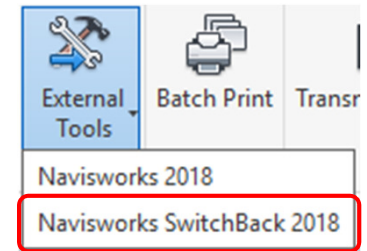
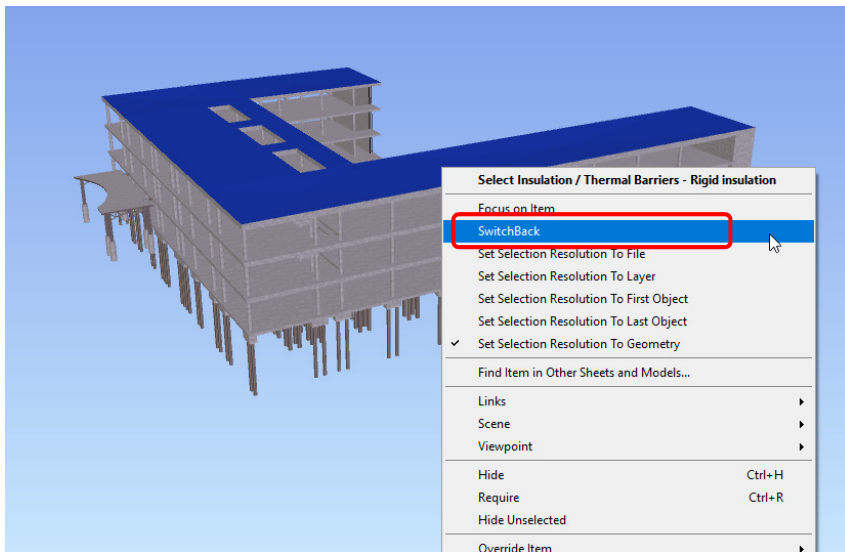
■ Get Element Location (View Cube)



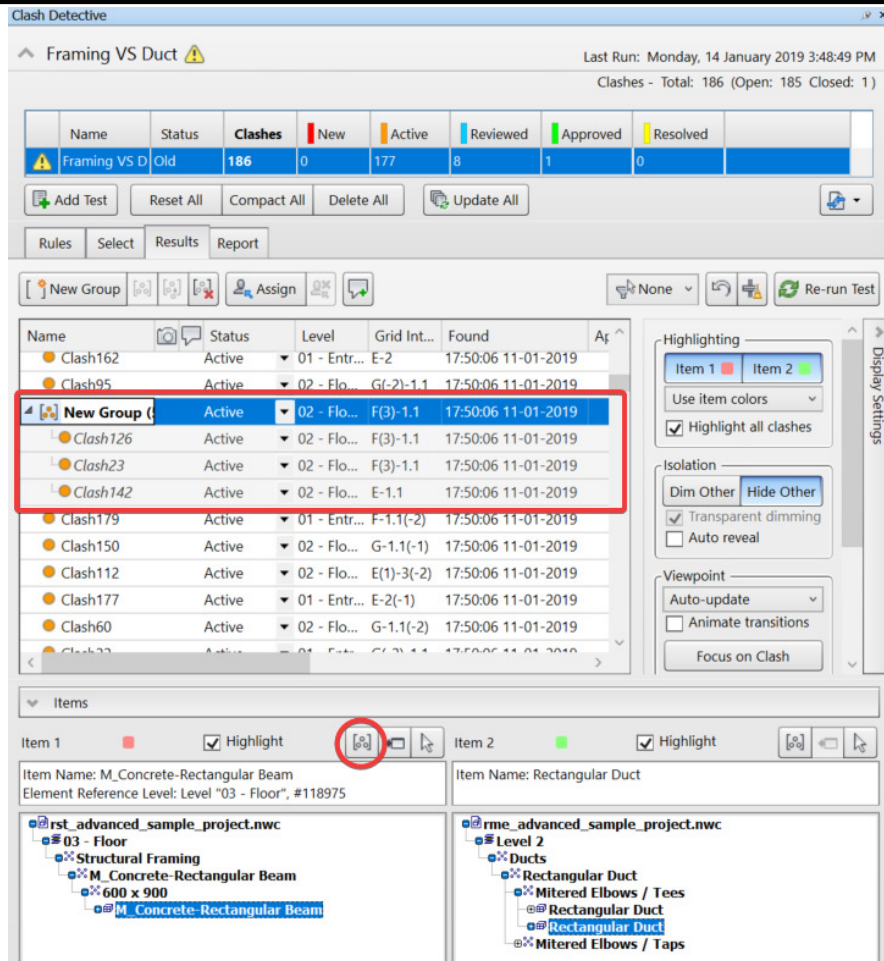
Find Elements in Revit



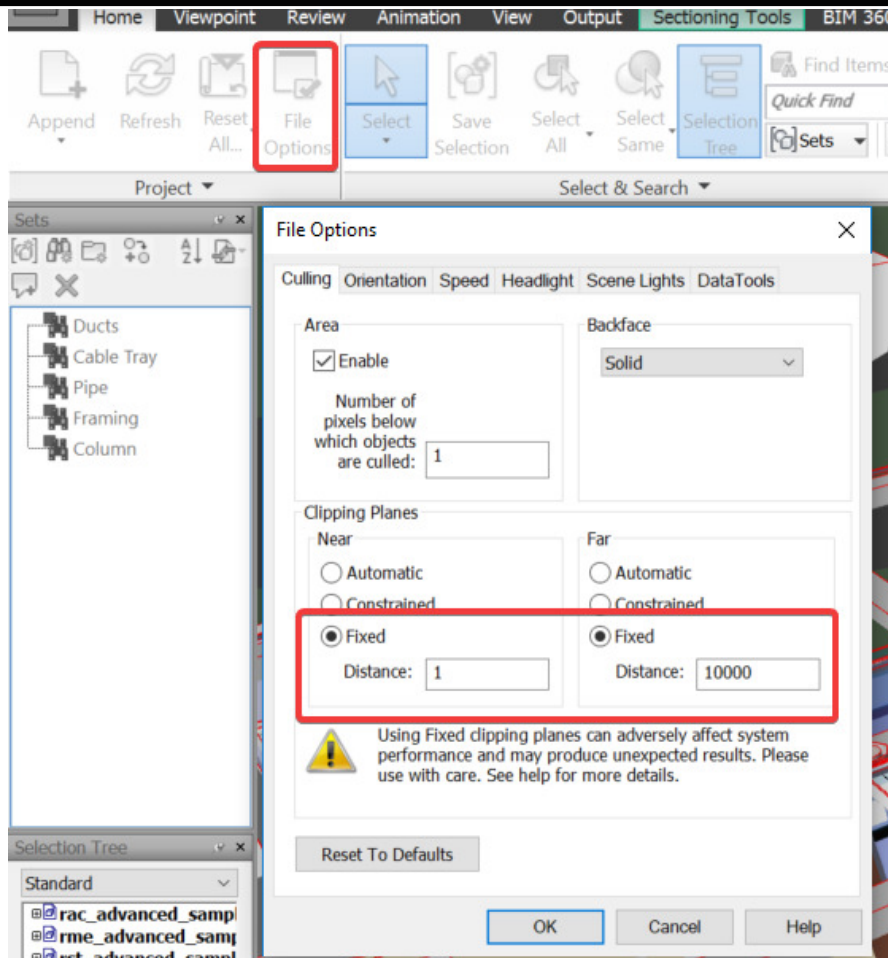
■ Switching back to Revit



Grouping Clash (Manually)



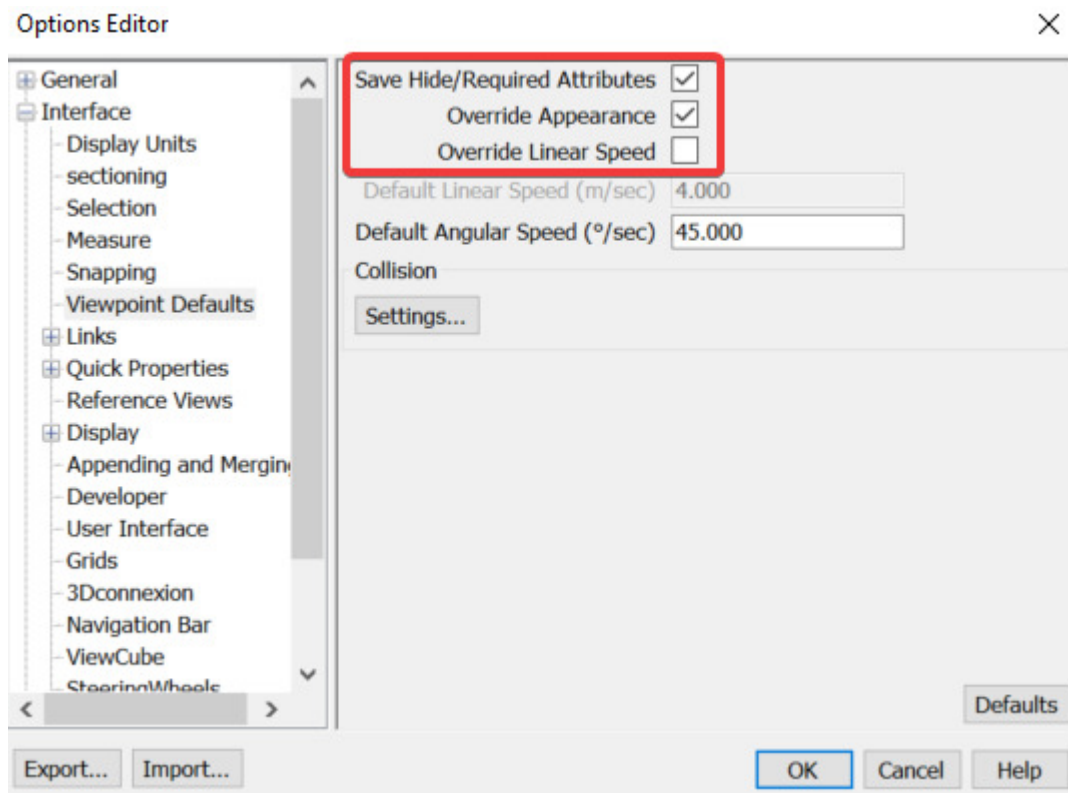
Clipping Planes



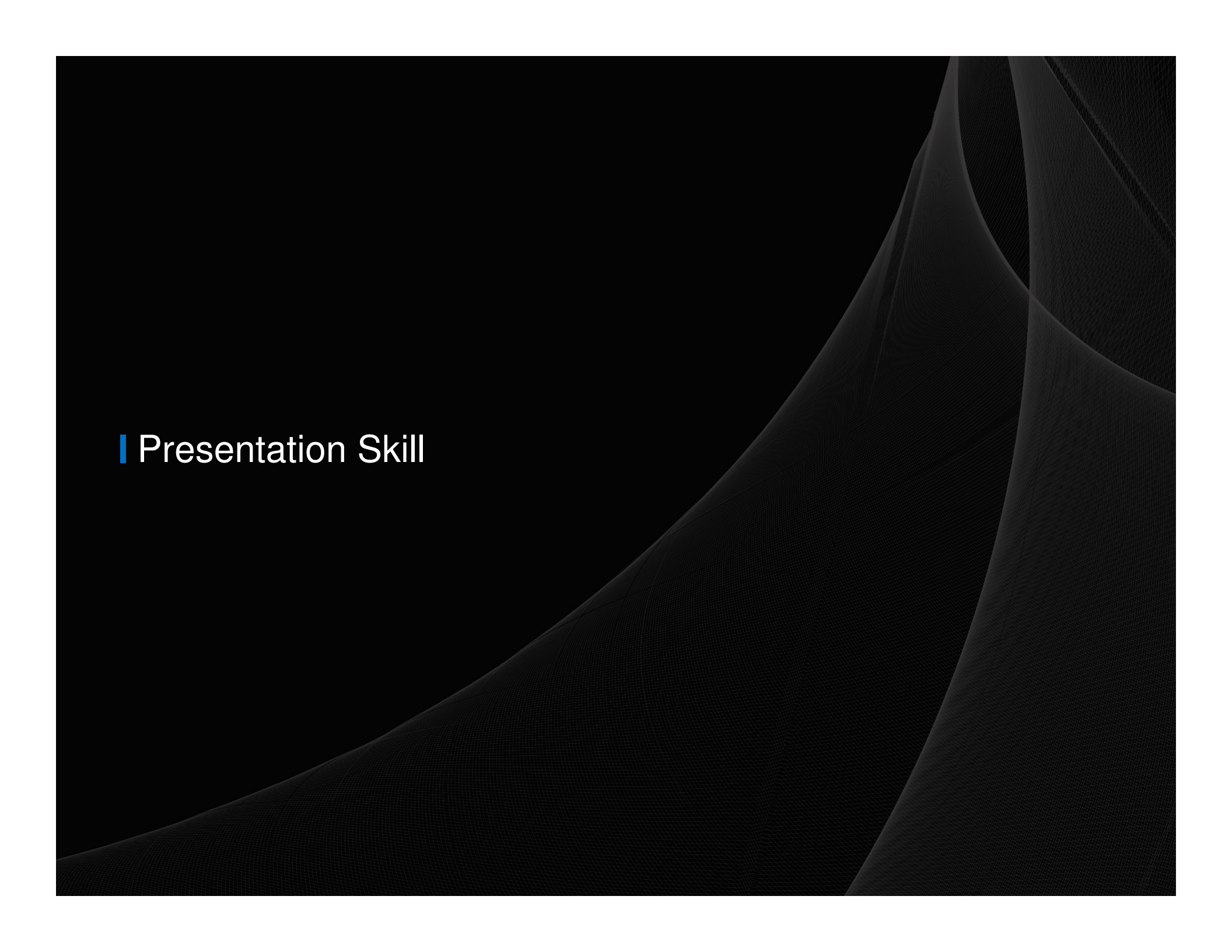
To have a better setting on clipping plane:

- low number for “Near”
- large number for “Far”

Viewpoint Setting

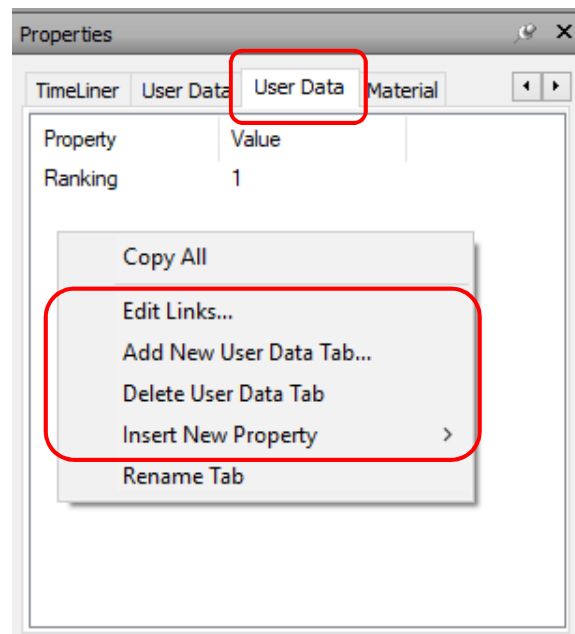
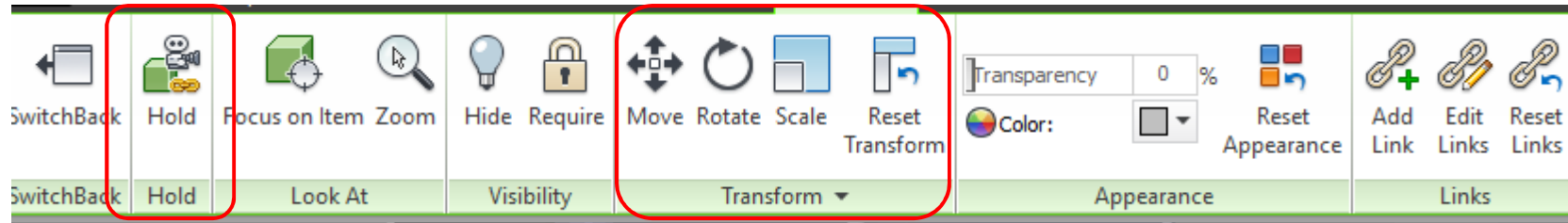


Assign special setting for viewpoint

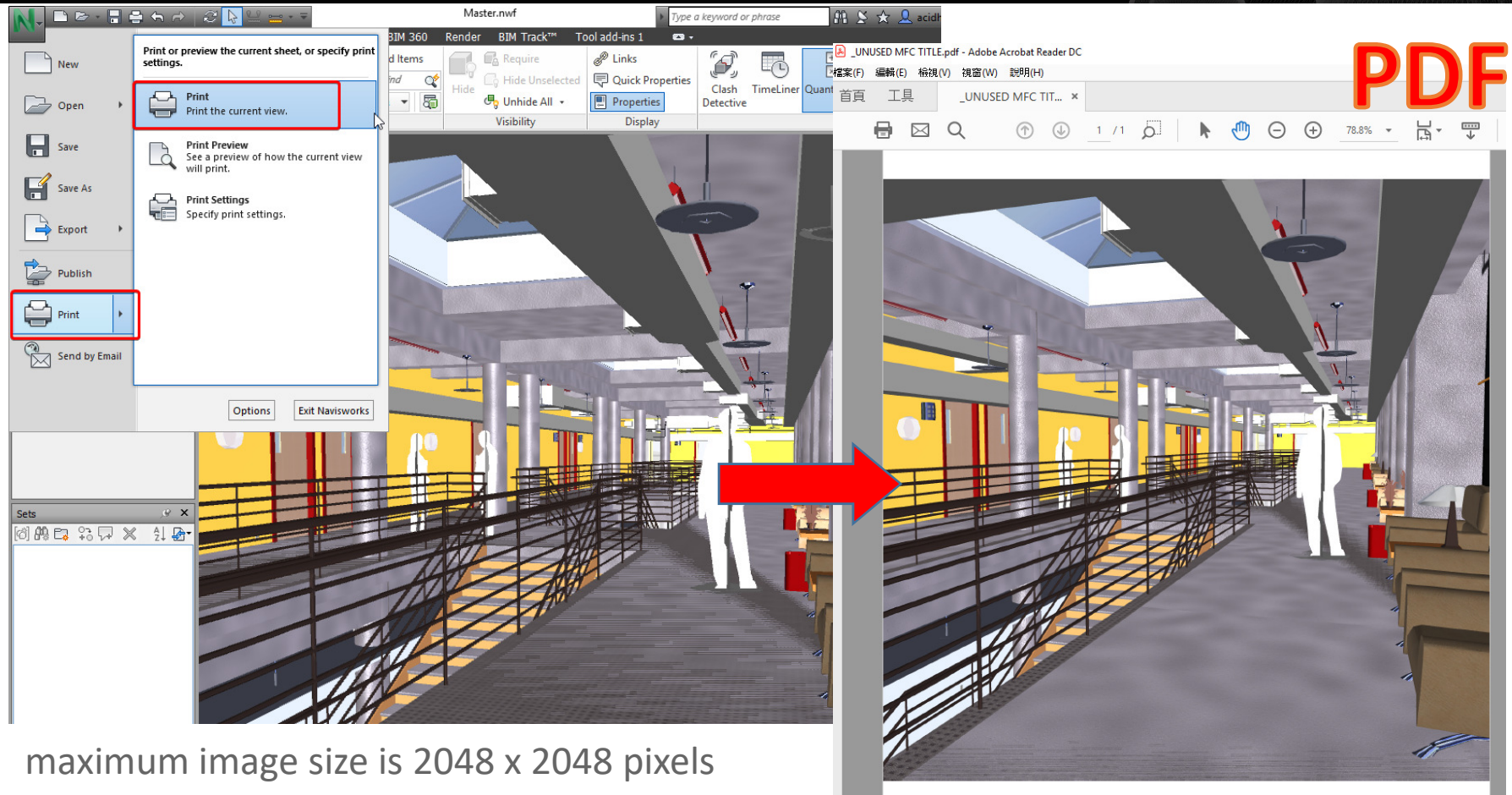


| Presentation Skill

▪ Edit Element Object



■ Printing



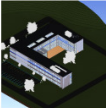
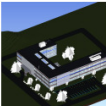
maximum image size is 2048 x 2048 pixels

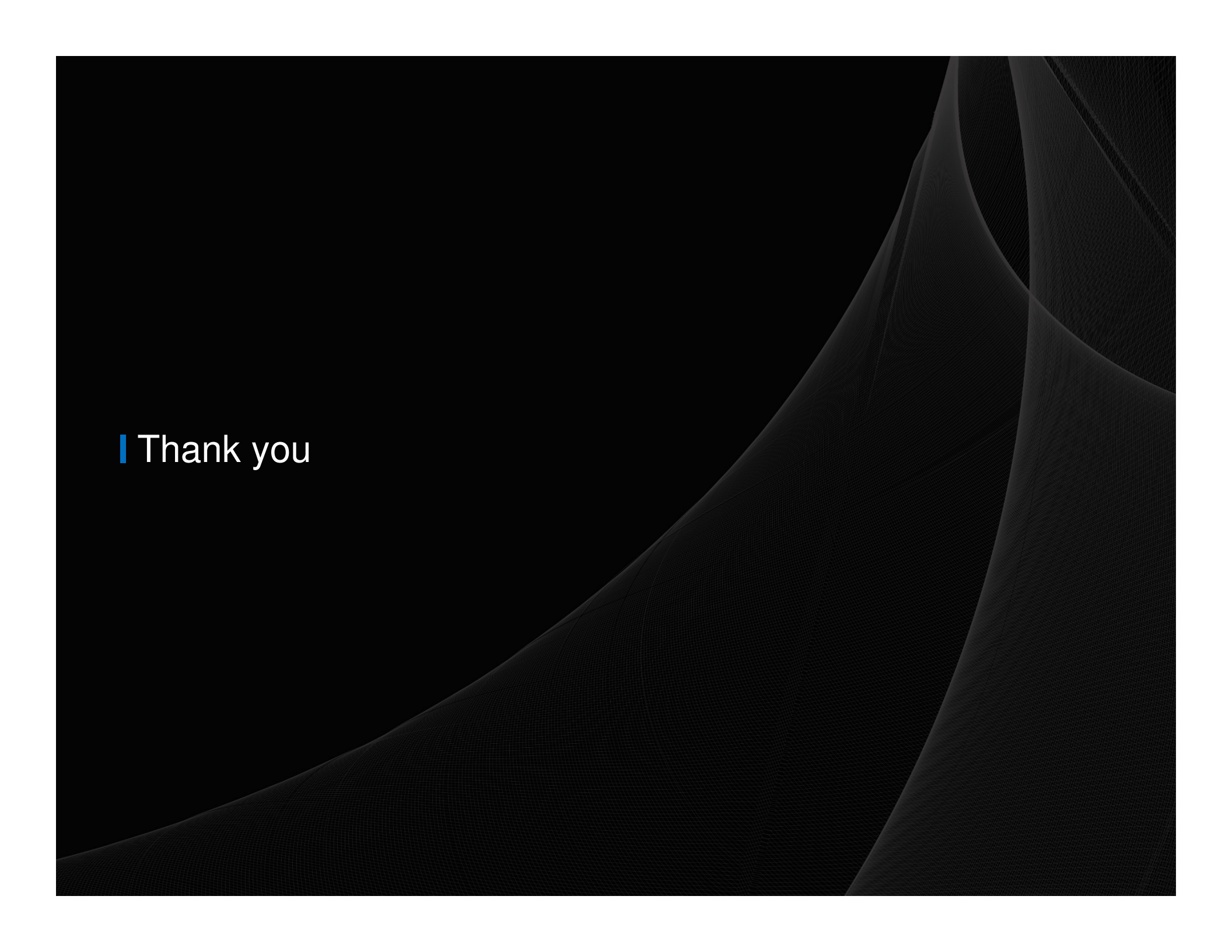
■ Export Viewpoints Report

The screenshot displays the Navisworks interface with three main components:

- Saved Viewpoints Panel:** Shows a tree view of viewpoints. The 'Viewpoints' menu is open, highlighting 'Export Viewpoints Report...'.
- Viewpoints List:** A table listing the viewpoints and their types.
- Viewpoints Preview:** A summary of the viewpoints included in the report.

Name	Type
Master	Chrome HTML Document
vp0004	JPG File
vp0005	JPG File
vp0006	JPG File
vp0007	JPG File
vp0008	JPG File
vp0009	JPG File

Viewpoints —	
3D View - AM	
	Camera Position: 270.781ft, -88.526ft, 189.302ft
{3D}	
	Camera Position: -38.632ft, -88.425ft, 185.719ft
Building Courtyard	
	Camera Position: 287.821ft, 206.849ft, 5.741ft



Thank you