

4D SCHEDULING &
CONSTRUCTION
PROJECT
MANAGEMENT
SOFTWARE



SYNCHRO

SYNCHRO Pro Basic Training 2020

The screenshot displays the SYNCHRO Pro software interface, which is used for 4D construction project management. The interface includes a top toolbar with various icons for file operations, project management, and visualization. Below the toolbar, there are several panels and views:

- Resources Panel:** Located on the left, it lists resources such as Equipment, Human, Location, and Material, with a table showing details like ID, Name, Duration, Start, and Finish.
- 3D View Properties Panel:** Located on the right, it allows users to configure the 3D view, including settings for General, Display, and Visibility.
- 3D Viewports:** The main area contains three 3D viewports showing different perspectives of the construction project. The top viewport shows a wide view of the site with a 'High Risk' warning sign. The bottom-left viewport shows a close-up of a construction area with a crane. The bottom-right viewport shows a construction area with a scissor lift.
- Task Properties Panel:** Located at the bottom right, it provides information about the current task, including its name, duration, and start/finish dates.

The interface is designed to provide a comprehensive view of the construction project, allowing users to manage resources, schedule tasks, and visualize the construction process in 3D.

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Overview

1.1. Why SYNCHRO Pro?

1. At SYNCHRO, we are passionate about improving construction project performance because we understand the impact construction has on global resources and we recognize the importance of the industry to quality of life and economic prosperity. We have also experienced how significantly digital technology improves results over the tried and true methods that have been standard in the industry for generations. Imagine crystal clear communications and engaged team collaboration. Imagine the ability to easily create a shared vision of the project among your stakeholders, the ability to identify spatial and resource clashes in the planning phase rather than the costly construction phase, imagine a project schedule that gives you confidence to deliver according to plan!

1.2. Why 4D?

Scheduling and planning is critical to safe, efficient, high quality construction. While using 4D, the computer becomes a practice field where sequences, safety, special relationships and more can be viewed and discussed continuously before and throughout the project lifetime. Because SYNCHRO links 3D Resources (human, material, equipment, and space) to the associated Schedule tasks, making changes and comparing baselines to alternatives is quick and easy. Testing sequencing and running “what if” scenarios is highly efficient and engaging. Communications are crystal clear, because you can see each step in the process. Cooperative knowledge sharing creates innovation and unique approaches that build competitive advantage. The result is an efficient, reliable and safe project delivery process that saves time and money.

1.3. Who uses SYNCHRO Pro?

Contractors, Subcontractors, Specialty Supplies, Consultants and Owners use SYNCHRO for the construction of buildings, infrastructure, roads and bridges, healthcare facilities, Industrial, Oil and Gas, Power, Alternative Energy, Marine, as well as Mining projects.

1.4. How does SYNCHRO Pro apply to you?

SYNCHRO Pro integrates with major scheduling softwares but it can also be used as a stand-alone scheduling tool. In this tutorial, you will learn how to integrate your schedule with 3D models from most CAD systems to produce a 4D schedule and visualization in virtual reality. Whether you like to see the schedule through the model or see the model through the schedule, the ability to visualize your plan while maintaining its integrity allows project delivery performance to consistently and reliably exceed today's performance standards in an immediate and dramatic way.

1.5. Course Description

This course will take you through the basics for SYNCHRO Pro. This course is appropriate for anyone involved in construction delivery - including planners and schedulers, virtual design coordinators, and project managers. The course will introduce you to 4D scheduling in SYNCHRO. It will cover everything you need to get started working in SYNCHRO, including importing schedules and models, linking 3D objects to tasks, inserting new tasks, subdividing geometry, animating equipment using 3D paths, and producing outputs.

At the end of the course you will be able to import a model and schedule, fully link the model to the schedule using colour coding and growth simulation, review the construction sequence, and export a video to present to stakeholders.

It is time to synchronise your projects. As always, we welcome your feedback at any time, we look forward to seeing your results and we hope you will share your experience with SYNCHRO with others to spread the word. Thank you for investing your time in learning SYNCHRO Pro. Together we will make a positive change in how projects are planned and delivered.

Workspace Layout

This section will present the various windows in SYNCHRO and how to reorganize and manage your workspace.

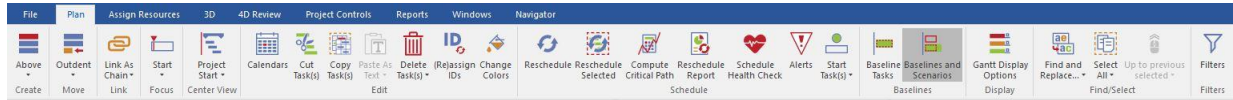
2.1. Windows in SYNCHRO Pro

Quick Access Toolbar

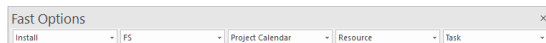


2.

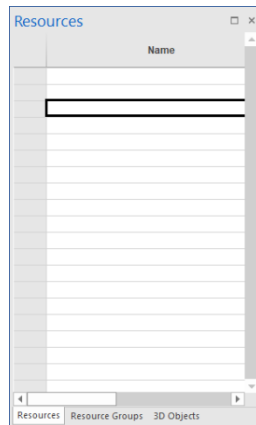
Ribbon



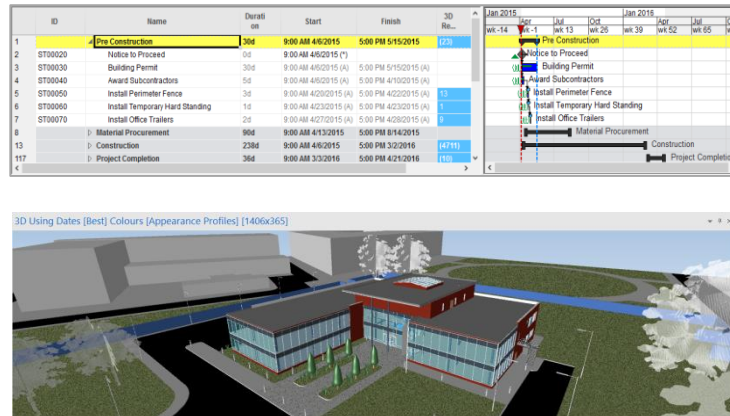
Toolbar



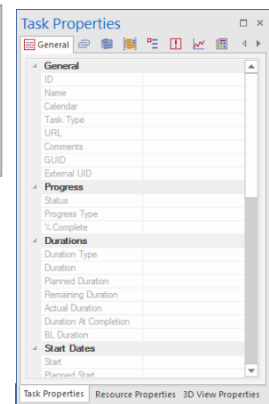
Resource/Object Tables



Task List & Gantt Chart Window




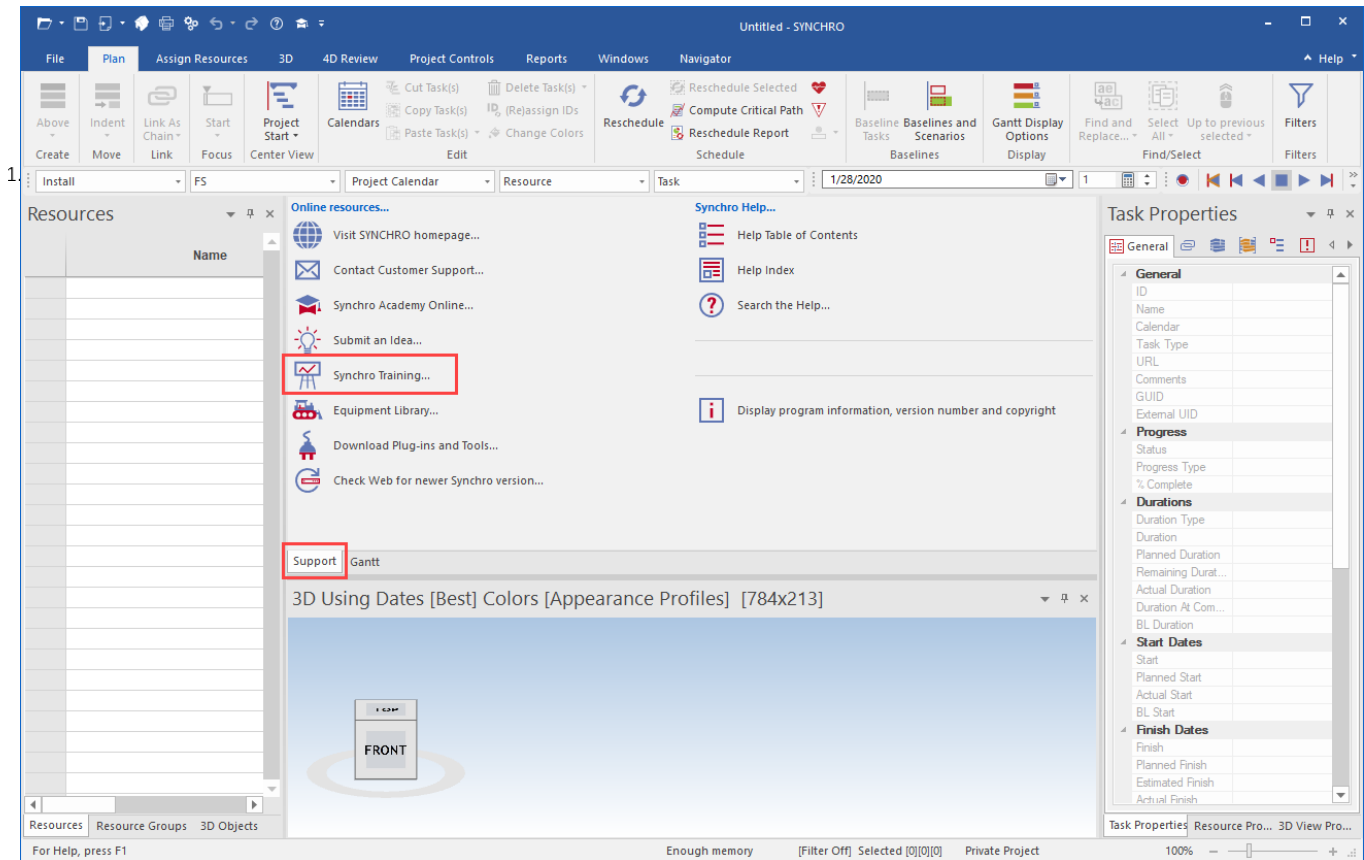
Properties



- **Quick Access Toolbar:** contains commonly used icons. The Quick Access toolbar can be customized by left clicking on the down arrow and selecting **More Commands**.
- **Ribbon:** contains commands, sorted by category. In the top right corner of the Ribbon is the **Help** menu which can be used to find more information about a particular feature.
- **Toolbars:** contain shortcuts and useful commands found in SYNCHRO. Right click in the empty space below the Ribbon to view and select available toolbars. Select **Customise** to create your own custom toolbar of commonly used commands.
- **Gantt Chart:** window displays the list of Tasks, which can be created, modified, linked, etc.
- **3D Window:** displays the modelled resources at any defined point in time.
- **3D Objects:** contains the list of 3D Objects and Workspaces (including those imported and those created in SYNCHRO).
- **Resources:** contains the list of Resources (including those imported and those created in SYNCHRO).
- **Resource Groups:** contains the list of Resource Groups created in SYNCHRO
- **Task Properties:** contains data related to the selected Task(s) including Task Status (in the General panel), assigned Resources, and Budgeted Costs.
- **Resource Properties:** contains data related to the selected Resource(s) including Costs, assigned to Tasks, and User Fields.
- **3D View Properties:** contains properties that allow the user to set different view settings per view. Filters, View Indicators, Render modes, Cutting Planes etc.

2.2. Workspace Management

Start SYNCHRO Pro by double clicking on the  icon on your desktop



NOTE: To access the training files, select **Synchro Training** from the **Support** tab. The default location for tutorial files:
C:\Users\Public\Documents\Shared SYNCHRO Projects\Tutorial Files\SYNCHRO Pro Training

2.2.1. Resizing Windows

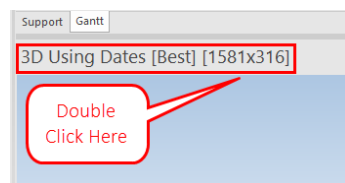
Place the cursor at the top of the **3D Window** so the double arrow icon  appears.

Select it with a left mouse click, hold down and drag the 3D window up. All windows in SYNCHRO can be resized by this method. Windows can also be resized horizontally

2.2.2. Undocking and Relocating Windows

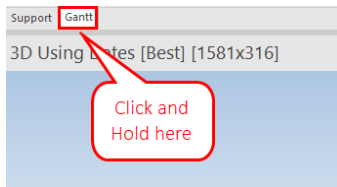
To undock a window, double click in the window header.

To undock a single tab, left click on the tab and keep holding the mouse button while moving the mouse. The tab will be undocked as a new window.



If you are using multiple monitors, you can then move the new window to another screen.

To resize the undocked window, hover over a corner until a diagonal arrow appears, then left click and drag to the desired size.



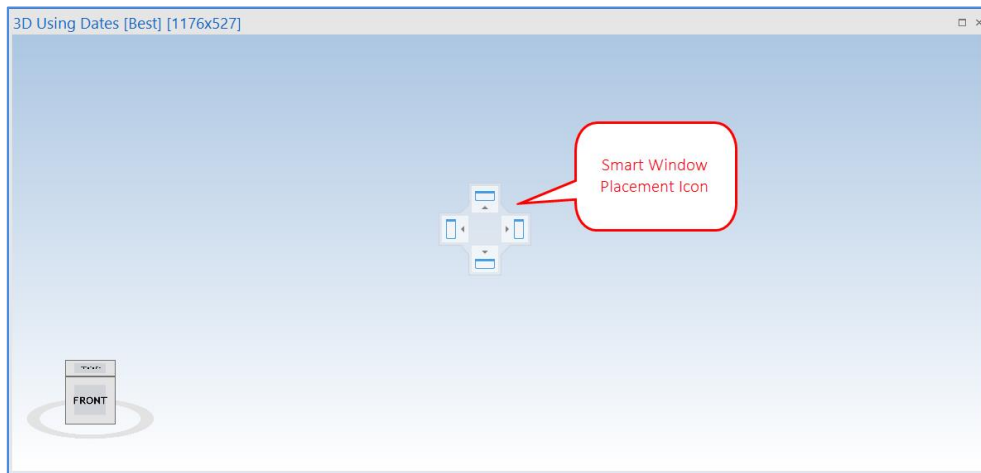
6.

To re-dock the window in the previous location, simply double click the window header.

To re-dock the window in a different location, left click and drag in the window header. Move the mouse over another window until the smart window placement icons appears. Hover over one of the icons – a blue preview of where the window will be place will be shown. Release the mouse button to place.

7.

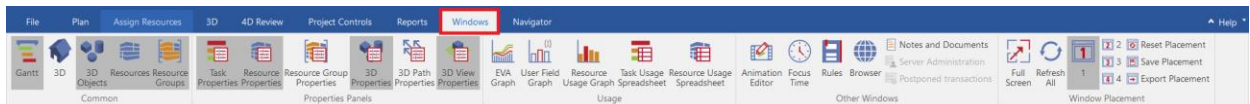
8.



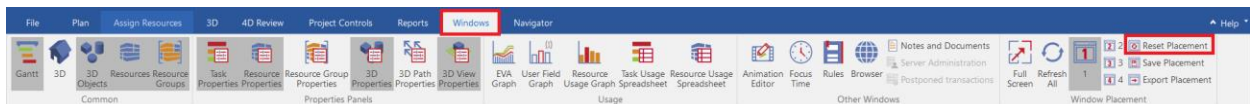
9. 2.2.3. Reset layout

If you close any of these windows, you can re-open them by selecting the appropriate icons in the **Windows** tab.

10.



To reset the window layout to the default, select **Windows** tab → **Windows Placement** panel → select **Reset Placement**.



This command is particularly useful if you cannot locate a particular window or the window placement is changed when switching from multiple monitors to only one.

Importing Schedules/Plans

This section will demonstrate how to import a schedule/plan from another source and manipulate the Gantt Chart display options.

You can import a range of different schedule/plan files into SYNCHRO PRO. The types of plan/schedule files that can be imported:

3.
 - SYNCHRO Pro and SYNCHRO Scheduler (.SP file extension)
 - Asta PowerProject
 - Microsoft Project XML
 - PMA NetPoint
 - Primavera P6
 - IFC

NOTE: Asta PowerProject must be installed on the same computer as SYNCHRO in order to import schedules from this program.

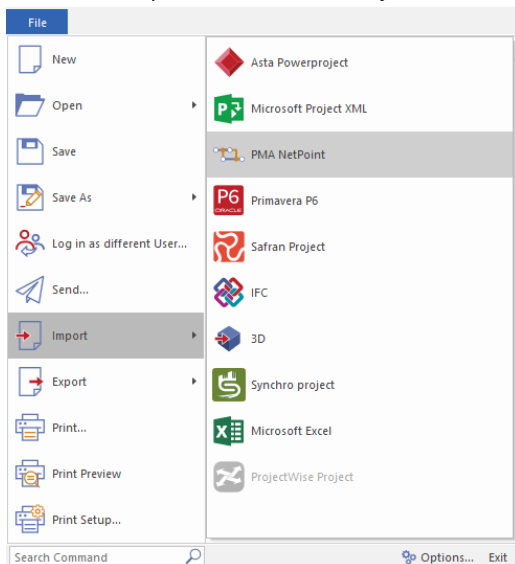
Importing from Primavera can be achieved via P6 XML or directly from the P6 database using the P6 API. Direct database access can be achieved for either PPM or EPPM (Standalone/Local or Server) versions of Primavera P6.

SYNCHRO Pro and **SYNCHRO Scheduler** are both complete CPM scheduling tools for construction – users can create a schedule from scratch, calculate the critical path, manage resources and costs, create baselines, track progress, and compare schedules. SYNCHRO Scheduler is essentially SYNCHRO Pro without 3D/4D capability and is available at zero cost to anyone.

For this training, we will import a schedule in Microsoft Project XML format.

3.1. Importing a schedule from Microsoft Project XML

1. To import a schedule, select **File** tab → **Import** then select the source program. For Microsoft Project, select **File** tab → **Import** → **Microsoft Project XML** as shown below.



2. Select **Browse** to locate and select the *Training Project Schedule.xml* file, then select **Open**. File Location *C:\Users\Public\Public Documents\Shared SYNCHRO Projects\Tutorial Files\SYNCHRO Pro Training\Schedule*
3. Select **Next**.

4. This screen allows the user to choose how to treat different attributes of the file on import. The **Command** for each **Object** can be individually set to **Import** or **Skip**. Keep the default settings.

Microsoft Project import

How would you like to import this file?

☐ Use the Selected Task to merge the data into the current Project

☒ Append the data to the end of the current Project

☒ Reframe Gantt to show imported data

Choose how you would like to process each object

Object	Command
Tasks	Import
Links	Import
Task constraints	Import
Costs	Import
Calendars	Import
Resources	Import
Resource assignments	Import
Activity codes	Import
Activity code assignments	Import
User fields	Import
User field values	Import
Resource codes	Import
Resource code assignments	Import

Default Skip all

☐ Use these settings for all new synchronizations of this type

< Back Import Cancel Help

5. Select **Import**. A **Progress** bar will display while importing and the **Output** panel will display what was imported and any relevant notifications.

NOTE: This data can be copied and pasted into a text editor for future reference by using the **Select All** and **Copy to clipboard** buttons.

6. Select **Finish**.

Microsoft Project import

Progress

Storing information...

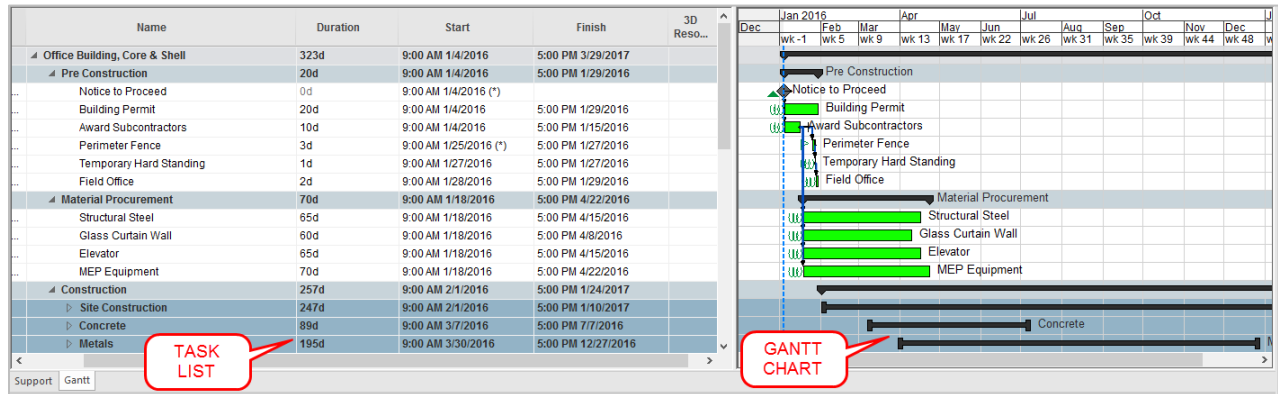
Output

Started: 2020-07-03 19:02
 Import completed successfully
 0 activity codes were imported
 0 resource codes were imported
 0 code values were imported
 1 calendars were imported
 118 tasks were imported
 0 resources were imported
 0 resource assignments were imported
 0 user fields were imported
 0 user field values were imported
 0 code assignments were imported
 Finished: 2020-07-03 19:02

Select All Copy to clipboard

< Back Finish Cancel Help

7. Select (left mouse click) the Gantt tab (at the bottom of the Support Panel) to display the Gantt Chart. The imported schedule should look like this. Note: In SYNCHRO, the left side of the Gantt window is called the **Task List** and the right side is referred to as the **Gantt Chart**.



3.2. Gantt Chart Navigation

- Move the mouse into the **Gantt Chart** area.
- To **Pan**, hold down the middle mouse button then move the mouse up, down, left and right.
- To **Zoom**, roll the middle mouse button wheel forward and back to zoom in and out respectively.
- This schedule is organized by Work Breakdown Structure (WBS). In the **Plan** ribbon → **Gantt Display Options**, ensure that it is set to **WBS**. Schedules may alternatively be **Custom** grouped by any attribute, including **Activity Codes**.

The Gantt Display Options dialog box is open, showing the following settings:

- Task Grouping:** WBS (selected), Custom, Activity Code
- WBS Layout Colors:** Display the Gantt Chart in WBS mode
- Bar Colors:** Task Status (selected), Task Supplier, Activity Code Color
- Show Links:** On Screen
- Indicators:**
 - ☐ Spotlight
 - ☐ Hidden Link Warnings
 - ☒ Non-working Time
 - ☒ Planned Dates
 - ☒ Baselines
 - ☒ Upstream Floats
 - ☐ Downstream Floats
 - ☐ Task Names
 - ☒ Progress Labels
 - ☐ Constraint Markers
 - ☐ Resource Markers
 - ☒ URL Markers
 - ☒ Early Tasks Progress Line
 - ☒ Late Tasks Progress Line
 - ☒ Proposed Dates
 - ☒ Late Dates

12. In the Task List, click on the or icon next to any WBS summary to collapse the schedule to that level. When collapsed, click on the or icon to expand the summary task.

13. Right click in the **Task List** and choose **Collapse → All** to view only the top level Task.
14. Right click in the **Task List** and use **Collapse To → Level 3** to view the 3rd level of the WBS

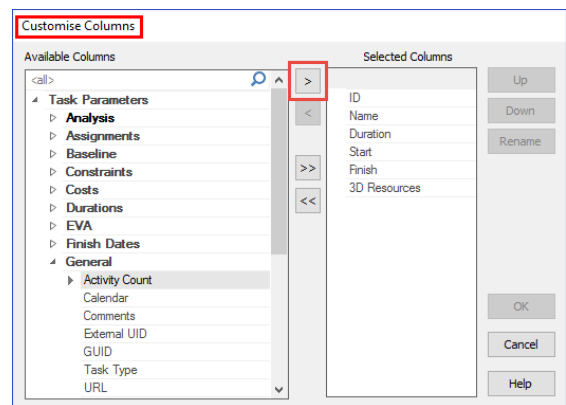
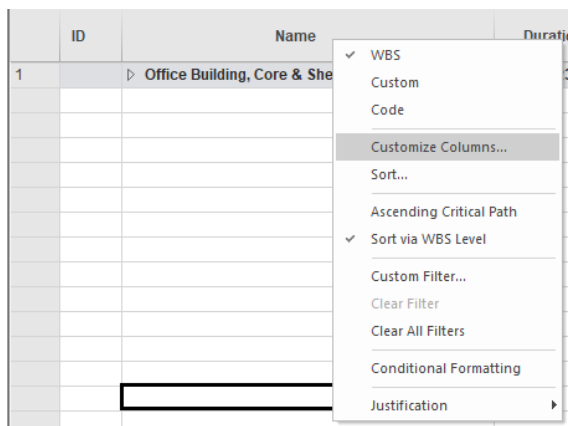
ID	Name	Duration	Start	Finish
1	Office Building, Core & Shell	323d	9:00 AM 1/4/2016	5:00 PM 3/29/2017

15. Right click again and choose **Expand → All** to see all the tasks again.

3.2.1. Customise Columns

SYNCHRO gives you the option to customise the columns shown in the Gantt chart by adding or removing columns, or changing the order or names of the columns displayed.

16. Right click in the heading field of the **Task List** and select “Customise Columns” (below left) to open the “Customise Columns” window (right).




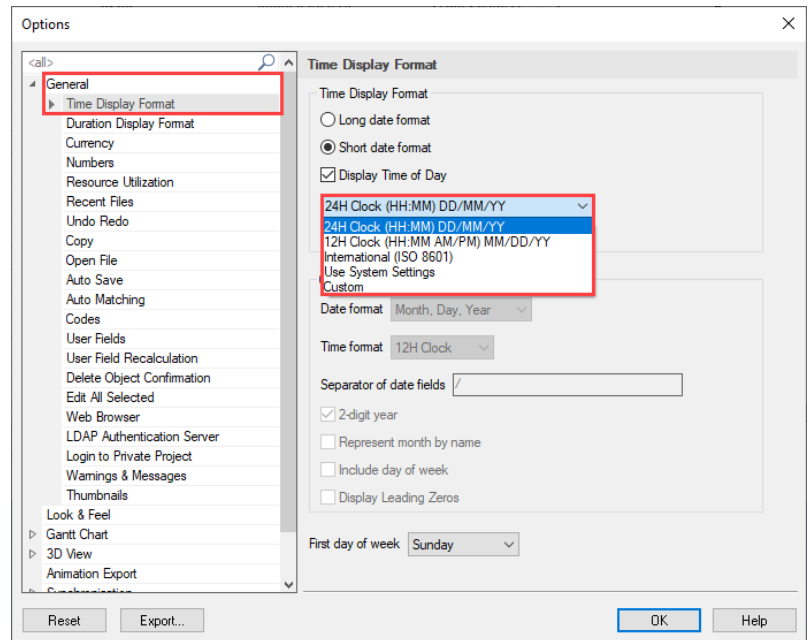
17. To add a **Column**, in the “Customise Columns” window, select a **Task Parameter** on the left under “Available Columns” and press the **Single Arrow** (outlined above) to move the Task Parameter to the right under “Selected”.
18. Conversely, to remove a **Column**, highlight a **Task Parameter** under “Selected” and press the single **Left Arrow** to move the parameter back to “Available Columns”.
19. Once you have finished adding and removing Task Parameters, you can re-order the columns by highlighting a **Task Parameter** in the “Selected” Column and pressing “Up” or “Down” or **Dragging and Dropping** in the list. Similarly, you can rename the Columns titles by highlighting the parameter and pressing the “Rename” button.

NOTE: The top Task Parameter in the “Selected” column is the farthest left column in the Task List.

3.3. Date Display

The time and date format can be changed to match the local convention.

20. In the **File** tab, **Navigator** tab or **Quick Access Toolbar**, select the  **Options** icon. This will open the Options dialog which contains many settings related to all aspects of SYNCHRO including the customization of the Gantt Chart and 3D view, as well as scheduling and Synchronisation preferences.
21. Expand the **General** tab, and select **Time Display Format**.
22. From the first drop down menu, select **24H Clock** for this training. This will set the date format to DD/MM/YY. There is also the option to hide the time of day, but we will leave it on for this training.



You can leave the **Options** dialog open for the next section.

4. Auto Save

This section will teach you how to use the Auto Save and Backup functions in the Options menu to ensure you will lose no data while working on your SYNCHRO Project.

At this stage it is advisable to activate the **Auto Save** and **Backup** functions.

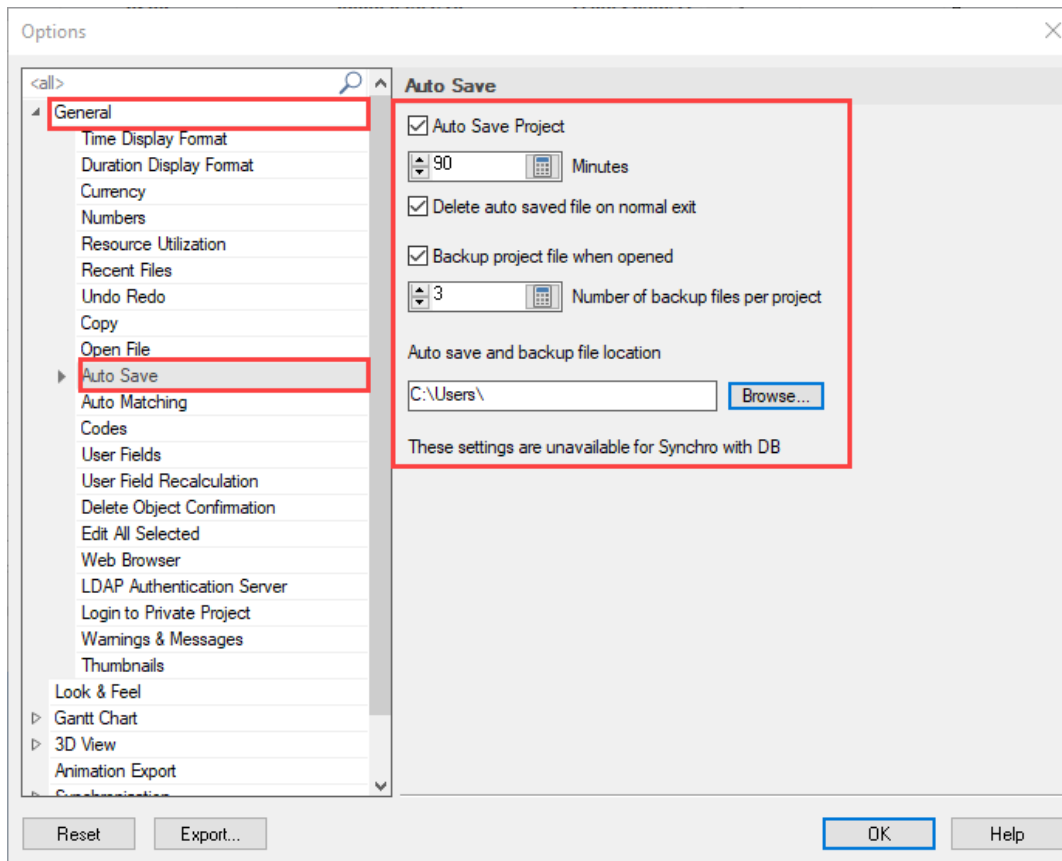
1. In **Options** → **General** → **Auto Save**, enable **Auto Save Project** (if it is not already on) and designate 90 minutes (optional).

NOTE: The time specified for the Auto Save will depend on the size on the file. Larger files take longer to save and the file will be un-editable during the auto save process, so you should pick a frequency that balances time waiting and amount of work you are willing to lose if the file or computer crashes.

2. Enable **Backup project file when opened** and **Browse** to select a convenient location. If the location is left blank, the Auto Save, Backup and Dump files will be saved in the default windows Temp folder as defined by the %TEMP% environment variable.

NOTE: You will need to empty this folder from time to time as a time-stamped backup file is created every time you open a project (up to the maximum **Number of backup files per project**). These automatically generated backups can be very useful to return to an older copy if you find a mistake later on or want to access work you've since deleted. The Auto Save file and any DMP (dump) files will also save in this folder.

3. If Auto Save is enabled, it is recommended to enable **Delete auto saved file on normal exit**. This command will delete the Auto Saved files (but not the Backup file) when you close SYNCHRO normally. Otherwise, the file will be available to the last Auto Save point if necessary.



5. Importing Models

In this section, you will learn how to import various external 3D model files and what settings to use to optimize the model within your SYNCHRO project.

SYNCHRO Pro can import 58 file types for 3D models including DWF, DWG, DGN, SKP, 3D PDF, and IFC. Multiple file types can be imported into the same master SYNCHRO Project.

NOTE: For a full list of importable file types, please see [Appendix A: 3D File Formats](#).

Additionally, there are SYNCHRO plugins available on the [SYNCHRO website](#) to convert Revit (RVT), Navisworks (NWF and NWC) and Bentley (i-Model and DGN) to SYNCHRO Project format (SPX). For more information on the Bentley and Revit workflows, please see [Appendix B](#) and [Appendix C](#), respectively.

NOTE: To work with Bentley iModels, use SYNCHRO 4D Pro to Open>SYNCHRO Control Project. iModels hosted in the cloud can contain Bentley model files as well as other file types (e.g. Revit) bridged into the iModel using iTwins Synchronizer. Hosting the iModel via SYNCHRO Control also allows for collaboration between multiple users.

5.1. Importing 3D Files

This section will define and explain various 3D import settings and teach you how and when to use each.

1. Select **File** tab → **Import** → **3D**.

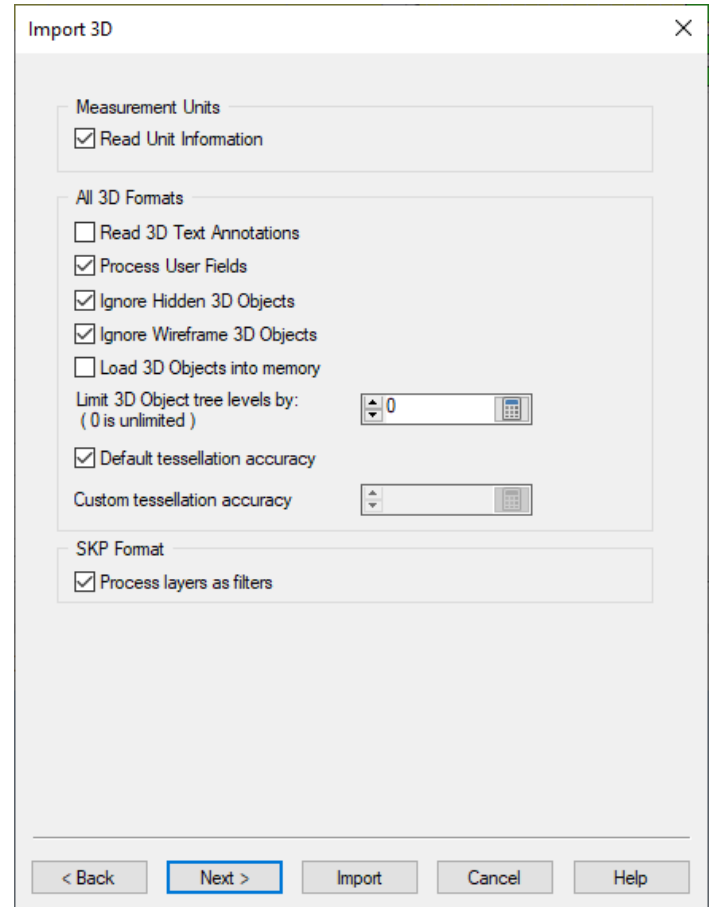
2. **Browse** to locate the training models to **Import**. File location: C:\Users\Public\Public Documents\Shared SYNCHRO Projects\Tutorial Files\SYNCHRO Pro Training\Models. By holding down the **Ctrl** key you can select multiple files for import. Select the following files:

- Site.dwfx
- Landscape.dwfx

3. Select **Open**.

4. Select **Next** to view the import settings. Ensure that your settings match those in the image below right.

- **Read Unit Information** – when enabled, processes the unit information of the 3D Object (i.e. cm, inches)
- **Read 3D Text Annotations** – when enabled, SYNCHRO will process any text assigned to the 3D Object in the CAD file
- **Process User Fields** – when enabled, SYNCHRO will import system- and user-generated parameters (or tags) with the 3D geometry as **User Fields**
- **Ignore Hidden 3D Objects** – when enabled, objects that are hidden by filters or other display controls in the 3D file will not be imported into the SP file
- **Ignore Wireframe 3D Objects** – when enabled, polylines, lines, circular arcs, circles, elliptical arcs, ellipses, and nurbs curves objects will not be imported into the SP file
- **Load 3D Objects into memory** - controls whether imported objects are automatically loaded into memory. If disabled, imported objects will not be loaded into memory and will not be visible in the 3D window. Disabling this option tends to reduce the time to import and is recommended especially for large files.
NOTE: To load/unload an object from memory after importing, check the box next to the object name in the **3D Objects** tab.
- **Default Tessellation Accuracy** – allows the modelling engine to determine its own Tessellation accuracy to control Tessellation.
NOTE: “Tessellation” means the surface of the geometry is built using triangles. **High** tessellation will *slowly* render very detailed geometry surfaces. **Low** tessellation will *quickly* render less detailed geometry surfaces.
- **SKP Format (Process Layers as Filters)** – when enabled, creates Filters for Sketchup Layers



5. Select **Next** to view additional import settings related to the geometry location, scale and rotation. We do not need to edit any of these settings for this training.

NOTE: The **Rotate (DWF Format)** option can be enabled to apply a 90° rotation about the X Axis specifically to Autodesk published DWF where the Y axis is set as vertically up.

6. Select **Import**. A progress bar will display while the files are importing.
7. When the import is finished the **Resource Wizard** will appear.

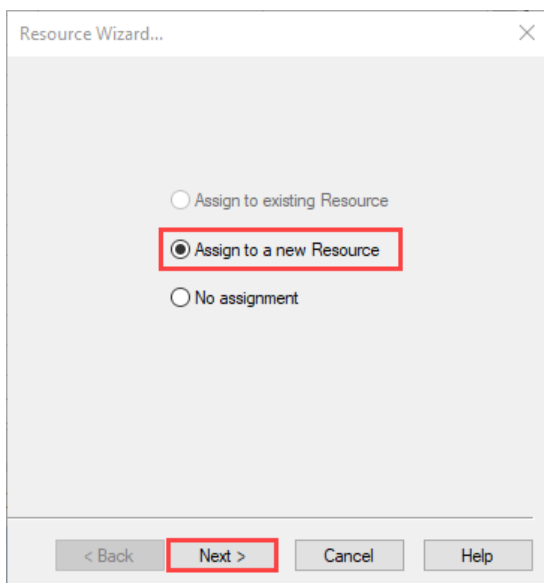
5.2. Understanding Resources

- When 3D Objects are imported into SYNCHRO, they are just 3D Representations / Geometry that can be viewed and manipulated in the 3D View.
- In order for 3D geometry to be linked to the project schedule they must be assigned to Resources. These can be considered '3D Resources' which can be in essence a copy of the object name or several objects grouped together as one '3D Resource'.
- A Resource is anything utilised by a project schedule. In SYNCHRO, Resources are categorized as **Equipment**, **Human**, **Location**, or **Material**. Resources do not necessarily need to have a 3D representation.

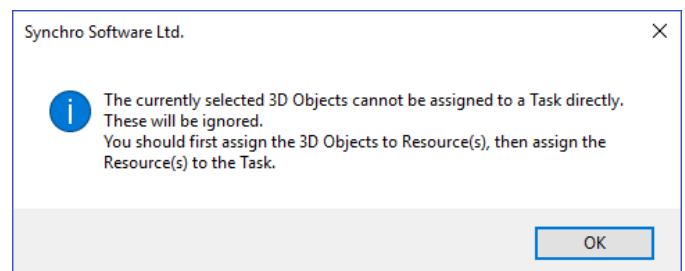
5.3. Resource Wizard

This section will show you how to properly use the Resource Wizard to create resources during your 3D model import.

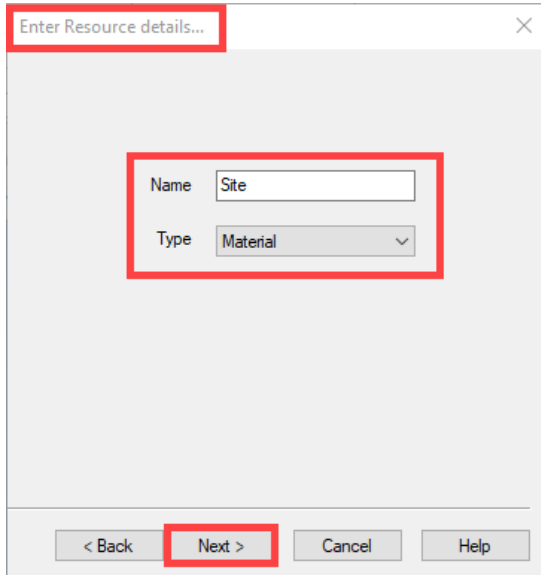
8. Choose **Assign to a new Resource** and select **Next**.



NOTE: Selecting “**No assignment**” will finish the 3D import process without creating any Resources. These 3D objects would not be able to be assigned to Tasks until Resources were created. If you receive the warning shown to the right, it is likely because you chose **No Assignment** on import. You would then need to create Resources for the 3D objects by activating the **Resource Wizard** manually.



9. Enter **Site** for the **Name** and make sure the **Type** is set to **Material**.



Enter Resource details...

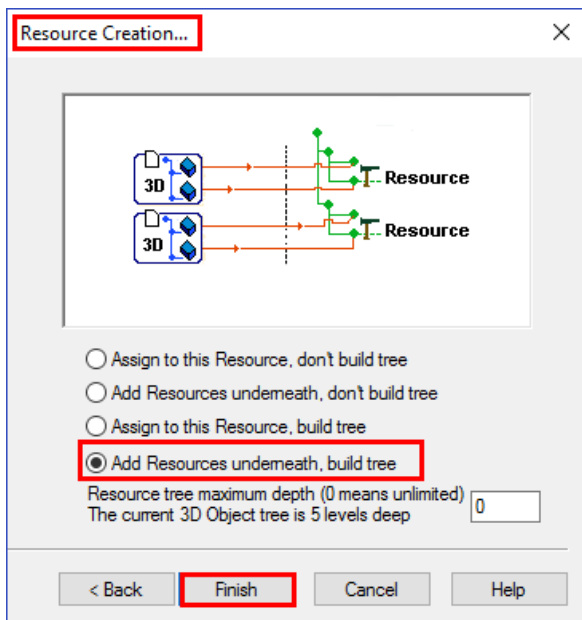
Name Site

Type Material

< Back Next > Cancel Help

NOTE: Name will be the top node of the resource tree, so always pick something that will help you identify the contents.

10. Then select **Next**, the **Resource Creation** options will show next. This step merits further explanation in the next section.



Resource Creation...

3D 3D

Resource Resource

☐ Assign to this Resource, don't build tree

☐ Add Resources underneath, don't build tree

☐ Assign to this Resource, build tree

☒ Add Resources underneath, build tree

Resource tree maximum depth (0 means unlimited)
The current 3D Object tree is 5 levels deep

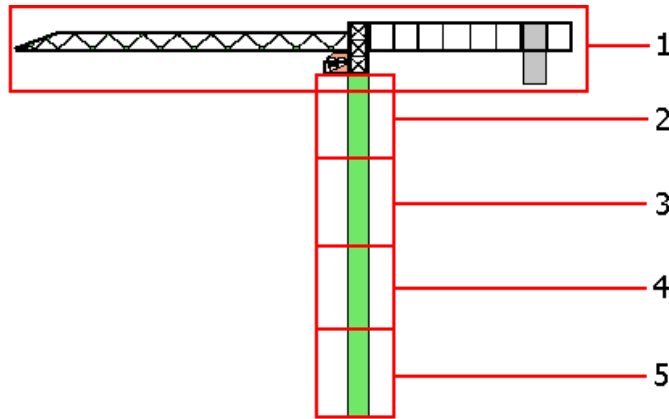
0

< Back Finish Cancel Help

5.4. Resource Creation Options

The Resource Creation options can be used to help filter or group the imported 3D objects. The easiest way to describe this is if we consider an example.

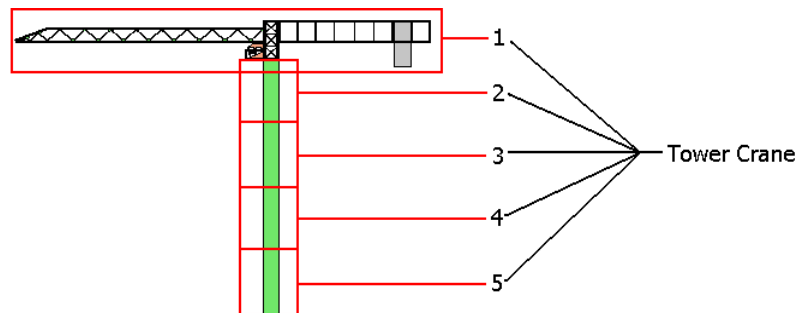
This crane model is split into 5 CAD files called 1 to 5, each containing several items. The following sections will demonstrate the result of choosing each of the 4 Resource Creation options.



5.4.1. Assign to this Resource, don't build tree

The first option, **Assign to this Resource, don't build tree**, creates a single resource in which multiple objects are grouped when importing one or multiple 3D files.

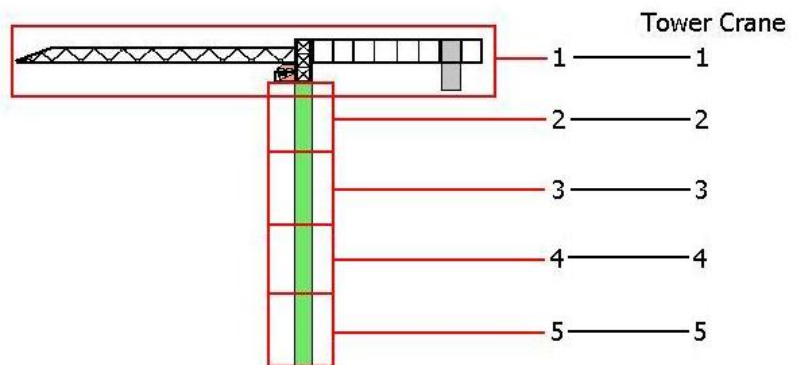
In the example of the crane, if you chose **Assign to this Resource, don't build a tree**, all 5 files will be imported and assigned to *one Resource for the whole crane*, which you could name **Tower Crane**.



5.4.2. Add Resource underneath, don't build a tree

The second option, **Add Resource underneath, don't build a tree**, creates one resource for each file, to which any parts are combined within each 3D file name.

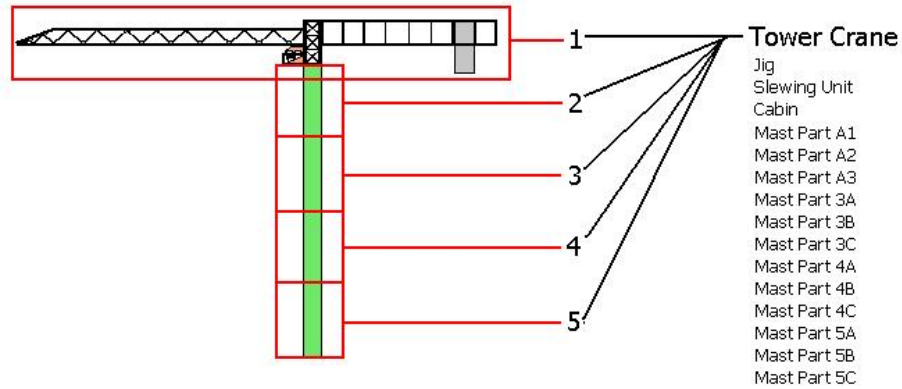
If you chose this option in the example of the crane, you will import files 1 to 5 and will have 5 resources named as the CAD file names (**1, 2, 3, 4, 5** in this example) under the Resource heading **Tower Crane** so that the crane is split into 5 resources, *one for each file*.



5.4.3. Assign to this Resource, build tree

The third option, **Assign to this Resource, build tree**, creates multiple resources with the same tree structure as exists in the corresponding 3D objects list when importing one 3D file. When importing multiple 3D files, the tree structures will be merged.

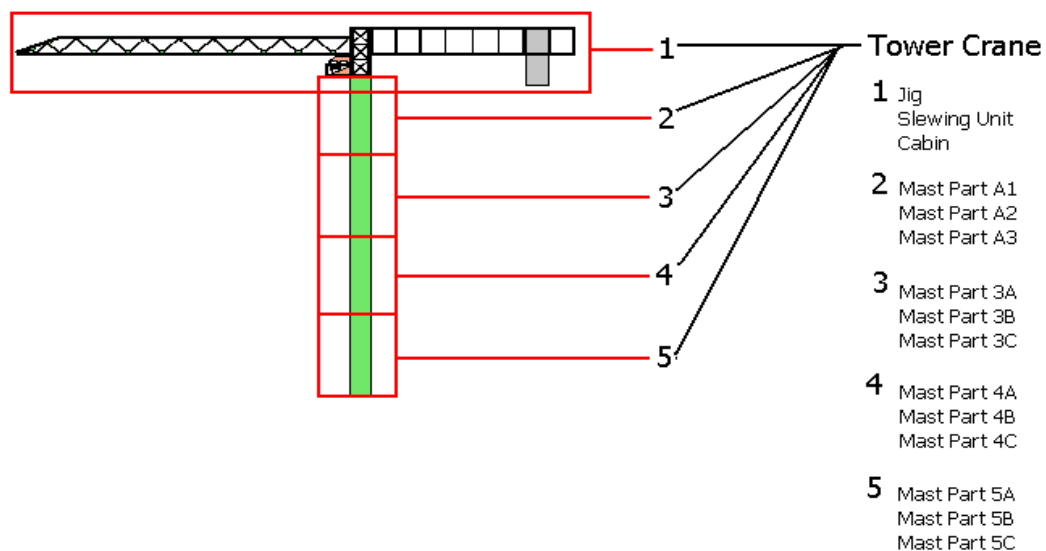
If you chose this option in the example of the crane, SYNCHRO will import files 1 to 5 and create *a resource for each of the individual items of the crane*, as a list under the heading **Tower Crane**.



5.4.4. Add Resources underneath, build tree

The fourth option, **Add Resources underneath, build tree**, creates multiple resources with the same tree structure as exists in the corresponding 3D objects list when importing one OR multiple 3D files.

If you chose this option in the example of the crane, you will import files 1 to 5 and will have *a resource for each of the individual items of the crane with the same tree structure as the CAD data* under the Resource heading **Tower Crane**.



5.4.5. Which Option to Choose

Which option you choose depends on whether you are importing one or multiple files and how you intend to use the models in SYNCHRO.

Generally speaking:

- Use the first or second “**don’t build tree**” option to group all the objects within a CAD file as one; for example, an equipment model with all its subparts (wheels, bolts, etc.) that does not need to be assembled in the animation, but will be assigned to tasks as a whole;
- Use the third or fourth “**build tree**” option if you want to assign model objects separately to different tasks.
- The bottom option “**Add Resources underneath, build tree**” gives you the largest object tree and the most options for filtering and assigning resources to tasks.

In the crane example, we would pick the first option **Assign to this Resource, don’t build a tree** if we just want to assign the whole crane to the tasks that utilize it. If, however, our schedule includes multiple tasks for the assembly of the crane part by part, we should choose the fourth option **Add Resources underneath, build tree**.

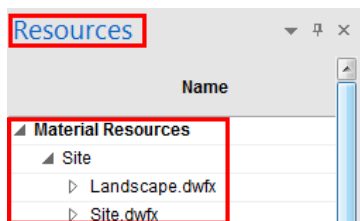
5.4.6. Resource Tree structure

For this training we will give each individual item a separate resource.

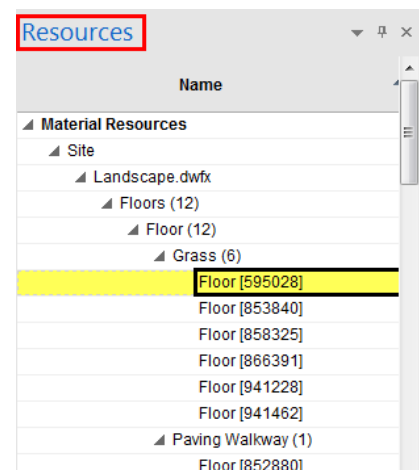
11. Select the bottom option **Add Resources underneath, build tree**.
12. Select **Finish**.

At this point SYNCHRO will read-in the 3D files, analysing their content and creating associated material resources.

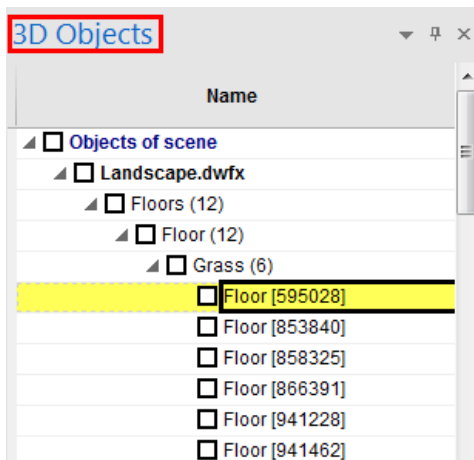
13. In the **Resources** tab, under **Material Resources** expand the **Site** tab to see that both files have been given a separate branch in the Resource tree.



14. Right click anywhere in the **Resources window** and select **Expand → All** to see the full Resource tree. You will notice that each object is its own resource (the bottom level of the tree)



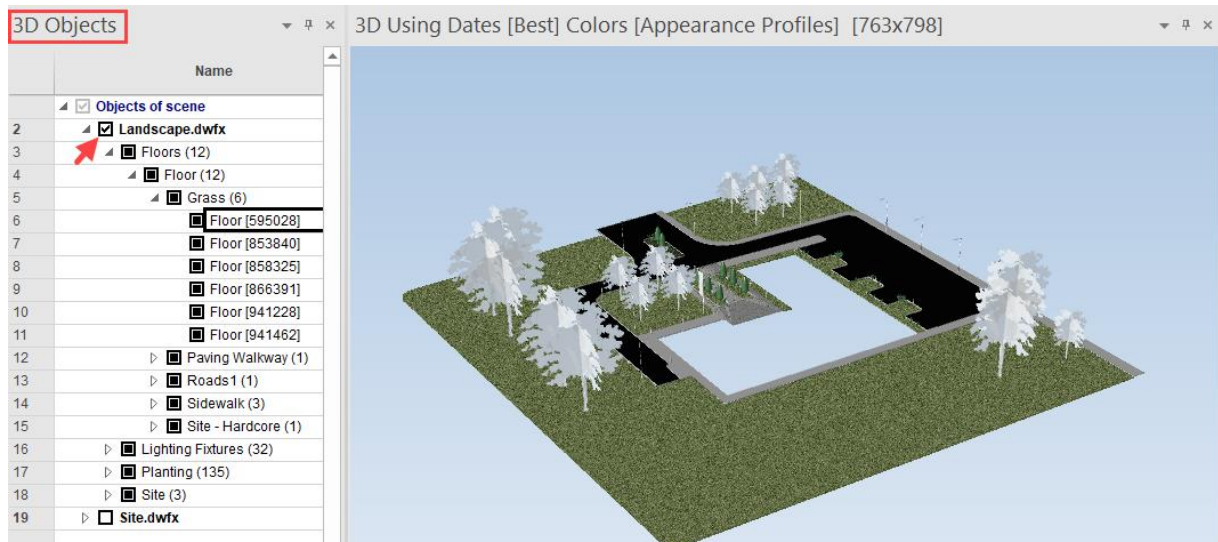
15. Open the **3D Objects** window.
16. Right click in the **3D Objects** window and choose **Expand → All**. Here you can see that the Resource tree is essentially a copy of the 3D objects tree. This is because we chose the **Add Resources underneath, build tree** Resource Creation option.



5.5. Load 3D Objects

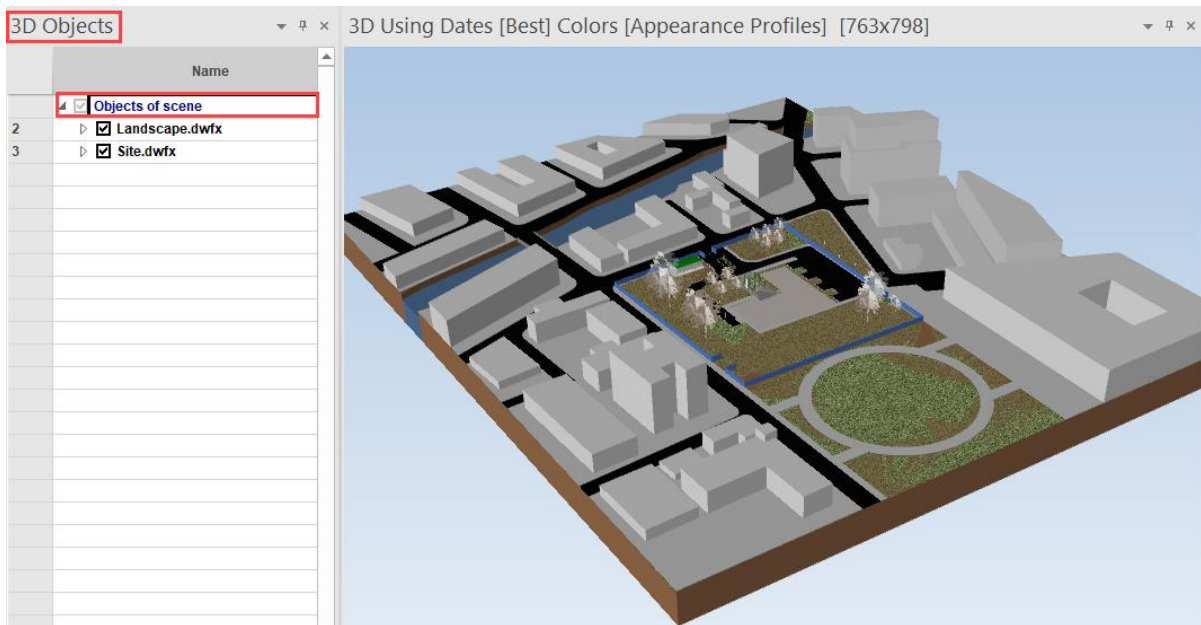
You will notice that although the **3D Objects** and **Resources** are populated, there is no 3D geometry in the **3D Window**. This is because we disabled **Load 3D Objects into memory** when importing the files. Objects that are not loaded into memory will not be displayed in the 3D window. Objects can be loaded into memory using the check boxes in the **3D Objects**.

17. In the **3D Objects**, enable the check box beside **Landscape.dwfx**. The Landscape geometry will show in the **3D Window**.



18. Enable the check box beside **Objects of scene** to load *all* 3D Objects into memory.

NOTE: The first click of the box may unload all objects if some objects are already loaded. A second click will then load all objects.



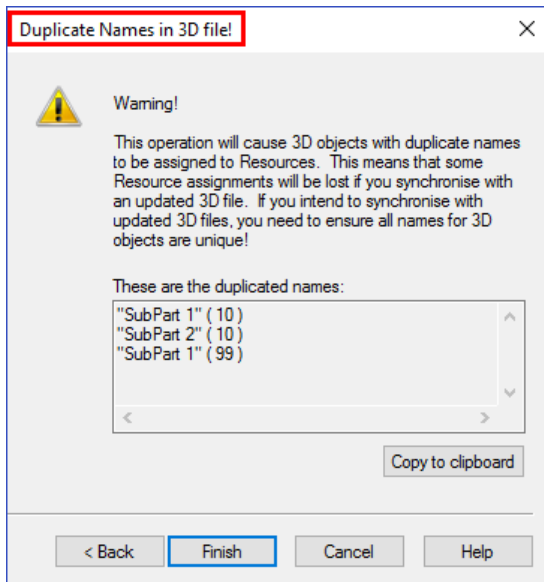
NOTE: Objects and/or files can be selectively unloaded from memory to help increase the performance of large files.

5.6. Duplicate Names Warning

This tutorial explains how to troubleshoot the Duplicate Names Warning that occasionally occurs when using the Resource Creation Wizard. If left unresolved, duplicate Resource names can lead to improper synchronisation.

19. Select **File** tab → **Import** → **3D**.
20. Browse to locate the training models. File location: *C:\Users\Public\Public Documents\Shared SYNCHRO Projects\Tutorial Files\SYNCHRO Pro Training\Models*. By holding down the **Ctrl** key you can select multiple files for import. Select the following files:
 - Architecture.dwfx
 - Structure.dwfx
21. Select **Open**.
22. Select **Next** to view the import settings. Settings will be saved from the last import.
23. Enable **Load 3D Objects into memory**.
24. Select **Import**.
25. When the import is finished the **Resource Wizard** will appear. Choose **Assign to a new Resource** and select **Next**.
26. Enter **Office Building** for the **Name** and make sure the **Type** is set to **Material**. By importing the Architecture and Structure models separately from the Site and Landscape models, we are able to create separate nodes for **Office Building** and **Site** in the Resources tree to aid with selection and filtering. Select **Next**.
27. For **Resource Creation**, again select the bottom option **Add Resources underneath, build tree** and
28. Select **Next**.

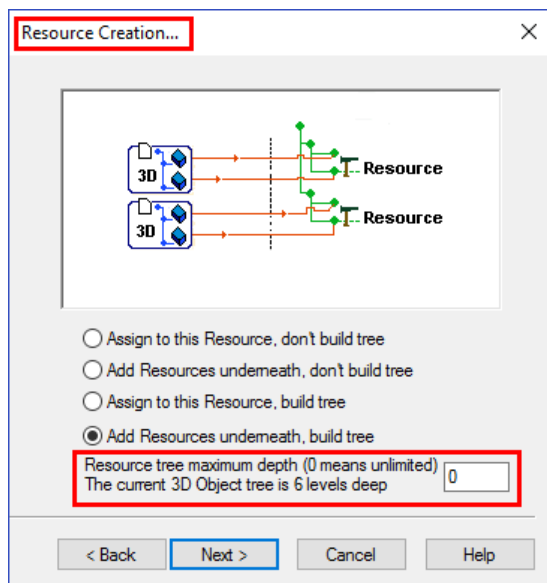
You will be presented with the following **Duplicate Names in 3D file** Warning!



This warning will sometimes appear when you import a file that had been exported from Revit. Within this Revit file, there are SubParts that appear at the bottom level of the 3D object tree, which is a result of copying and pasting in Revit. If you select **Finish**, 3D Objects with duplicate names will be assigned to Resources. If you ignore this warning and begin assigning Resources to Tasks, and later synchronise from an updated 3D file, some Resource assignments may be lost because SYNCHRO cannot distinguish which 3D object is assigned to which Resource as they have the same name.

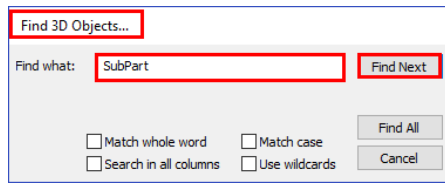
It is therefore important to ensure all names for 3D objects are unique! In the case of SubParts this can be done by limiting the 3D tree depth on import.

29. Select **Back**. Note that the 3D Object tree is 6 levels deep.



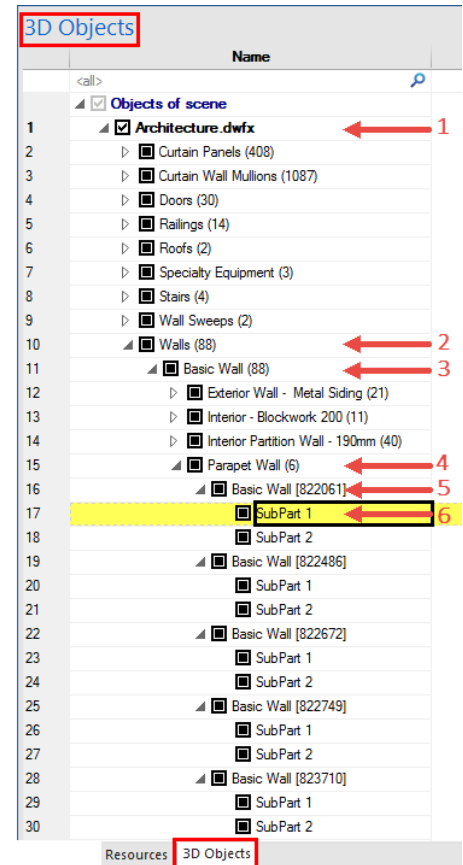
30. At this point, you could select **Cancel** to undo the 3D import and start again. For the purposes of training, select **Next** and then **Finish**.

31. In the **3D Objects**, right click and choose **Expand→ All**.
32. Right click again and choose **Find 3D Object**.
33. Type **SubPart** in the **Find 3D Objects** dialog and select **Find Next**

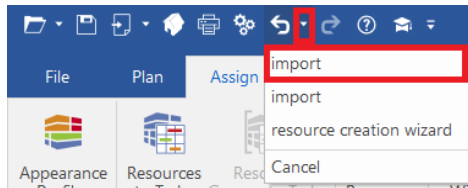


You can see that the SubParts are at the bottom or 6th level of the tree. The unique object name is at the 5th level of the tree.

34. From the Quick Access Menu at the top of the screen, use the drop-down arrow to the right of the **Undo** icon to view the list of recent commands. Select the first item in the undo stack (**import**) to undo the import of the Office Building 3D files.



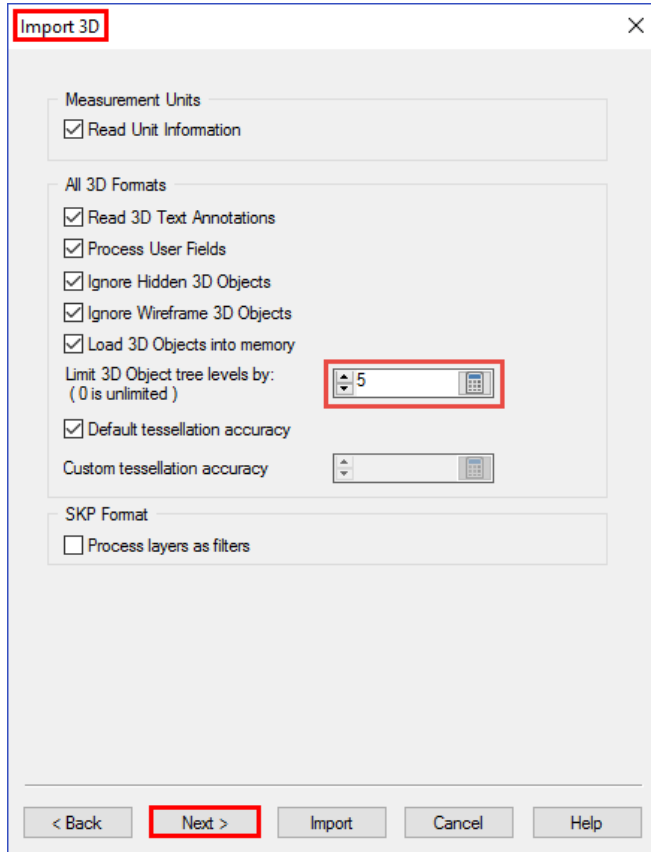
We will now re-import the Architecture and Structure models, but this time, limit the 3D Object tree to a depth of 5 to eliminate the SubPart duplicate names.



NOTE: SubParts are always at the bottom level of the tree, but this is not always the 6th level. When the duplicate name warning is encountered, use the Back button in the Resource Creation dialog to see the current 3D Object tree depth (step 29 above), then limit the tree to 1 level less than the current depth.

To re-import the models, repeat steps 19 through 21 above.

35. When you get to the import options (step 22), set the value for **Limit 3D Object tree levels by:** to 5.



36. Continue importing and creating Resources by repeating steps 23 through 28. You will not receive the Duplicate Names warning this time and will be able to successfully synchronise the file later.

3D View

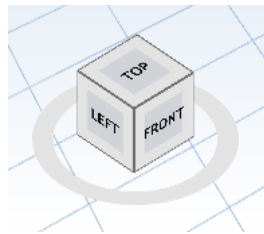
In this section, you will learn how to navigate and customize the 3D View window.

6.1. 3D Window Navigation

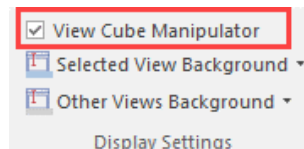
It is highly recommended to have a mouse with left click and right click buttons, as well as a scroll wheel (that has center click capabilities).

6.

- **Zoom All** - This will show all the objects from the front as the models have been created- it can be used if the view becomes disoriented.
 - Within the **3D window** click the right mouse button and select **Zoom All**.
 - Or select the **3D** tab → **Zoom** panel → **Zoom All**.
- **Rotate** - Hold down the left mouse button at a point in the 3D View that you want to rotate about, then move the mouse.
- **Zoom** - Scroll the middle mouse button forward to zoom in and back to zoom out.
- **Pan** - Hold down the middle mouse button and move the mouse left, right, up and down.
- **View Cube** - Left click on points or faces on the cube and the view will rotate to that viewpoint, or hold down the left mouse button on the circle to rotate.

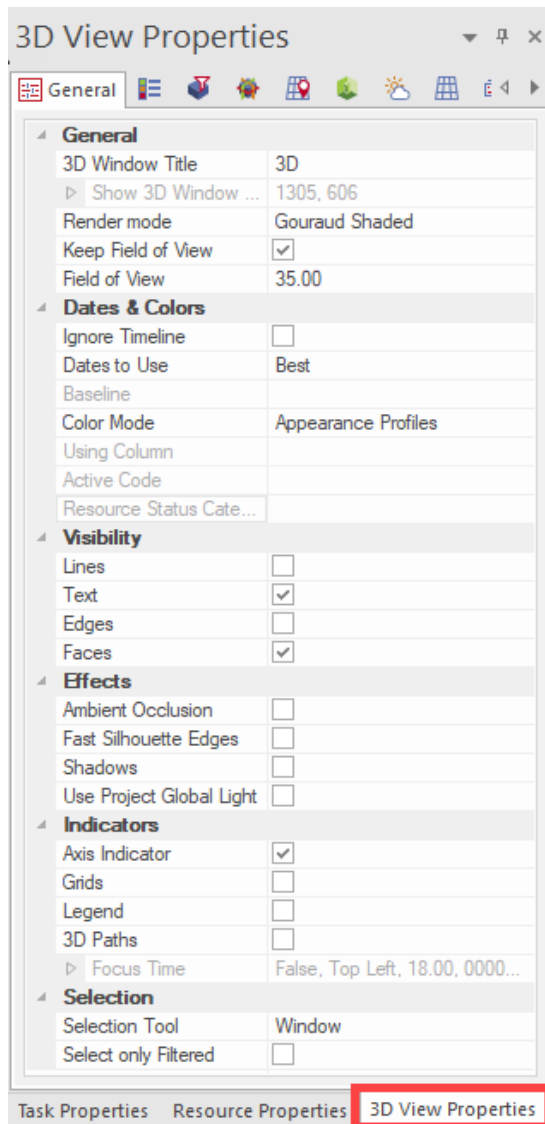


NOTE: To enable the View Cube (if not already enabled), in the **3D** tab → **Display Settings** panel. Check the box next to “**View Cube Manipulator**”

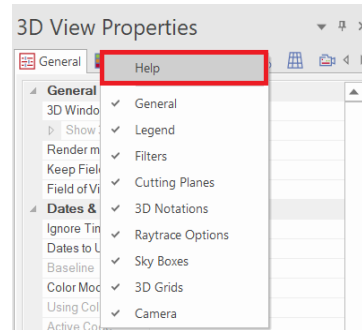


6.2. Preferences

This section will teach you which custom settings are available for the 3D Window.



- In the **3D** tab → **Display Settings** panel, **Selected View Background** or **Other Views Background** will change the colour of the background for the selected and other 3D views.
- The **3D View Properties** window contains many other settings which apply to the selected 3D Window. More information can be found on these settings by right clicking on the **3D View Properties** window title and choosing **Help** from the context menu



4D Linking Process – Assigning Resources to Tasks

This section will outline how to attach your scheduled tasks to the resources created from your 3D import, to create a 4D project.

The crux of 4D is creating links between 3D representations and schedule data. When the linking process is complete, the view of the model will be controlled by the schedule - the 3D view tells the story of the schedule. The process for assigning

7. Resources to Tasks follows a simple procedure, which will be explained further in the following sections:

1. Left click on the Task to select/highlight.
2. Choose the **Appearance Profile** (which dictates how the Resource is to behave before, during, and after the Task).
3. Select the Resource.
4. Assign the Resource to the Task.

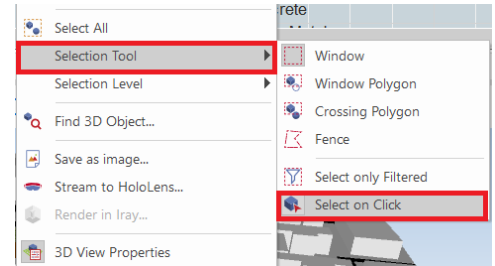
7.1. Resource Selection


This section explains the various methods to select a single (or multiple) resource.

When you select a 3D Resource, it will be highlighted **purple** in the 3D window (or selection colour as defined in **Options** → 3D View → Colours → Selection Highlighting).

- **Left Click** - Single left click an object in the 3D window to select. Any object that you click twice will be deselected.

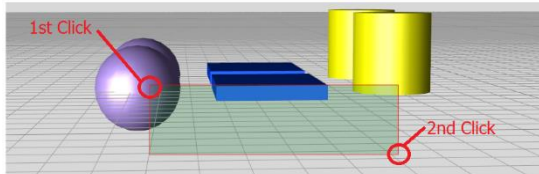
NOTE: If a single left click does not select an object, press Esc in the 3D window to unselect all objects, then right click in the 3D window and enable **Selection Tool** → **Select on Click**.



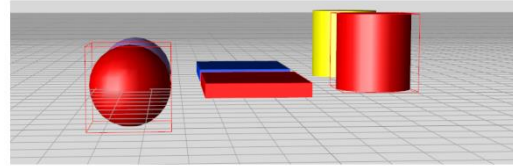
- **Shift Select** - When **Select on Click** is disabled, holding down the **Shift** button on the keyboard and single left clicking with the mouse will select objects in the 3D View. You can continue to select objects while holding Shift. Objects that you select twice will not be deselected.
- **Ctrl Select** - When **Select on Click** is disabled, holding down **Ctrl** on the keyboard will work like using the **Shift** selection, except that any selected object that is clicked will be deselected.
- **Navigator / Window** tabs - You can highlight the name of the 3D Object or Resource in the **3D Objects** window, **Resources** window, or **3D Filters** window.
- **Window Box** - By default,  **Window Box** will be selected in 3D → Selection Tool.

Hold down both the **Shift** button and the left mouse button then move the mouse so you can select by a window box. Selection depends upon the direction you draw the box:

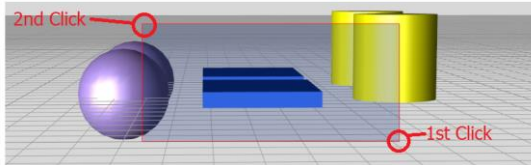
- a. **Top Left to Bottom Right**- All objects within the window box and all that it touches that are visible.
Selection:



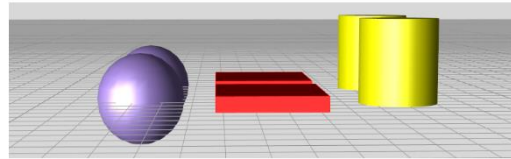
Result:



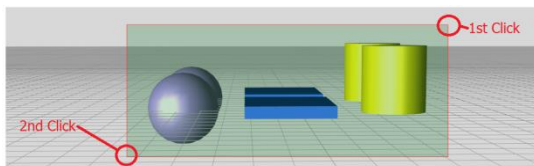
- b. **Bottom Right to Top Left**- All objects completely within the box that are visible.
Selection:



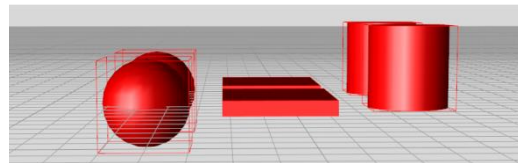
Result:



- c. **Top Right to Bottom Left**- All objects within the window box and all that it touches that are visible and non-visible.
Selection:




























Result:



NOTE-You can also hold **Ctrl** on your keyboard instead of Shift to select and deselect objects using the window selection methods shown above

- **Cancelling Selection** - If you left click anywhere within the 3D Window then press **Esc** on your keyboard, the selection will be cancelled.

NOTE: There are two different context (right-click) menus in the 3D window depending on whether any 3D objects are selected:

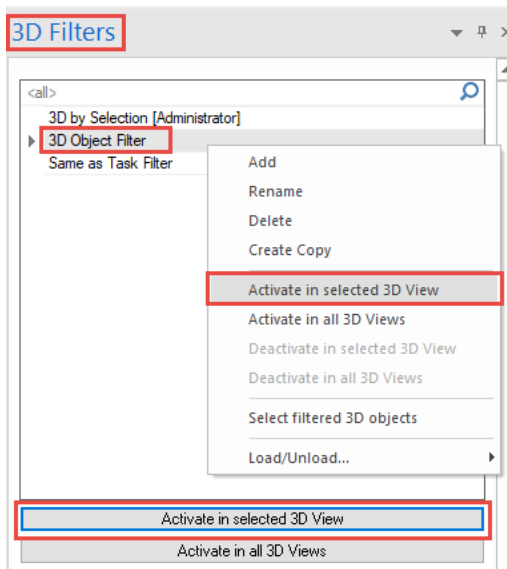
When one or more objects are selected, the context menu contains commands related to working with the selected objects	When no objects are selected, the context menu contains commands related to the 3D View properties, navigation, and creating new items
 Resources Wizard... Ctrl+Shift+R <hr/> Select Assigned Task(s) <hr/> Zoom ▶ Filters ▶ <hr/> Create ▶ Create Workspace... ▶ <hr/> Edit ▶ Edit as Assigned ▶ <hr/> Cutting Planes ▶ <hr/>  Measure Distance <hr/>  Select All  Deselect All  Invert Selection Selection Level ▶ <hr/>  Copy  Paste <hr/>  Assign to Selected Task(s) Ctrl+Shift+A Unassign from All Tasks Ctrl+U Create Task(s) ▶ Resource Groups ▶ <hr/>  Convert 3D Text to User Fields...  Convert Polyline to 3D Path <hr/>  Find 3D Object... <hr/>  Physical Material Editor... <hr/>  3D Properties	Camera ▶  Zoom All Ctrl+Shift+J Viewpoint ▶ Filters ▶ <hr/> Create ▶ Create Workspace... ▶ <hr/> Render Mode ▶ Visibility ▶ Effects ▶ Visual Indicators ▶ <hr/>  Change Window Caption... <hr/> Cutting Planes ▶  Enable Markup Mode  Enable Snapping <hr/> Dates to Use ▶ Color Mode ▶ <hr/>  Isometric  Measure Distance <hr/>  Select All Selection Tool ▶ Selection Level ▶ <hr/>  Find 3D Object... <hr/>  Save as image...  Stream to HoloLens...  Render in Iray... <hr/>  3D View Properties

7.2. 3D Filters

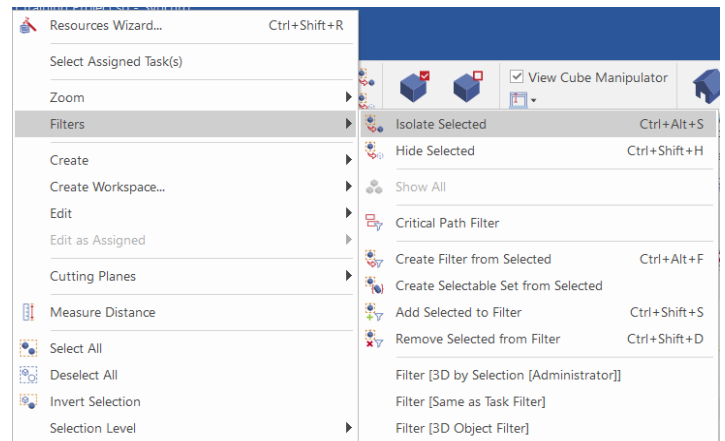
3D Filters can help with the 3D Resource selection process by limiting the objects visible in the 3D window. The most commonly used filter (the built-in **3D Object Filter**) is explained here. Users can also create their own custom filters, which will be demonstrated later in the training. For more information, please see Section 12.1 User Fields.

In the **Navigator** ribbon → **4D Visualization** panel open the **3D Filters** window. There are 3 built-in filters. Right click on **3D Object Filter** and select **Activate in selected 3D View** or select the **Activate in selected 3D View** button.

1.
2.



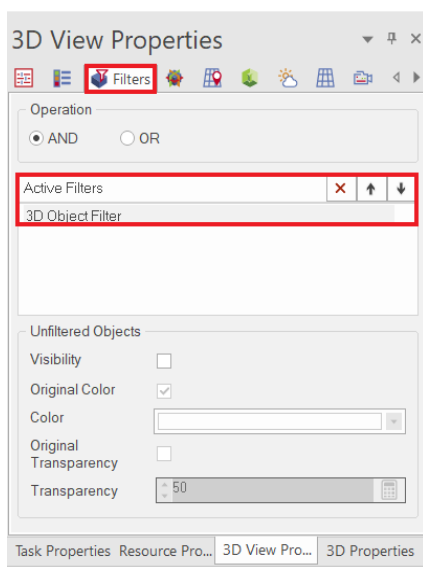
NOTE: The **3D by Selection** filter is automatically enabled when using the **3D → Filters → Isolate Selected** or **Hide Selected** commands.



The **Same as Task Filter** shows in the 3D view only the objects assigned to Tasks included in the current **Task Filter**.

3.

The **3D Object Filter** will be added to the **3D View Properties → Filters: Active Filters** list.

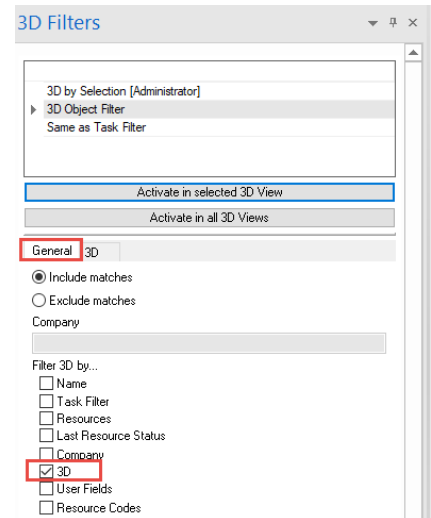


NOTE: The Active Filters panel allows the user to apply multiple filters to each 3D window combined with AND or OR operation. Each filter may have a different color scheme. The order of the filters in the Active Filters list controls which color scheme(s) take precedence.

With **3D Object Filter** selected in the **Navigator→3D Filters** list, select the **General** tab and ensure that the box is activated next to **3D**.

This filters the 3D View by the **3D Objects** list. Initially everything will disappear in the 3D view since nothing is selected in the 3D tab.

4.



In the **3D Filters → 3D** tab, right click within the 3D list and select **Collapse → All**. Then click on the icon left of the **Objects of scene** node to expand it.

5.

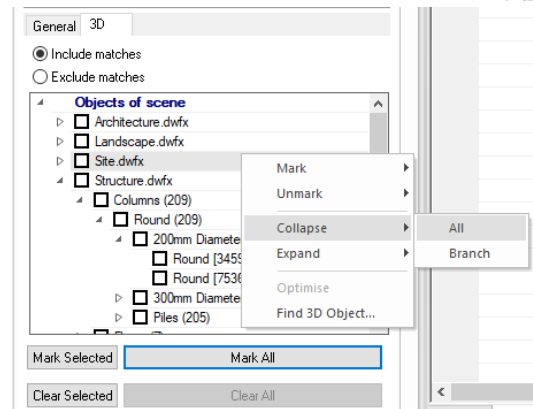
If you expand each file, you will see that you then have the layer the items are on.

Click to expand a layer and you will see the individual items which you can hide or unhide as you so wish.

Enabling (checking) the box next to the **File Name, Layer, or Object Name** will show the objects associated with each in the 3D View (Disabling/un-checking will hide these objects the 3D View):

6.

Select **Mark All** to enable all objects or **Clear All** to disable.



NOTE: You can begin with all objects disabled and begin checking files, layers, or objects to add to the visible scene, or you may prefer to begin with all objects enabled and uncheck files, layers or objects to hide them from the scene.

Use the **Exclude Matches** rather than **Include Matches** options to hide all objects checked in the filter – this inverts the visible and hidden objects.

Filter via 3D Filters vs Load / Unload in 3D Objects window: The **3D Filters** control the visibility of an object only. Un-checking an object in **3D Filters → 3D** tab, hides it in any 3D windows where that filter is active; un-checking an object in the **3D Objects** tab unloads it from memory (RAM) and also hides it from all 3D windows. Unloading from memory will help improve performance on large files. When an object is unloaded in the 3D Objects tab, it will not be visible in the 3D view, regardless of whether it is included in a 3D Filters filter or not – it must be enabled (checked) in both the 3D Filters and 3D Objects tab to be visible. For visualisation purposes and ease of sorting/assigning, it is recommended to use the 3D Filters rather than 3D Objects list. The benefits to using the 3D Filters include: can save multiple filters, can create colour schemes to affect filtered/non-filtered objects, can show the intersection (AND) or union (OR) of multiple filters, can filter by other attributes than just the 3D Objects list (eg. text or parameters), and can easily switch between multiple saved filters. For more information on 3D Filters, please see the Help Section in SYNCHRO.


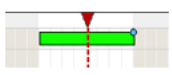

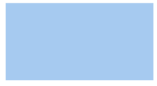
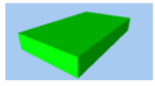
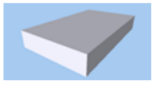
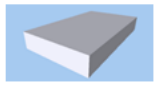
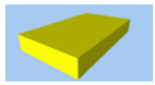
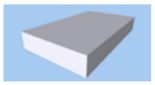



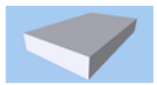
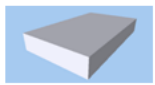
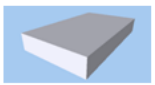
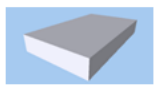
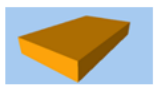
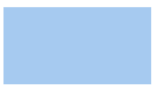
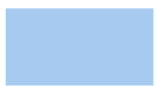
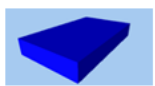
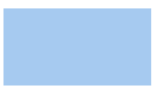
TIP: You can unload selected **3D Objects** from the **3D View** via Right Click→**Edit→Unload Selected Objects**.

7.3. Appearance Profiles

The **Appearance Profile** selected when assigning a Resource to a task dictates how the Resource is to behave before, during, and after the Task. The **Appearance Profile** controls:

- when the Resource is visible (before, during, and/or after) according to one of 5 Actions (Install, Maintain, Neutral, Remove, and Temporary).
- the colour of the Resource in the 3D view before during and after the Task.
- any growth simulation or transparency interpolation during the Task.

In the **Navigator** tab → **4D Visualization** panel → **Appearance Profiles**. In the **Appearance Profiles** tab, under **System Profiles** you will see 5 predefined options which will be used when assigning to tasks. The functions of these are shown in the table below.

	BEFORE	DURING	AFTER
			
INSTALL			
MAINTAIN			
NEUTRAL			
			
REMOVE			
TEMPORARY			

These are the predefined **Appearance Profiles** you can use.

Later in this tutorial you will create your own Profiles where you can:

- Set the Action.
- Change the Colours.
- Add Transparency.
- Set Different Start & Finish Transparencies.
- Show Growth Simulation.

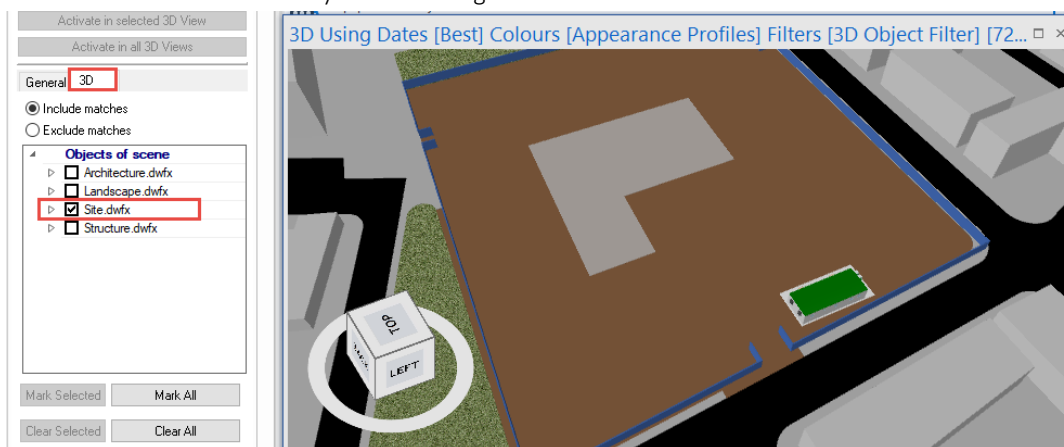
7.4. Basic Linking Process

This section will guide you through the steps to link a 3D Resource to a Task using the Training Project model.

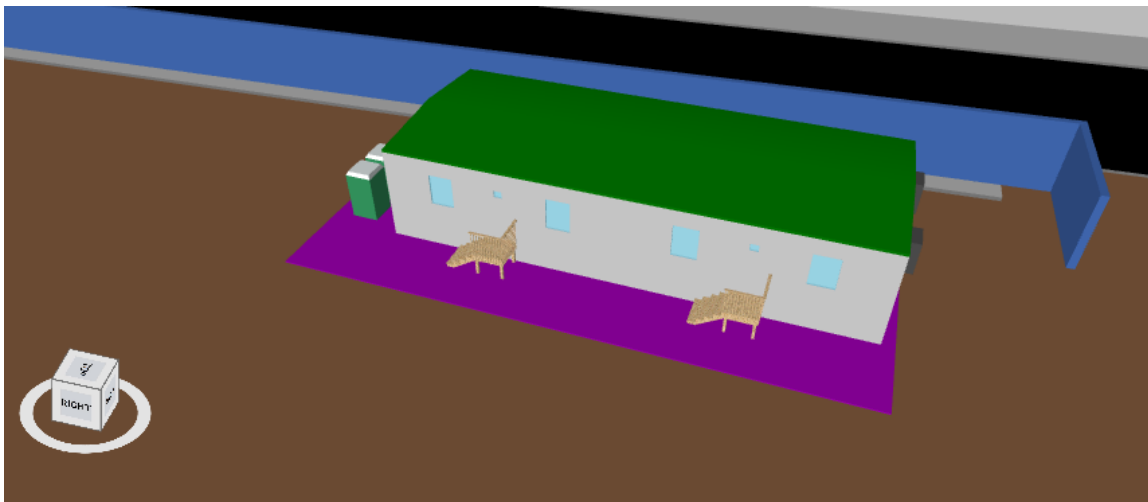
1. Single left click to select the task **Temporary Hard Standing** in the Task List. It will be highlighted yellow.

ID	Name	Duration	Start	Finish
1	Office Building, Core & Shell	323d	9:00 AM 1/4/16	5:00 PM 3/29/17
2	Pre Construction	20d	9:00 AM 1/4/16	5:00 PM 1/29/16
3	ST00020 Notice to Proceed	0 Days	9:00 AM 1/4/16 (*)	
4	ST00030 Building Permit	20d	9:00 AM 1/4/16	5:00 PM 1/29/16
5	ST00040 Award Subcontractors	10d	9:00 AM 1/4/16	5:00 PM 1/15/16
6	ST00050 Perimeter Fence	3d	9:00 AM 1/25/16 (*)	5:00 PM 1/27/16
7	ST00060 Temporary Hard Standing	1d	9:00 AM 1/27/16	5:00 PM 1/27/16
8	ST00070 Field Office	2d	9:00 AM 1/28/16	5:00 PM 1/29/16
9	Material Procurement	70d	9:00 AM 1/18/16	5:00 PM 4/22/16

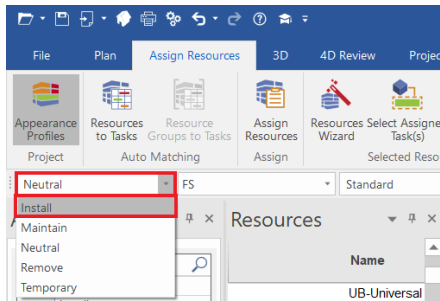
2. In **Navigator** → **3D Filters** activate the **3D Object Filter**; this will limit the displayed objects in the 3D view.
3. In the **3D Filters** → **3D** tab, check the box to show only **Site.dwfx**.
4. Rotate in the 3D view so that you are looking down on the site:



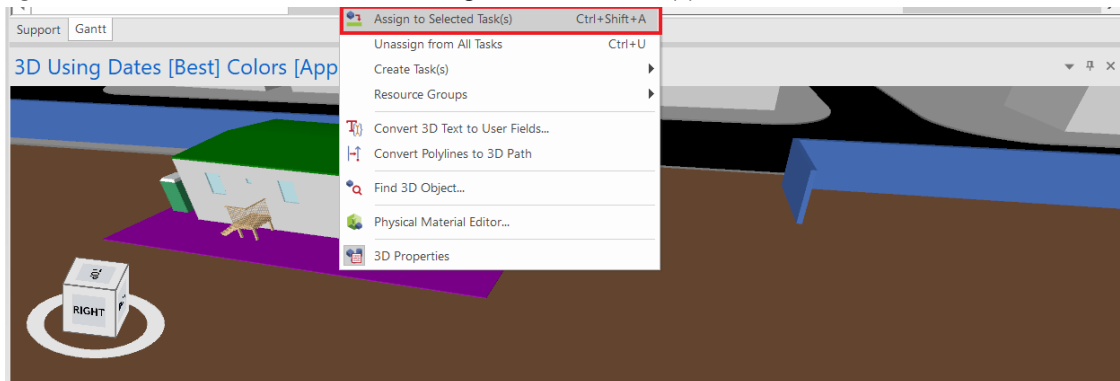
5. Left click to select the hard standing beneath the site trailers (you may need to zoom in using the mouse scroll wheel).



- From the **Fast Options** toolbar located beneath the ribbon, ensure that **Install** is selected for the **Appearance Profiles**.



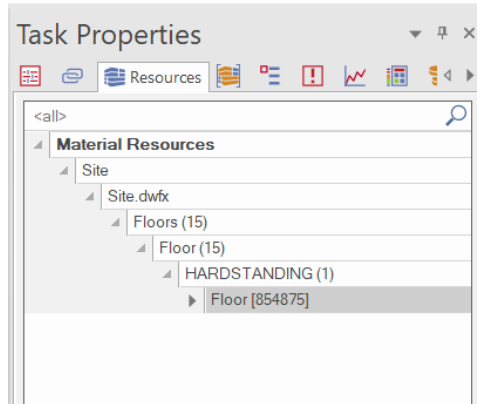
- Right click in the 3D window and select **Assign to Selected Task(s)** from the context menu



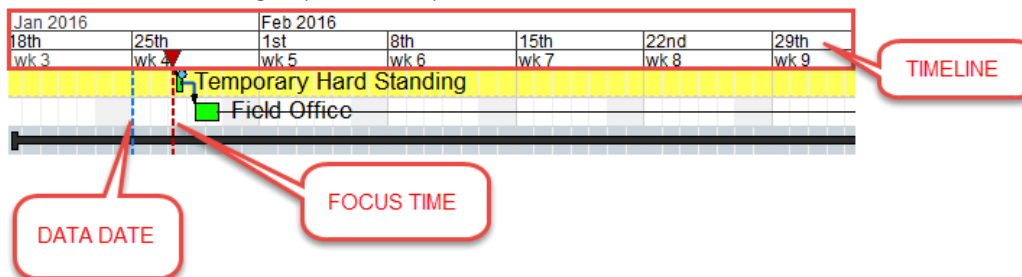
- You will notice that the **3D Resources** column in the Task List turns blue for that task, indicating that a 3D Resource has been assigned. The column also indicates the number of 3D Resources assigned. For this task it should read "1"

	ID	Name	Duration	Start	Finish	3D Resources
7	ST00060	Temporary Hard Standing	1d	9:00 AM 1/27/16	5:00 PM 1/27/16	1
8	ST00070	Field Office	2d	9:00 AM 1/28/16	5:00 PM 1/29/16	
9		Material Procurement	70d	9:00 AM 1/18/16	5:00 PM 4/22/16	

In the **Task Properties** → **Resources** tab, you will see the 3D model resource that you have assigned to that task.



The hard standing model object may have disappeared from the 3D view. Once an object is assigned to a task, its visibility is controlled by the red Focus Time bar in the Gantt Chart. In the Gantt Chart, The **Focus Time** is indicated by the red dashed line with a triangle symbol on top.

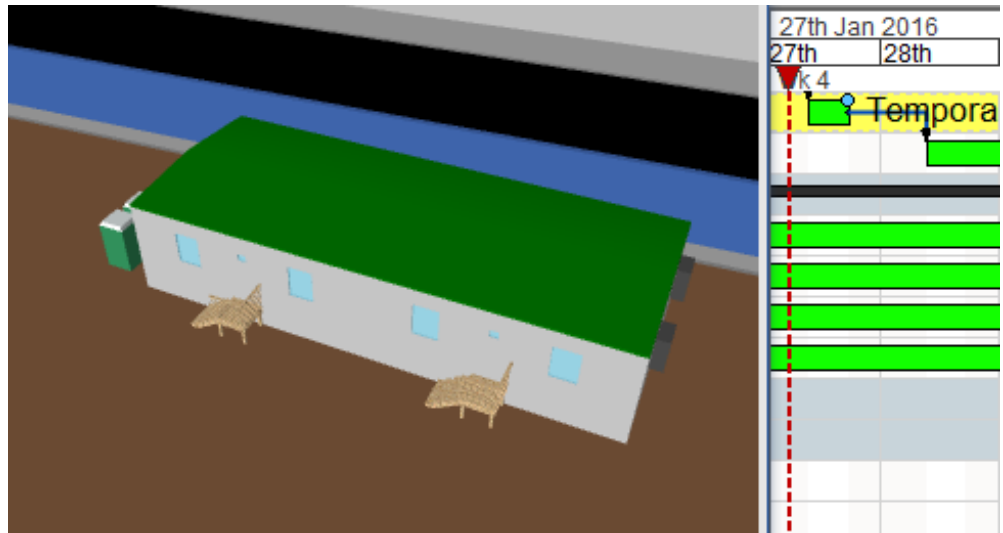


NOTE: The **Data Date** is indicated by a vertical blue dashed line. This defines the project scheduling date for progress reporting and can be confirmed and edited in **Navigator** → **Project** → **Scheduling** tab.

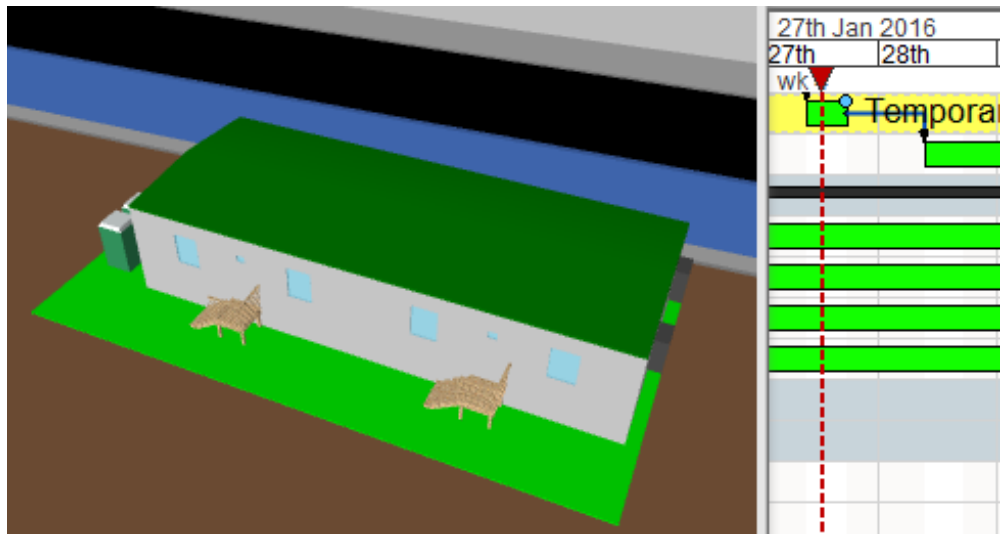
9. Left click and hold in the **Timeline** where the red triangle is and move the **Focus Time** bar left and right. This will move the Focus Time to any point in time in the schedule.

TIP: You can also single left click anywhere in the **Timeline** and the **Focus Time** will jump to that point.

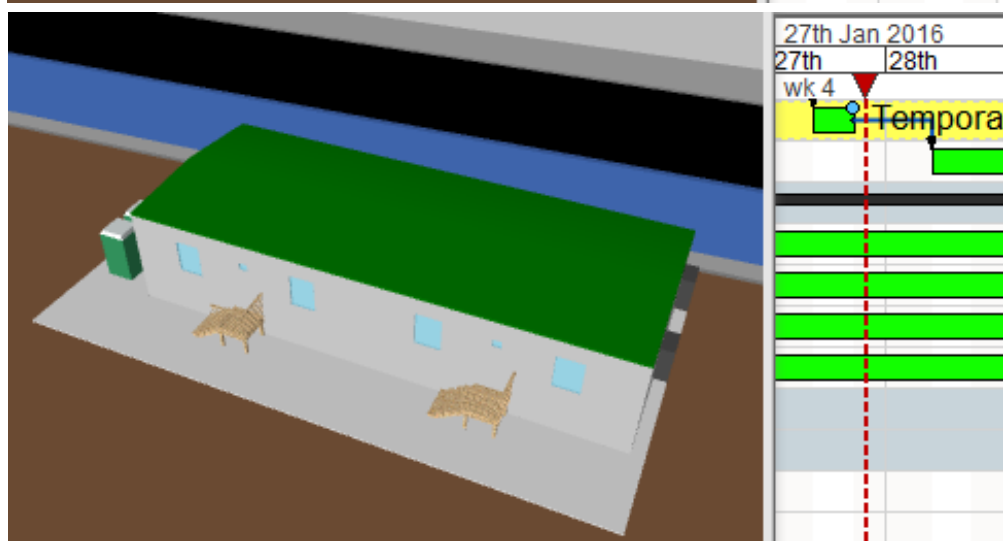
10. Move the **Focus Time** before the start of the **Install Temporary Hard Standing** task. When the **Focus Time** is before the start of the Task, the hard standing object is not visible in the 3D window because it has not yet been installed.



11. Move the **Focus Time** during the **Install Temporary Hard Standing** task. The hard standing object is visible and highlighted green according to the **Appearance Profile** to indicate that it is currently being installed.



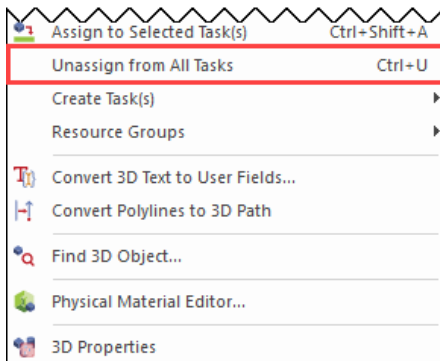
12. Move the **Focus Time** after the **Install Temporary Hard Standing** task. The hard standing object is visible and shown in its original colour because it has already been installed.



7.5. Correcting Resource Assignment Mistakes

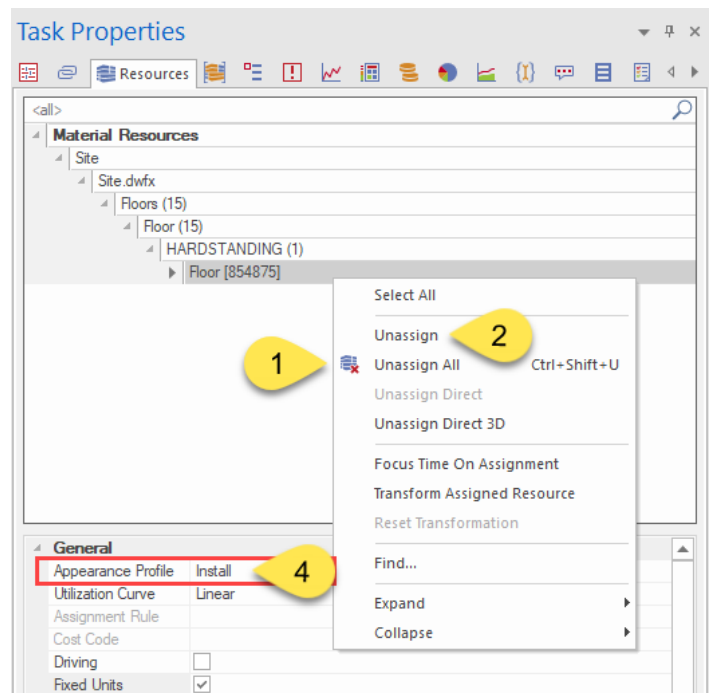
If you realize that you have assigned a Resource to the wrong task by mistake, you can make this correction by using one of the following options:

1. In **Task Properties → Resources**, right click on the resources and select **Unassign All** to remove all the resources.
2. If you want to remove just one resource, right click on each item's lowest level (shown as **Floor [854875]**) and select **Unassign**
3. Alternatively, you can select the object in the 3D View, right click and **Unassign from All Tasks**, or use the **Ctrl+U** keyboard shortcut



4. If you have assigned an object using the wrong Profile you can change it by selecting the lowest tree level of the resource in **Task Properties → Resources** and select the correct **Appearance Profile** from the dropdown box below.

NOTE: After selecting and editing an object in the **Task Properties → Resources**, make sure you click in the open space in this window or the 3D window and press **Esc** on your keyboard to deselect it and avoid accidentally assigning it to another task later



7.6. Linking Options

There are 5 different ways to link the 3D models to the schedule that can be utilised at the user's discretion. They are listed and explained below.

1. Assigned from 3D Window via right click

- i. Select the desired task(s).
- ii. Select item(s) within the 3D window so they are highlighted.
- iii. Right click in the 3D window and select **Assign to Selected Task(s)**.

2. Assigned from 3D Window via drag and drop

- i. Select item(s) within the 3D window so they are highlighted.
- ii. Hold down the **Alt** key on your keyboard and the left mouse button then drag the cursor over the desired task, letting go to assign it.

NOTE: With this method, you do not need to pre-select the desired task so that it is highlighted.

3. Assigned using 'Ctrl + Shift + A' quick key

- I. Select the desired task(s).
- II. Select item(s) so they are highlighted.
- III. Click in the 3D window, then simultaneously hold down the **Ctrl**, **Shift** and **A** keys on the keyboard.

4. Assigned from Resources or 3D Objects window via right click

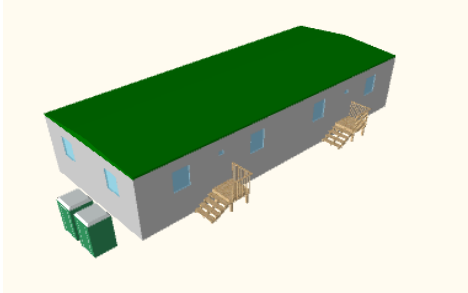
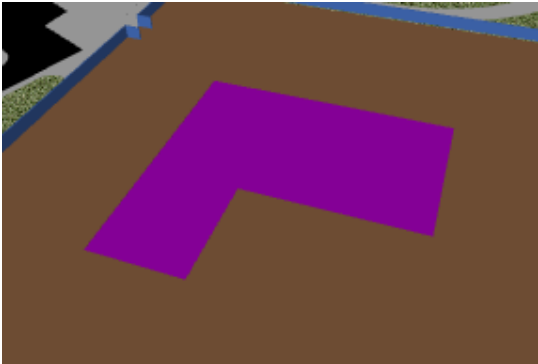
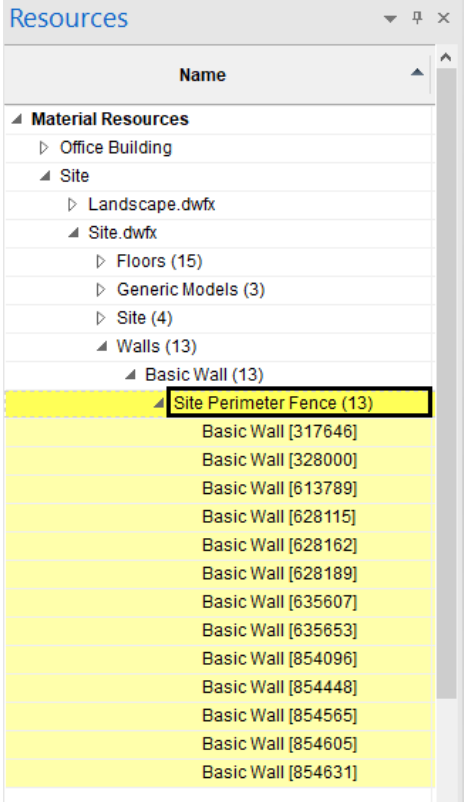
- i. Select the desired task(s).
- ii. Select the **Resources** or **3D Objects** window.
- iii. Select item(s) so they are highlighted.
- iv. Right click on the 3D Object/Resource name and select **Assign to Selected Task(s)**.

5. Assigned from Resources Window via drag and drop

- i. Select the **Resources** tab.
- ii. Select an individual item within the Resources list or an entire level of the Resource tree (eg. file or level) so they are highlighted.
- iii. Hold down the left mouse button and drag and drop over the required task.

NOTE: With this method, you do not need to pre-select the desired task so that it is highlighted.

Using any of the above methods, practice assigning Resources to Tasks for the following items:

Resource(s)	Task	Appearance Profile	
<p>Double Wide Construction Trailer & Portable Restrooms.</p> <p>TIP: Select these items visually in the 3D Window</p>	Field Office	Install	
<p>Excavation1 [680854]</p> <p>TIP: You can search for Resources by name by right clicking in the Resources window and selecting Find...</p>	Foundation Excavation	Remove	
<p>All 13 “Basic Wall” Resources that make up the node “Site Perimeter Fence”.</p> <p>TIP: From the Resources window, you can select the parent node “Site Perimeter Fence” and drag and drop onto the task – this will assign all the Basic Wall Resources that make up the node.</p>	Perimeter Fence	Install	

Review and Investigate Assignments

In this section you will learn how to review resource assignments. After assigning resources to tasks, you can play the construction sequence in the 3D View, like a movie, to review.

8.1. Saving and Opening Projects





8.
 1. Select **File** tab → **Save**.
You will also see the option to **Save As**.
 2. Select **File** tab → **Exit**.
 3. Start **SYNCHRO**.
 4. Select **File** tab → **Open** → **Private Project** then locate and select *Training Building.sp* to **Open**. File Location:
C:\Users\Public\Documents\Shared SYNCHRO Projects\Tutorial Files\SYNCHRO Pro Training\ .sp Files

8.2. Review

1. In 3D View right click and select **Zoom** → **Zoom All**.
2. Rotate in the 3D window so you can see the whole site.
3. Drag the **Focus Time** back to the start of the project and drag along to the right at your own discretion though time.

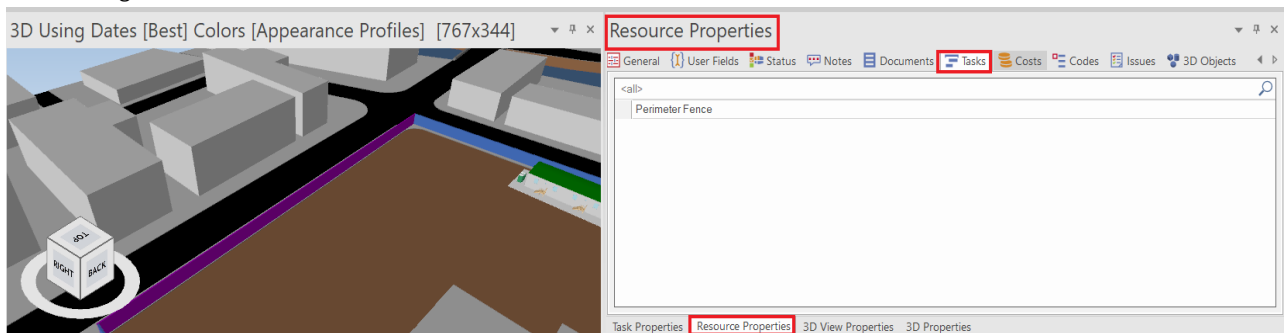
8.3. 4D Review

The 4D Review tab contains all the commands needed to control the Focus Time.

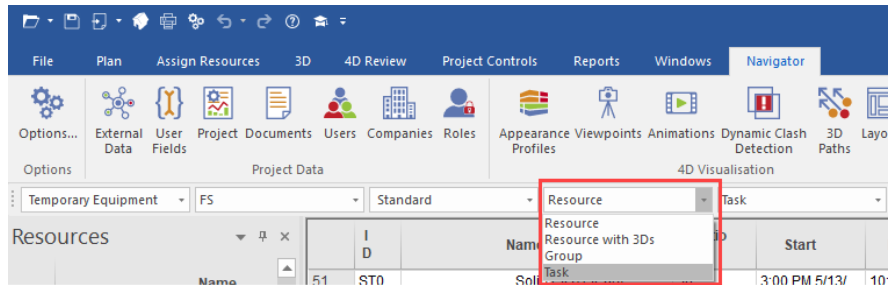
1. From the **4D Review** ribbon → **Player** panel, select  to **Move to Start**.
2. From the **4D Review** ribbon → **Player** panel, select  to **Play**.
3. The speed can be adjusted by selecting from the **4D Review** ribbon → **Speed** panel, then chose an option from the drop-down menu, for example  1 Week. Note that in this instance, the red Focus Timeline will move ahead in intervals of one week.
4. From the **4D Review** ribbon → **Player** panel, select  to **Stop**.

8.4. Select Assigned Tasks from an Object

1. Select one of the Perimeter Fence items from the 3D Window.
2. Right click in the 3D window and choose **Select Assigned Task(s)**.
This command will automatically find and highlight the task(s) that the object has been assigned to. If the Resource is assigned to multiple tasks, the Task list will automatically jump to the first task. You would need to scroll through the task list to see the other highlighted tasks, or use **Plan** ribbon → **Find/Select** panel → **Down to next selected** command
3. You can also see a list of all tasks that a selected Resource is assigned in **Resource Properties** window → **Tasks** tab. Left clicking on a task in this list will select it in the Gantt Window.



- Another way to quickly see which Tasks a Resource has been assigned to is to change the 3D selection mode in the Fast Options toolbar from **Resource** to **Task**

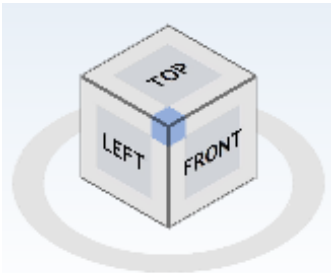


- As you select Resources in the 3D View, the Task(s) that the Resources are assigned to will be automatically selected in the Gantt Chart as well. Selecting additional Resources adds to the Task selection.
- Change the Task Selection Mode back to **Resource**
- Left click in the 3D Window then press **Esc** to cancel all selections.

8.5. Select Assigned Resources from a Task

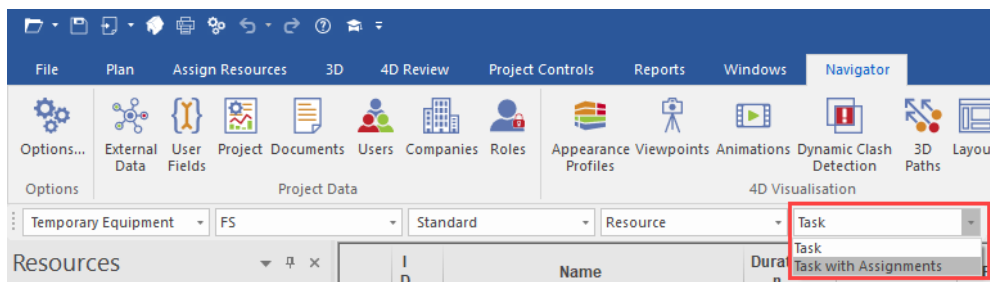
This section explains how to investigate which resources are assigned to a particular task.

- Select the task **Field Office**.
- Move the **Focus Time** after the end of the **Field Office** task.
- Right click on the task and choose **Select Assigned Resources**.
This command selects and highlights all the object(s) assigned to the selected task.
- If you cannot find the objects in the 3D window, left click one of the top corners of the **View Cube** to zoom to the selected objects, or right click in the 3D window and select **Zoom → Selected Objects**



You can also see all the Resources assigned to a task in the **Task Properties → Resources** tab.

- Another way to quickly see which Resources are assigned to a task is to change the Task Selection Mode in the Fast Options toolbar from **Task** to **Task with Assignments**.



- As you select a task or tasks, all the Resources assigned to those task(s) will be automatically selected as well. Selecting a new task updates the Resource selection.
- Change the Task Selection Mode back to **Task**

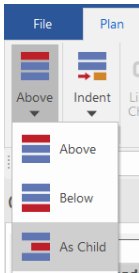
Creating New Tasks

This section will teach you how to create new tasks in the Project schedule.

9.1. Inserting New Tasks Manually

9. Suppose that it has been decided to schedule the structural pile installation as three separate tasks. The current schedule has only one task for all the structural piles – **Structural Piles (20d)**. We can divide the current task into 3 new subtasks.

1. Select the task **Structural Piles** in the Task List so that it is highlighted.
2. From the **Plan** ribbon → **Create** panel, select **As Child** in the drop down menu.



This will create a new task as a child task, or sub-task, of the selected task which has now been turned into a parent, or summary task. The new task will initially be given the duration of the parent task (20d in this case).


	ID	Name	Duration	Start	Finish
14		Construction	257d	9:00 AM 2/1/16	5:00 PM 1/24/17
15		Site Construction	247d	9:00 AM 2/1/16	5:00 PM 1/10/17
16	ST00120	Foundation Excavation	5d	9:00 AM 2/1/16	5:00 PM 2/5/16
17	ST00130	Structural Piles	20d	9:00 AM 2/8/16	5:00 PM 3/4/16
18	ST00970	New Task	20d	9:00 AM 2/8/16	5:00 PM 3/4/16
19	ST00140	Site Utilities	40d	9:00 AM 2/1/16	5:00 PM 3/25/16

3. With the New Task selected, select **Plan** → **Create** → **Below**, to insert a second new task below the first. Repeat this step once so that there is a total of three new tasks. Tasks inserted **Below** will automatically be given a duration of 1 day.

	ID	Name	Duration	Start	Finish
17	ST00130	Structural Piles	20d	9:00 AM 2/8/16	5:00 PM 3/4/16
18	ST00970	New Task	20d	9:00 AM 2/8/16	5:00 PM 3/4/16
19	ST00980	New Task	1d	9:00 AM 2/8/16	5:00 PM 2/8/16
20	ST00990	New Task	1d	9:00 AM 2/8/16	5:00 PM 2/8/16

NOTE: The **Plan** ribbon → **Create** commands are also available by right clicking on a task and choosing from the **Insert New Task** → commands.



4. Rename the first new task to **Piles 1** by double clicking on the name cell or right clicking and selecting **Rename Task**.
5. With the **Piles 1** task selected, you will see this symbol  within the bottom right of the **Name** cell. Move the cursor over this symbol until it becomes a crosshair. Select this with a left mouse click, hold and drag over the cells below until the tasks are named **Piles 1**, **Piles 2**, and **Piles 3**.

9.2. Editing Durations

Task durations for planned (not yet started) tasks can be edited by typing directly in the **Duration** cell in the Task List.

- Left click in the **Duration** cell of the **Piles 1** task, type **8** and press **Enter**. If no unit is entered, the duration unit defaults to days (d).

NOTE: Duration default units can be changed in **Navigator → Options → General → Duration Display Format**, for example if you typically schedule in hours. If you wish to enter a duration with a different unit use d for days, h for hours, or m for minutes.

- Tasks that are adjacent to each other in the Task List can quickly be given identical Durations using the same click and drag method as in step 5 above. Click on the crosshair at the bottom right of the **Duration** cell for the **Piles 1** task and drag down to change the Duration of the **Piles 2** task to **8d** as well.
- Change the Duration of the **Piles 3** task to **4d**.

You will notice that the Duration of the Structural Piles task now reads 8d. This is because it is a summary task – summary tasks take their duration from the overall duration of all their subtasks. The Structural Piles task should be 20d – we will correct this next by adding logic links to the subtasks.

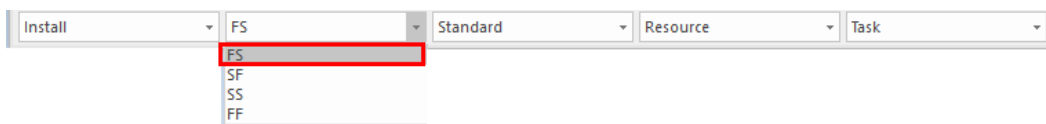
9.3. Adding Logic Links

Logic links between two tasks define a dependency between one task and another. Links are used to explicitly prevent tasks from being worked on out of sequence or to offset the start/finish of one versus another. If a Task is rescheduled, then any dependent tasks will also be re-sequenced. More than 2 tasks can be linked simultaneously. The order in which the tasks are selected will determine the order in which they are linked.

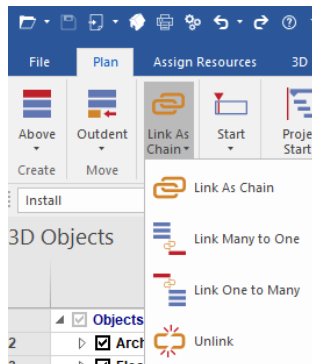
- Select **Piles 1**, hold **Shift** on the keyboard and select **Piles 3**.

NOTE: Order matters - selecting **Piles 3** followed by **Piles 1** would link the tasks in reverse order.

- Choose the **FS** (Finish to Start) Link type from the **Fast Options** toolbar. A Finish to Start link will prevent a downstream task from being started before the Finish of the upstream task.

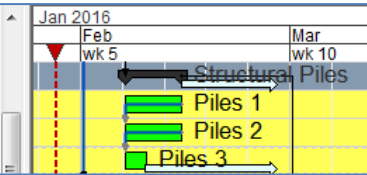


- From the **Plan** tab → **Links** panel → **Link As Chain** in the drop down menu.



The 3 tasks will be linked but not rescheduled.

Name	Duration	Start	Finish
Structural Piles	8d	9:00 AM 2/8/16	5:00 PM 2/17/16
Piles 1	8d	9:00 AM 2/8/16	5:00 PM 2/17/16
Piles 2	8d	9:00 AM 2/8/16	5:00 PM 2/17/16
Piles 3	4d	9:00 AM 2/8/16	5:00 PM 2/11/16

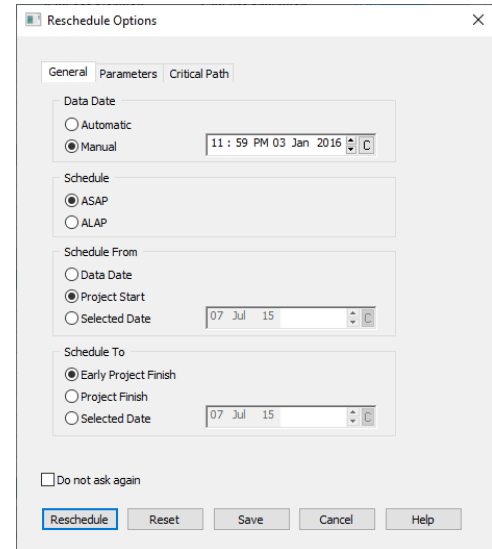


12. Select **F9** on your keyboard to reschedule the project. The **Reschedule** command is also available in the **Plan** ribbon → **Schedule** panel → **Reschedule**.

13. The **Reschedule Options** window will be raised. This window allows you to edit the various schedule related settings including **Data Date**.

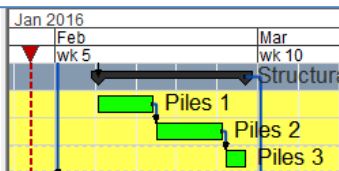
NOTE: The Parameters and Critical Path tabs contain further settings which may need to be updated on your own projects depending on the source of the schedule and your company's default scheduling methods.

For this training, leave the settings as shown and press **Reschedule**



14. The result in the Gantt Chart is shown below (notice how the summary task **Structural Piles** is 20 days again).

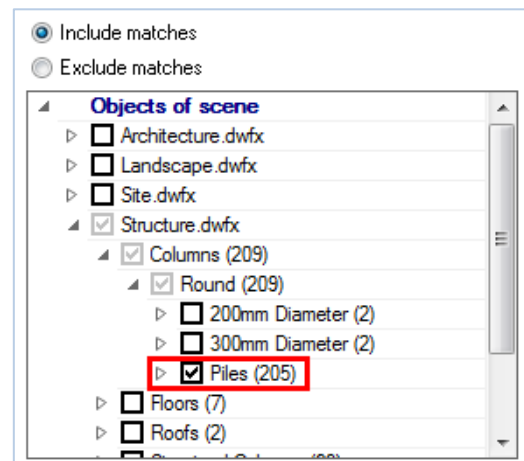
Name	Duration	Start	Finish
Structural Piles	20d	9:00 AM 2/8/16	5:00 PM 3/4/16
Piles 1	8d	9:00 AM 2/8/16	5:00 PM 2/17/16
Piles 2	8d	9:00 AM 2/18/16	5:00 PM 2/29/16
Piles 3	4d	9:00 AM 3/1/16	5:00 PM 3/4/16



15. To assign the piles to the tasks, begin by showing them in the 3D window. In the **3D Filters** window → **3D** tab, select **Clear All** to hide all objects.

16. Check the box next to **Piles (205)** to show them in the 3D view.

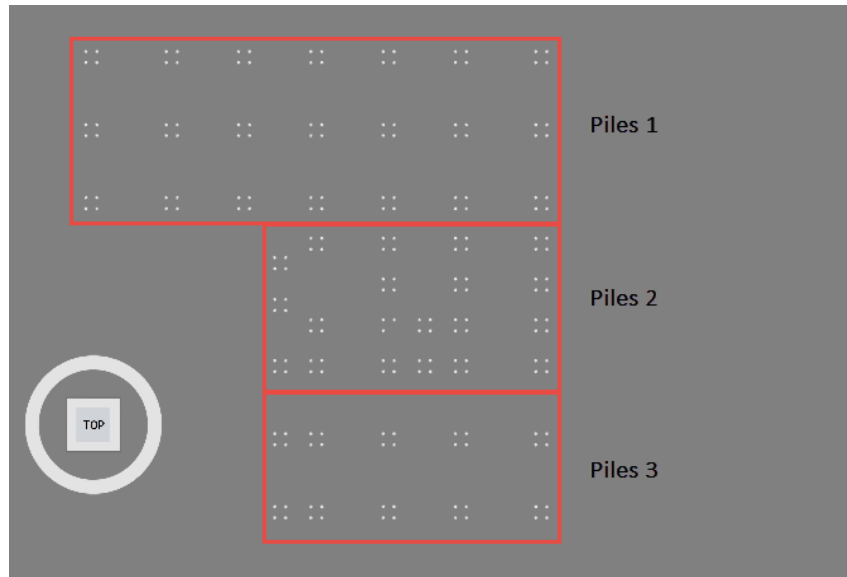
TIP: Right click in the list and choose **Find 3D Object** to quickly locate "Piles".



17. Click the **TOP** face of the **Viewcube** in the 3D window to view the piles from above.
18. Right click in the 3D window and choose **Isometric**. This will make it easier to select the piles using window box selection.

TIP: You may wish to change the **Selected View Background** colour in the 3D ribbon → **Display Settings** panel → select a colour for **Selected View Background** to provide more contrast between the piles and the background.

19. Use window box selection from top right to bottom left (as described in section 7.1) to select the Piles in Group 1, then assign to the task **Piles 1** using the **Install** Resource Appearance Profile.



20. Repeat step 19 to assign the correct group of piles to the tasks **Piles 2** and **Piles 3**.
21. Right click in the 3D window and select **Isometric** to turn off this setting.

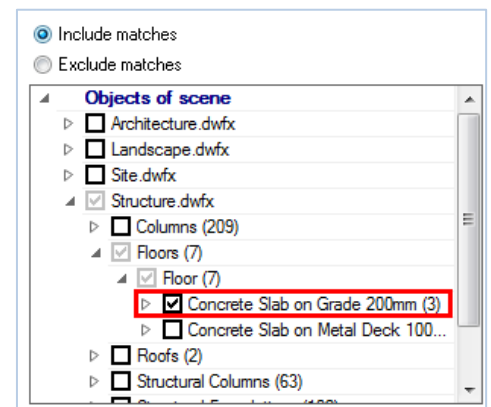
9.4. Model-Based Scheduling

In this section, you will learn how to use Model Based Scheduling - creating tasks from 3D Objects.

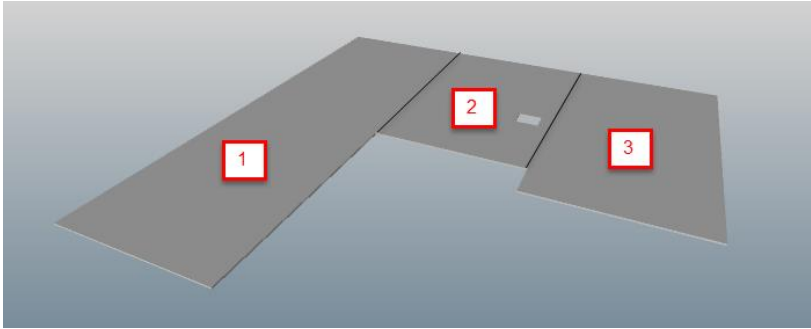
As an alternative to manually inserting new tasks as we did in section 9.1, SYNCHRO allows you to create tasks directly from 3D Resources. By default, SYNCHRO will generate the tasks in the order that you selected the objects, link the new tasks, and divide the durations of the selected task among the new tasks.

Suppose we would like to create a task for each of 3 pours of the concrete slab on grade. Instead of inserting the tasks manually, we will select the objects in the order we want them installed and then create tasks directly from the objects. This is called Model Based Scheduling.

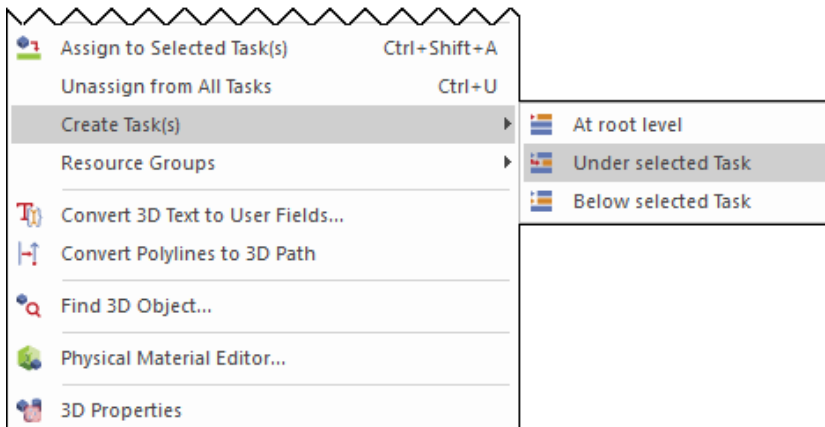
1. In the **3D Filters** → **3D** tab, show the “Concrete Slab on Grade 200mm” type in the Floors family of the Structure file.



2. Select the objects in the 3D window in the following order:

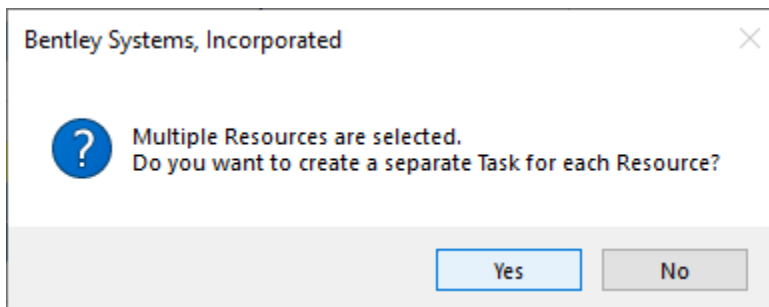


3. Select the task **Slab on Grade** in the Task List so it is highlighted. We will insert the new tasks as subtasks of this one.
4. With the 3 slabs selected, right click in the 3D window and choose **Create Task(s) → Under Selected Task**



NOTE: Selecting “Under selected Task” will create new task(s) as child task(s). If you select “At root level” the new task(s) will be created at the top (root) WBS level. Selecting “Below selected Task” will create new task(s) below the selected task at the same level; neither task will be parent or child to each other.

5. The following dialog will appear. Select **Yes** to create a new task for each selected resources.



NOTE: Selecting **No** will create a single task to which all selected resources will be assigned.

You will notice that 3 tasks (titled the same as their Resource name) have been added as subtasks of **Slab on Grade**. The total duration of these tasks is automatically created to sum to the parent task and they are linked as a chain.

6. Please rename the three Tasks created **Floor [166617]**, **Floor [821844]**, and **Floor [693039]** to **Slab on Grade Area 1**, **Slab on Grade, Area 2**, and **Slab on Grade Area 3**, respectively.

	ID	Name	Duration	Start	Finish	3D Resources
31	ST00230	▲ Slab on Grade	3d	9:00 AM 6/20/16	5:00 PM 6/22/16	(3)
32	ST01000	Slab on Grade, Area 1	1d	9:00 AM 6/20/16	5:00 PM 6/20/16	1
33	ST01010	Slab on Grade, Area 2	1d	9:00 AM 6/21/16	5:00 PM 6/21/16	1
34	ST01020	Slab on Grade, Area 3	1d	9:00 AM 6/22/16	5:00 PM 6/22/16	1

NOTE: See **Options → Defaults for New Objects → Creating Tasks from Resources** to change settings for how tasks are created in model-based scheduling. For example, you can choose not to link tasks when creating.

7. Drag the **Focus Time** forward to see the slabs installed in the order that you selected.

Custom Appearance Profiles

In this section, you will learn how to create custom Resource Appearance Profiles and how to apply a growth simulation.

10. In addition to the default system **Appearance Profiles** (Install, Remove, Maintain, Temporary, and Neutral), SYNCHRO gives you the ability to create as many custom user-generated custom profiles as you would like. These custom profiles will appear underneath the default **Appearance Profiles** under the label **Custom Profiles**.

You can vary the colour, the transparency, and/or add a growth simulation. You can use custom **Appearance Profiles** to differentiate phases and processes or work crews, as well as show the intended direction of an installation or removal.

10.1. Transparency Interpolation

One way to indicate change over the duration of a task is **Transparency Interpolation**. For example, an object being installed could start completely transparent at the beginning of the task and become increasingly opaque until it is solid at the end of the task.

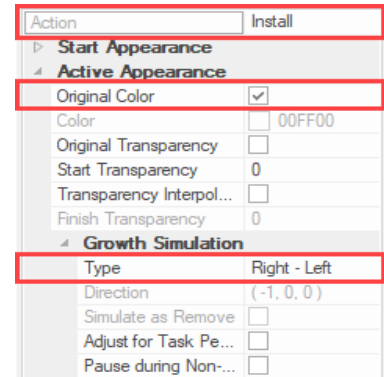
1. In **Navigator → Appearance Profiles** window, create a new user defined Profile by right clicking in the list panel then selecting **Add**.
2. Rename the Profile **Transparency Interpolation** and ensure it is highlighted.
3. In the **General** section, ensure the **Action** is set to **Install**.
4. In **Active Appearance**, enable **Original Colour** by checking the box next to it (or change the colour if desired).
5. Enable **Transparency Interpolation** (check the box next to it).
6. Change the **Start Transparency** to **100 (%)** and set **Finish Transparency** to **0 (%)**.
7. Ensure that the new **Transparency Interpolation** Appearance Profile is selected in **Navigator → Appearance Profiles**
8. In **3D Filters → 3D**, show **Roofs (2)** within the **Architecture** file.
9. Select **Part [1084292]** and assign to the task **Thermal and Moisture Protection → Roofing, Low Roof** under **Construction** in the Gantt Chart.
10. Select the task, right click and select **Focus Time on Task → Start** to jump to the start of the task.
11. Drag the Focus Time slowly through the task to see the **Transparency Interpolation**. (You may want to zoom in the Gantt Chart to make this easier to see).

The screenshot shows the 'Appearance Profiles' configuration window. The 'Action' is set to 'Install'. Under the 'Start Appearance' section, 'Original Color' is checked. Under the 'Active Appearance' section, 'Original Color' is checked, and 'Transparency Interpolation' is checked. The 'Start Transparency' is set to 100 and the 'Finish Transparency' is set to 0. Under the 'Growth Simulation' section, 'Type' is set to 'None'. Under the 'End Appearance' section, 'Original Color' is checked.

10.2. Growth Simulation

When a **Growth Simulation** is applied to a resource, the resource appears to grow incrementally in the specified direction (or shrink, in the case of **Appearance Profiles** with the **Remove** action selected) over the course of the task. Growth Simulations can be used to quickly and easily indicate the direction of construction.

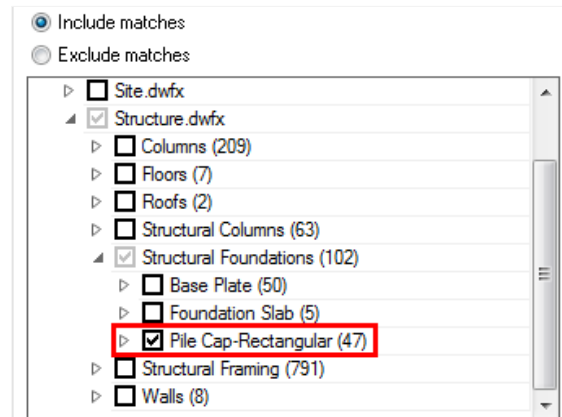
1. In the **Appearance Profiles** window, create a new user defined Profile by right clicking in the window then selecting **Add**.
2. Rename the Profile **R-L Growth** and ensure it is highlighted.
3. In the properties panel, ensure the **Action** is **Install**.
4. In **Active Appearance** enable **Original Colour** by ticking the box next to it
5. Select **Right – Left** from the **Growth Simulation**→**Type** dropdown
6. Select **Part[1084295]** and assign to the task **Thermal and Moisture Protection** → **Roofing, High Roof**
7. Move the Focus Time through the task- you will see the roof 'grow' as it is being installed



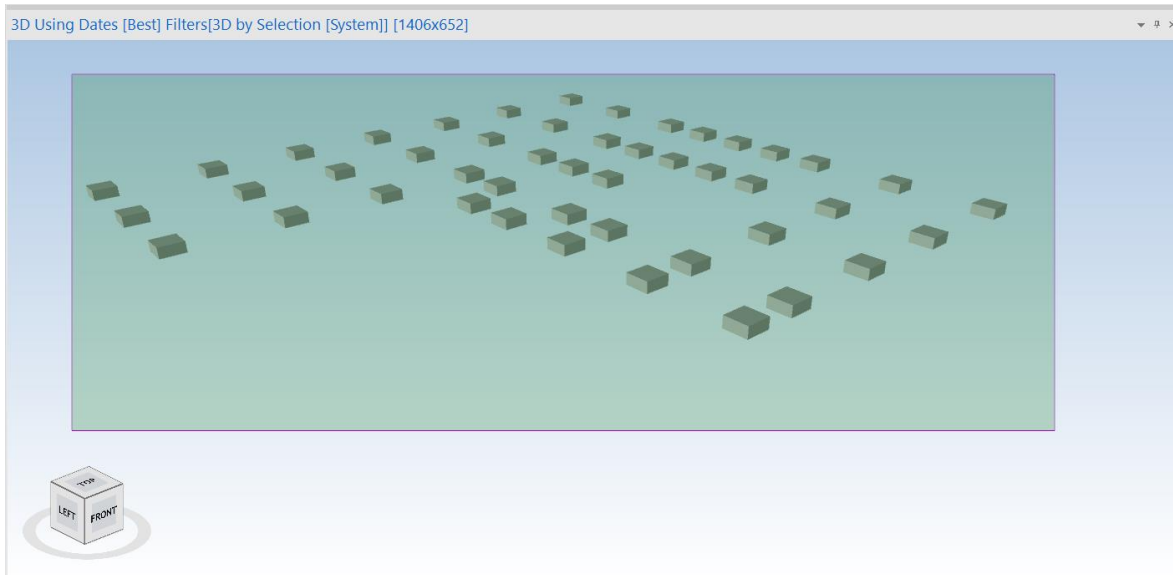
10.3. Resource Groups

Sometimes you may need to show multiple objects growing as a group using a growth simulation **Appearance Profile**, rather than growing individually. Using Resource Groups for growth allows you to show the general progression of construction for multiple objects without needing to create a task for each. For example, suppose you wish to show all of the pile caps being installed from right to left during a single task. If you assigned each pile cap to the task using a **Resource Appearance Profile** with a Right-Left Growth Simulation, they would each grow individually which is not the desired result. Instead, you should group all the pile caps into one Resource Group before assigning to the task.

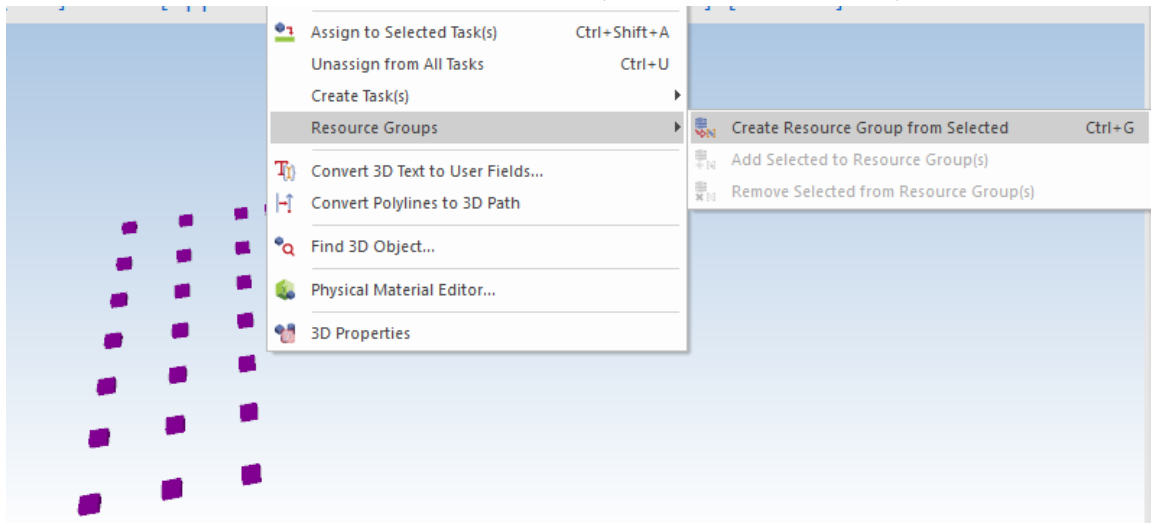
1. In **3D Filters** → **3D**, select **Clear All** to hide all objects, then show **Pile Cap-Rectangular (47)** within the **Structure** file.



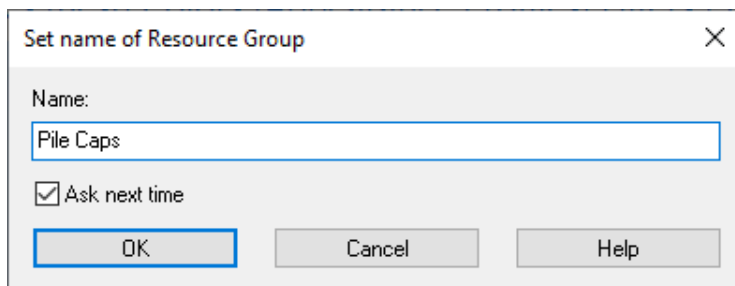
2. Select all the pile caps using window box selection.



3. Right click in the 3D window and choose **Resource Groups** → **Create Resource Group from Selected**

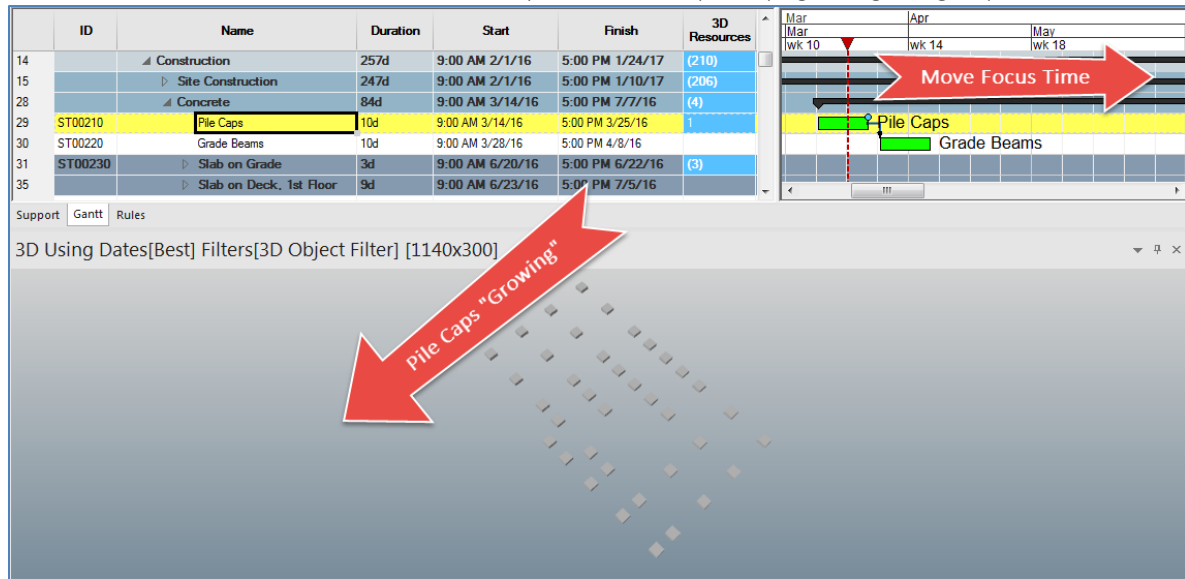


4. Name the Resource Group *Pile Caps*



5. In the Fast Options toolbar, change **Appearance Profile** to **R-L Growth**.
6. Open the **Resource Groups** window and select the newly created **Pile Caps** in the list. You will see the objects are all selected in the 3D View.

7. From the **Resource Groups** window, drag and drop the **Pile Caps** Resource Group onto the task **Pile Caps** under **Construction** → **Concrete**.
8. Move the **Focus Time** forward over the task and you will see the pile caps growing as a group.



NOTE: Resource Group assignments can be edited in **Task Properties** → **Resource Groups**. Select the top level Resource Group name to edit the **Appearance Profile** and/or **3D Path**

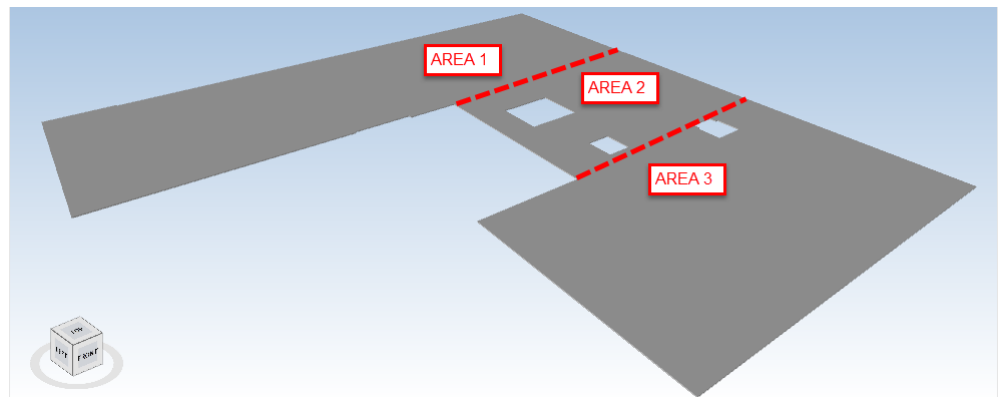
11. 3D Subdivision

In this section you will learn how to use the 3D Subdivision tools: **Slice**, **User Slice**, and **Freehand**.

The **3D Subdivision** tool can be used to divide a model object into smaller sub-parts. The sub-parts can be selected individually and assigned to separate tasks. This may be used, for example, to divide a single concrete slab into individual concrete pours or split continuous columns and walls by level without having to ask the modeller or architect to make the changes in the original file.

You will notice that the **Slab on Deck, 1st Floor** task is broken into 3 areas, each of which has multiple pours scheduled. There are only 3 slabs object on that level, however. The separate pours are not modelled – therefore, we will use the **3D**

Subdivision tool to create them in SYNCHRO. There are 3 options for Subdivision Type: **Slice**, **User Slice** and **Freehand**, which we will demonstrate in the following sections.



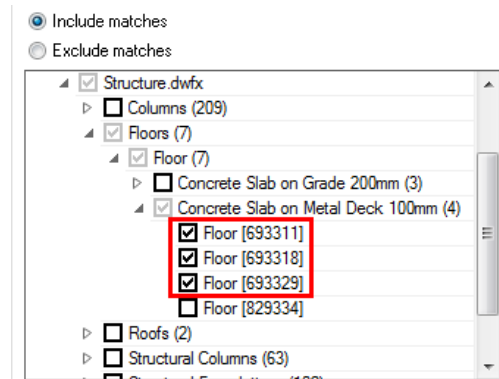
11.1. Subdivide by Slice

In **Slice** mode, the subdivided object is split into orthogonal uniform planes (columns, rows and layers). You simply define how many rows, columns and layers you require.

In **3D Filters** → **3D**, select **Clear All** to hide all objects, then show **Concrete Slab on Metal Deck 100mm** under **Floors** in the **Structure** file.

NOTE: We will only be using **Floor [693311]**, **Floor [693318]**, and **Floor [693329]** for this 3D Subdivision exercise. Please ensure **Floor [829334]** is *deselected*.

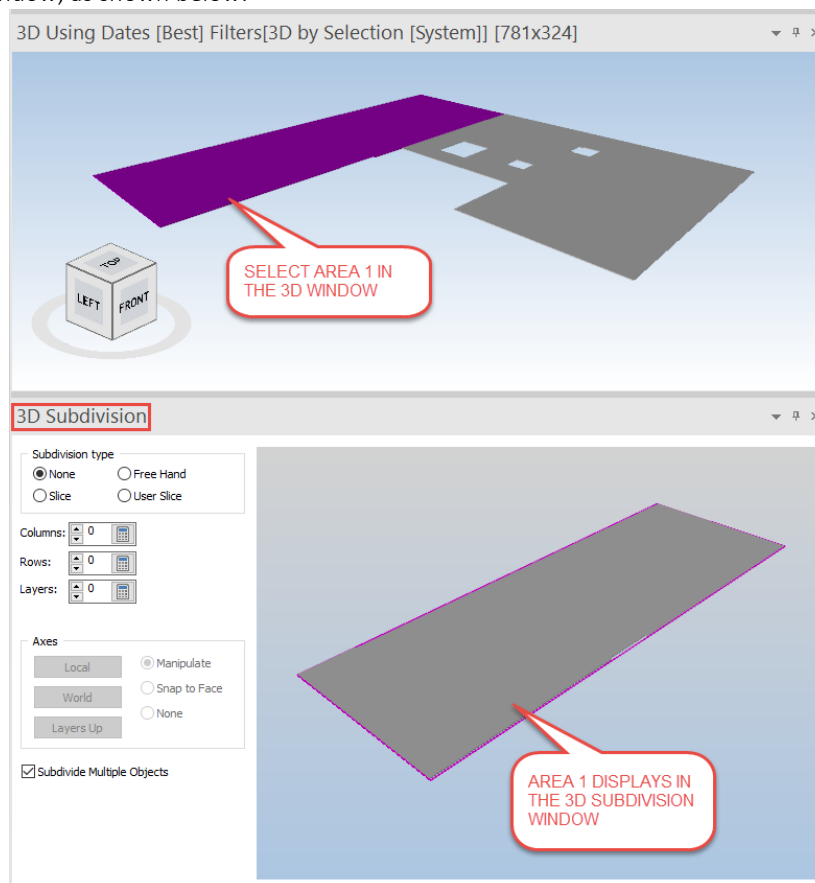
1.



From the **3D ribbon** → **Edit panel** → select **Subdivide**. If the 3D Subdivision window is docked on opening, double click the header to undock it as a floating window.

2. Select the “Area 1” slab - Floor [693311] - in the 3D Window. The selected item will be displayed in the 3D Subdivision window, as shown below.

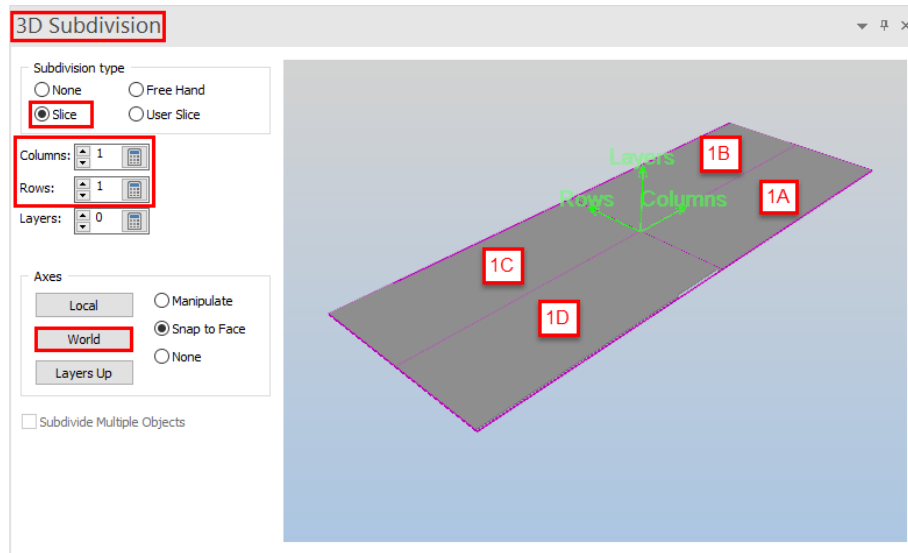
3.



Enter **1** for **Column** cuts.

In **Axes** select **World** so that layers are facing up then enter **1** in the **Row** cuts.

4.
5.



Close the 3D Subdivision Window to finish by selecting the 'X' in the top right, then left click in the main 3D Window and press **Esc** on the keyboard.

6.

NOTE: Each Subdivision can now be selected and assigned separately.

Change the **Appearance Profile** to **Install** in the **Fast Options** toolbar.

7.
8.

Select and assign the subdivided floor slab to the matching **Slab on Deck, 1st Floor, Area 1** subtasks according to the diagram above.

NOTE: You can rename the subdivided 3D Objects in the 3D Objects window by right clicking on them and selecting "Rename." Try it now by renaming the subdivisions with their associated Task Areas (i.e. Subdivision 1,1 will be Subdivision Area 1D).

TIP: Try using the **Ctrl + Alt** shortcut to drag and drop the 3D object onto the appropriate task.

11.2. Subdivide by User Slice

In **User Slice** mode, the subdivided object is split into orthogonal *non-uniform* planes (columns, rows and layers). The size of each slice is defined as a proportion of the original geometry and the slices can be resized using the manipulators in the preview window.

1.
2.
3.
4.
5.

There are 2 subtasks for **Slab on Deck, 1st Floor, Area 2** which requires a split that is at 75% of length of the slab rather than directly in the middle (50%).

Select "Area 2" - Floor [693329] - in the 3D window.

From the **3D Tab** → **Edit** panel → select **Subdivide**.

In the **Subdivision type** box activate the **User Slice** option.

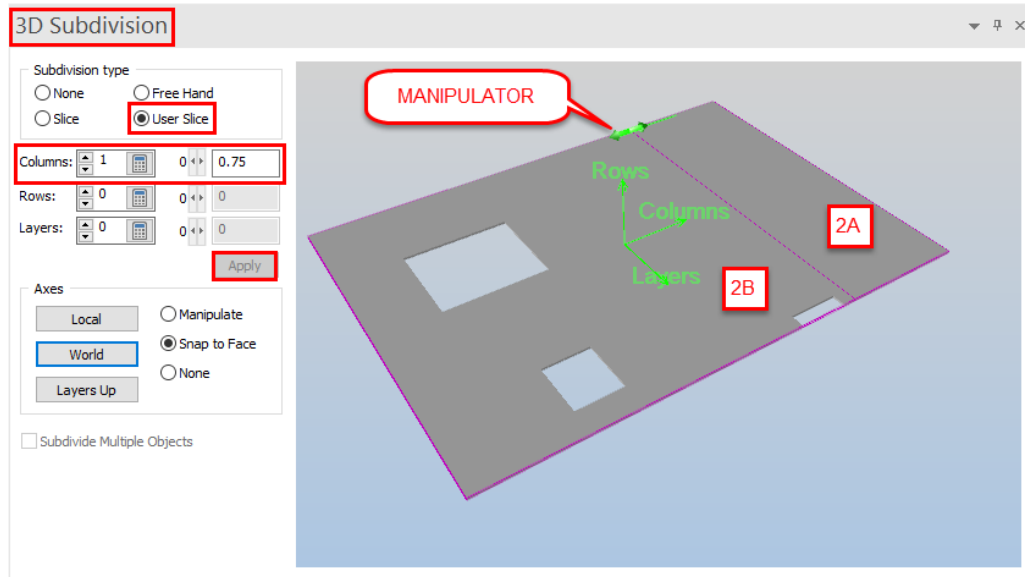
Enter **1** for **Column Cuts**.

Set **Axes** to **World**

Select **User Slice** then either-

- Change the figure from 0.5 (50%) to **0.75** (75%) then **Apply**.
- Use the Arrow manipulator as shown below.

6.

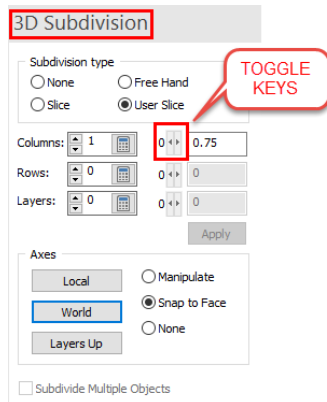


Close the 3D Subdivision Window to finish. Then left click in the Main 3D Window and press **Esc** on the keyboard.

7.

Select and assign the subdivided floor slab to the matching **Slab on Deck, 1st Floor, Area 2** subtasks.

8.



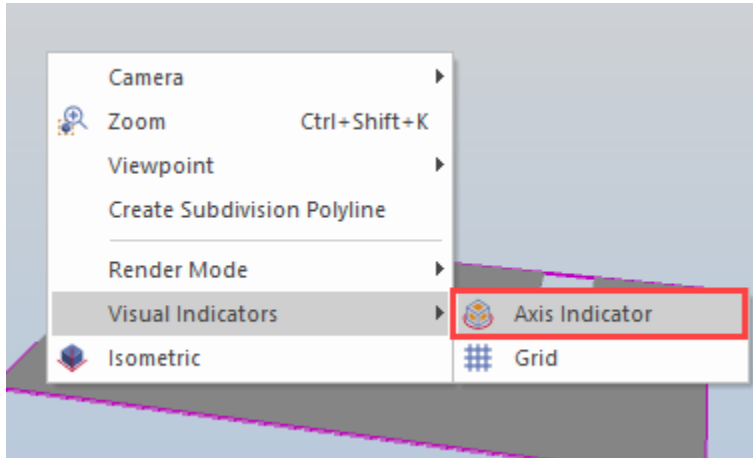
NOTE: If you have several splits that you want to use the **User Slice** on you can toggle between the splits with the arrow keys as shown.

11.3. Subdivide by Freehand

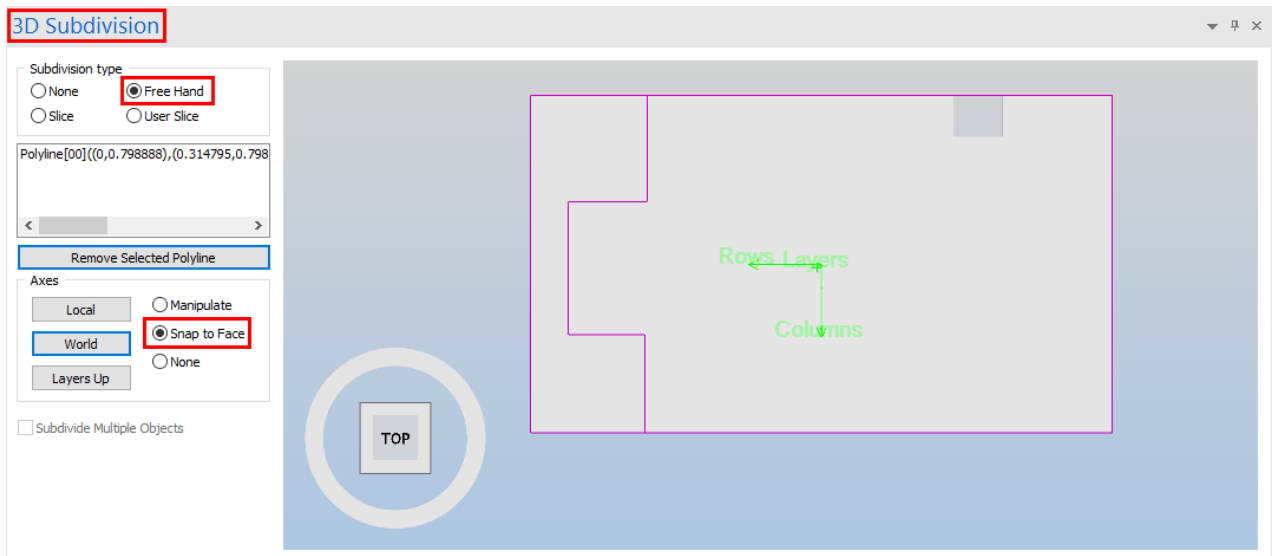
In **Free Hand** mode, the subdivision planes are defined by user-drawn lines (polylines) that are then extended in a particular direction. This can be used to split objects into irregular shapes.

- From the **3D** tab → **Edit** panel → select **Subdivide**.
- Select the final slab "Area 3" - Floor [693318] - in the 3D window.
- Select **Free Hand**.
- When using **Free Hand** slice, always make sure to select **Snap to Face** from the **Axes** box. Then in the 3D Subdivision Window, left click the face that you will be drawing the cut on (the top face in this case).

5. Right click in the 3D Subdivision window and select **Visual Indicators>Axis Indicator**



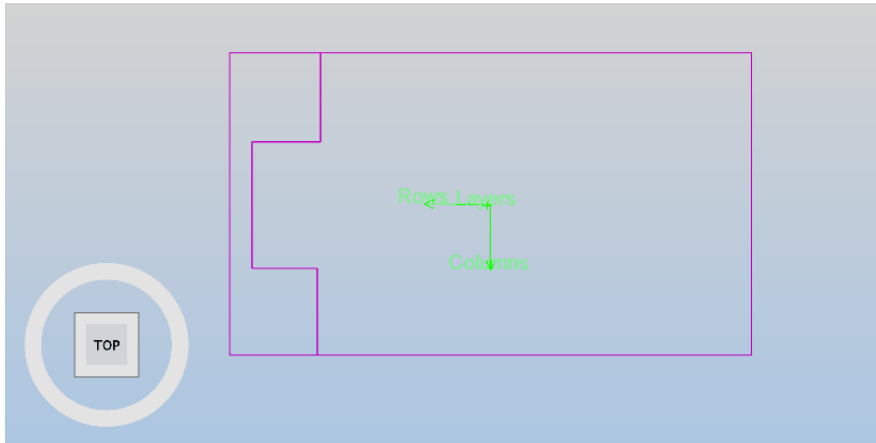
6. Right click in the 3D Subdivision window and select **Create Subdivision Polyline**.
7. Click the **Top** face on the view cube so you are looking down on the slab and scroll to zoom out a bit
8. Left click at one edge to begin the polyline, and then continue left clicking within the slab to add vertices to the polyline. Finally left click on an edge to finish the polyline. Try creating the shape shown below.



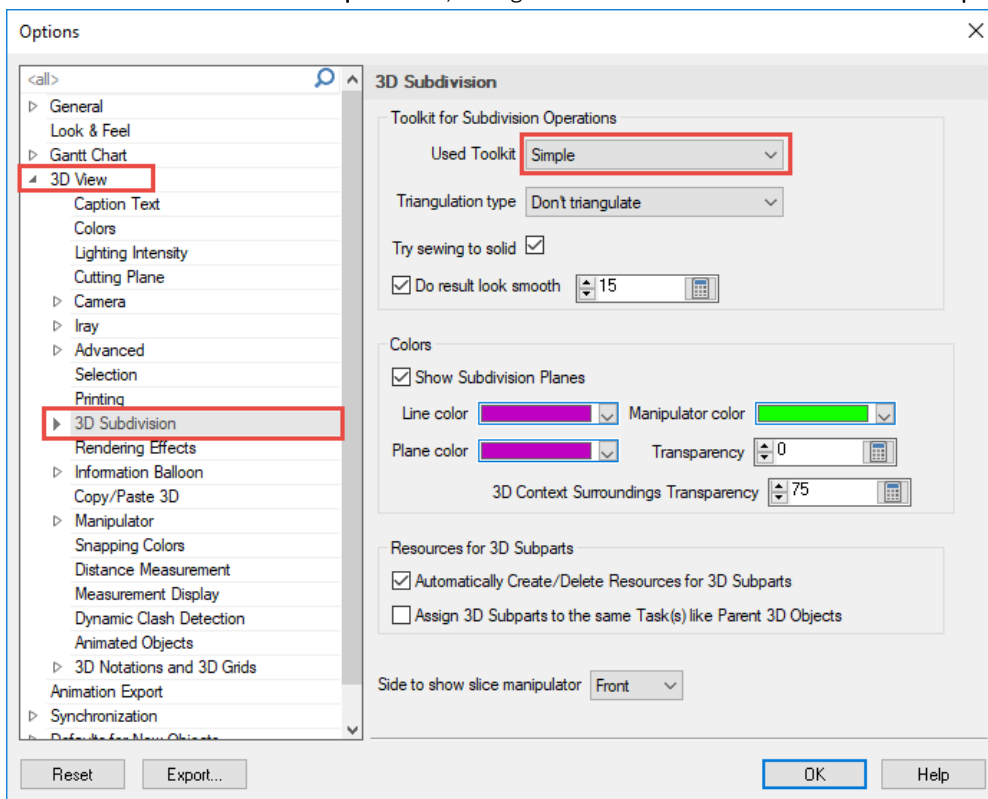
NOTE: Subdivision Polylines must extend from one edge of the object's bounding box to another (even if the object is irregularly shaped so that its edge is not the same as the rectangular bounding box).

11.4. Troubleshooting

If an object disappears or displays other unexpected behaviour upon subdivision, you may need to adjust your subdivision settings.

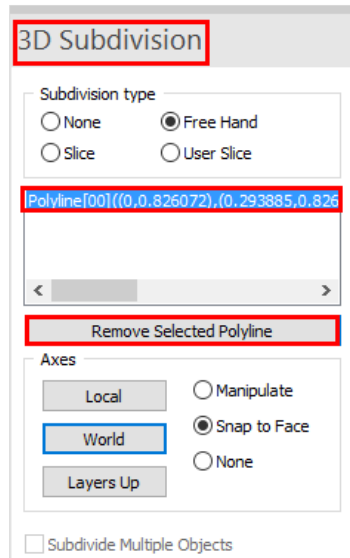


1. Select the **Navigator** tab → **Options**.
2. Expand **3D View** and select **3D Subdivision**.
3. Within **Toolkit for Subdivision Operations**, change the Used Toolkit from **Advanced** to **Simple** and press **OK**.

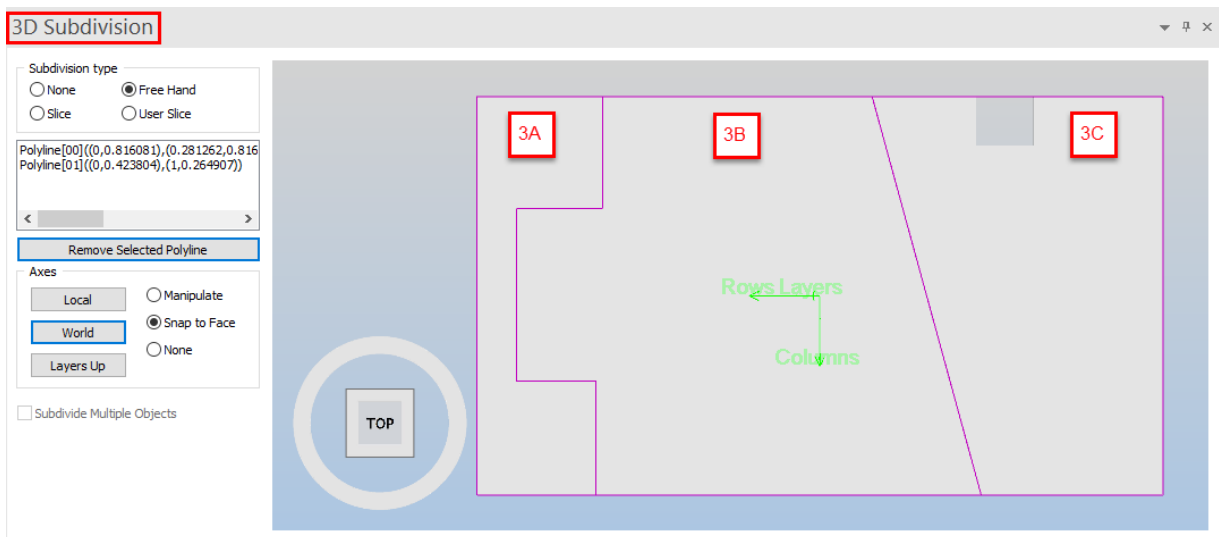


NOTE: For some files, the **Advanced** Toolkit may work better than the **Simple** and vice versa. You may also need to adjust the **Triangulation Type** setting and enable/disable **Try sewing to solid**.

4. Select the polyline from the list box in the 3D Subdivision window and choose the **Remove Selected Polyline** button.



5. Right click in the 3D Subdivision window and select **Create Subdivision Polyline**, and then redraw the polyline as in step 8 of section 11.3 above.
6. To add a second cut, right click in the 3D Subdivision window, select **Create Subdivision Polyline** again, and left click on one edge and across to the other as below:

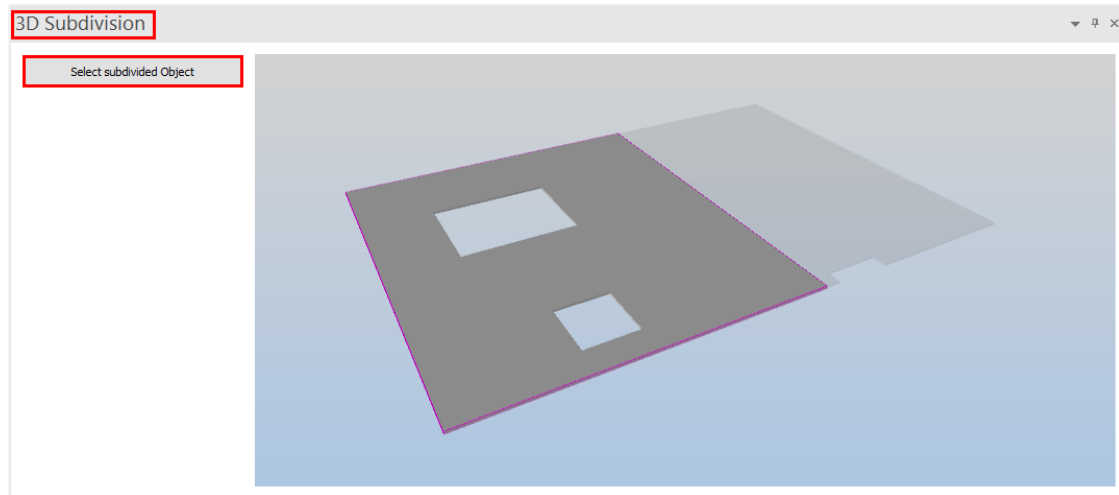


7. Close the **3D Subdivision** window to finish. Then left click in the main 3D window and press **Esc** on the keyboard.
8. Select and assign the subdivided floor slab to the matching **Slab on Deck, 1st Floor, Area 3** subtasks as indicated above.

11.5. Editing Subdivisions

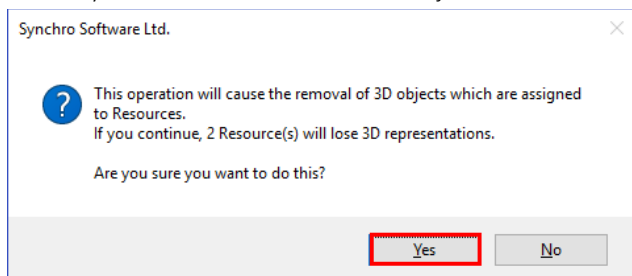
It is possible to edit a subdivision if you decide that you need to after closing the 3D Subdivision. Suppose, for example, that it is decided that “Area 2” should be split at 60% rather than 75%.

1. Move the **Focus Time** after the end of the **Slab on Deck, 1st Floor, Area 2** task.
2. From the **3D Tab** → **Edit panel** → **Subdivide**.
3. Select one of the “Area 2” subdivisions in the 3D window. You will see the object in the 3D Subdivision window, but the Subdivision commands will not be available.



4. Click the **Select Subdivided Object** button to select the entire original object. You can now edit, add or remove splits.
5. Change the **Columns** division to 0.6 and press **Apply**.

NOTE: Selecting **None** for **Subdivision Type** will remove all splits if needed. If you select none, or decrease the number of rows, columns, or layers, you will be presented with a warning. If you meant to remove the subdivision, press **Yes**. Any existing subdivisions will be removed, and any associated 3D Resources will be deleted and unassigned from any tasks that may have utilised them. The 3D Object and Resource trees will be updated accordingly.



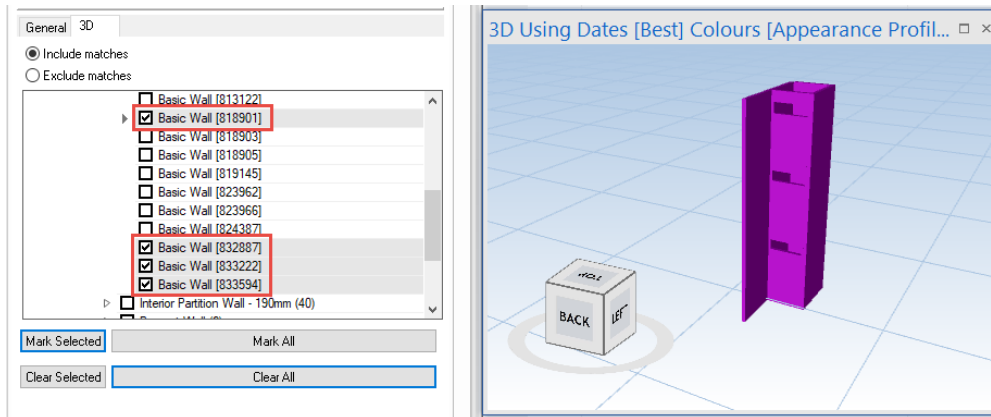
6. Close the 3D Subdivision window to finish. Then left click in the main 3D window and press **Esc** on the keyboard.
7. If Subdivisions were added or removed you would need to assign the subdivisions to the appropriate tasks, but since we only changed the size of the existing subdivisions, they have remained assigned to the correct tasks. You can confirm this by selecting one of the subdivisions in the 3D window, right clicking and choosing **Display Assigned to Task(s)**.

11.6. Subdivide Multiple Objects

SYNCHRO also provides the ability to subdivide multiple objects simultaneously. This can be used to split many objects along the same plane; for example, splitting slabs on many floors into the same number of pours or splitting many columns in a building by level.

In this tutorial, we will subdivide wall panels that span from the ground floor to the roof so that they have separate 3D Object representations for each floor (ground floor, first floor, and second floor).

1. In the **3D Filters** → **3D** tab, select **Clear All** to hide all objects, then expand **Walls** → **Basic Walls** → **Interior-Blockwork 200 (11)** under the **Architecture.dwg** file.
2. Show and select the Objects shown below in either the **3D Filters** → **3D** tab.



3. In the **3D ribbon** → **Edit panel** → select **Subdivide**.
4. In the **3D Subdivision** window enable **Subdivide Multiple Objects**. You will now see a purple bounding box that includes all selected **3D Objects** for Subdivision.

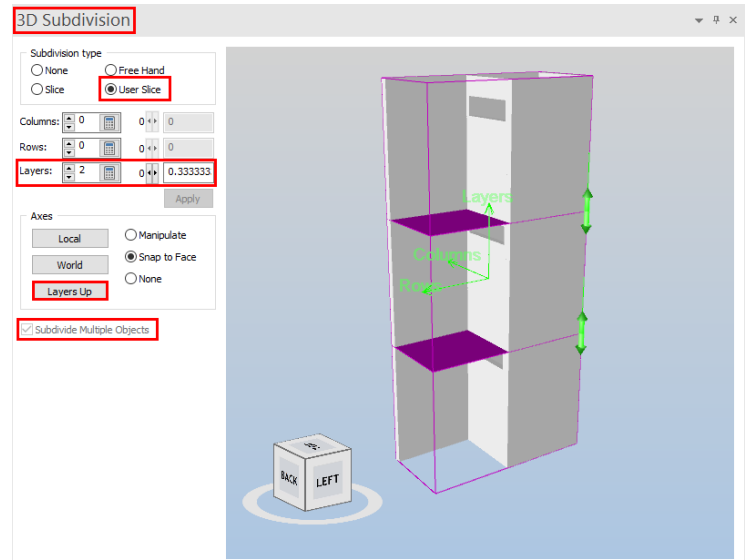
NOTE: When **Subdivide Multiple Objects** is disabled, only the first object selected can be subdivided; the other objects selected will still be shown semi-transparent as a reference, which can be helpful to guide you when making user slices for example. When **Subdivide Multiple Objects** is enabled, all objects become opaque; in this mode you cannot show additional objects as reference.

5. From the **Subdivision Type** panel, select **Slice**.
6. Enter 2 for **Layer Cuts**.
7. Select **Layers Up** from the **Axes** box.

9. **NOTE:** If the flows are not evenly spaced, you could use the **User Slice** and adjust the slices accordingly.
- 10.

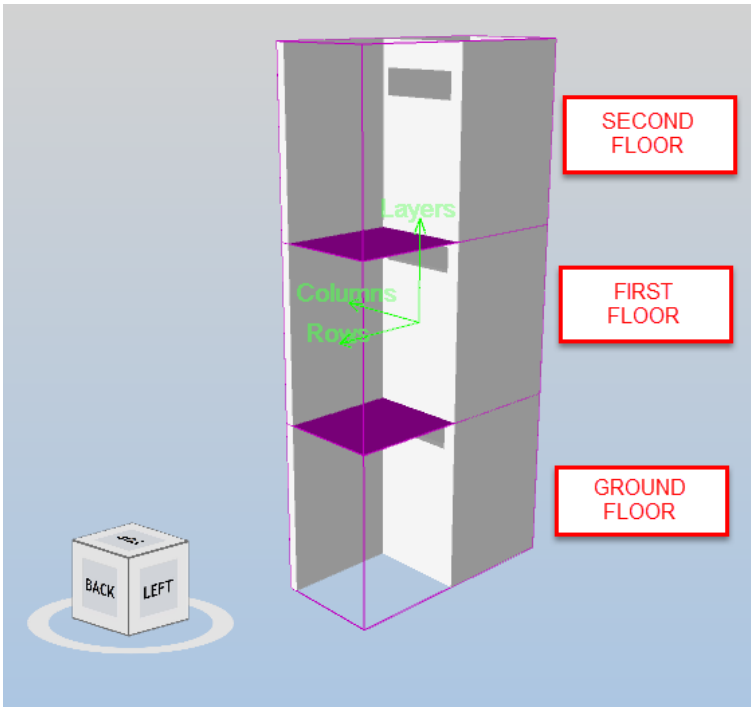
Close the 3D Subdivision window to finish. Then left click in the Main 3D window and press **Esc** on the keyboard.

In the **Task List** of the **Gantt Chart**, find the tasks:
 “Blockwork / Elevator Shaft, Ground Floor”,
 “Blockwork/ Elevator Shaft, 1st Floor”, and
 “Blockwork/ Elevator Shaft, 2nd Floor”,



Assign the **3D Subdivisions** to the associated Tasks as indicated below using the **Install** Appearance profile.

11.



Each **Task** should now have four **3D Objects** assigned to them:

12.

	ID	Name	Duration	Start	Finish	3D Resources	
70		Masonry	12d	9:00 AM 7/4/16	5:00 PM 7/19/16	(12)	
71	ST00530	Blockwork / Elevator Shaft, Ground Floor	4d	9:00 AM 7/4/16	5:00 PM 7/7/16	4	
72	ST00540	Blockwork / Elevator Shaft, 1st Floor	4d	9:00 AM 7/8/16	5:00 PM 7/13/16	4	
73	ST00550	Blockwork / Elevator Shaft, 2nd Floor	4d	9:00 AM 7/14/16	5:00 PM 7/19/16	4	

NOTE: When subdividing multiple objects, all selected objects will be split into the same number of subdivisions according to the settings specified. This may result in subdivisions listed in the **3D Objects** list which do not have a physical geometry. This will happen, for example, when all the cutting planes in the **3D Subdivision** window do not intersect each selected object.

Auto-Matching with User Fields

In this section, you will learn how to implement the Auto-Matching function using User Fields.

The **Auto-Matching** feature in SYNCHRO provides a facility to automatically assign Resources to Tasks using custom filters and search rules. The match is based on Resource Names or User Fields as well as Task Names, ID, Comment, User Fields or Activity Codes. Using the **Auto-Matching** function greatly simplifies the task of linking resources to tasks.

12.

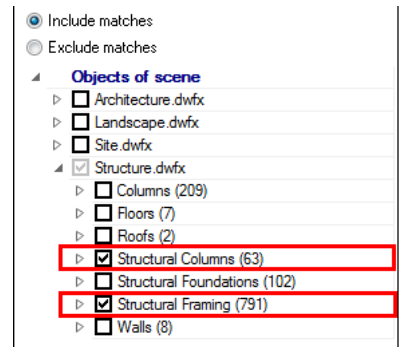
12.1. User Fields

User Fields are custom fields created to track or filter information for Tasks, Resources, and 3D Objects that isn't initially captured by SYNCHRO PRO's default attributes. **User Fields** can be created when importing a schedule or 3D Model that has these assigned parameters in their source files. Additionally, you can create custom **User Fields** in SYNCHRO PRO.

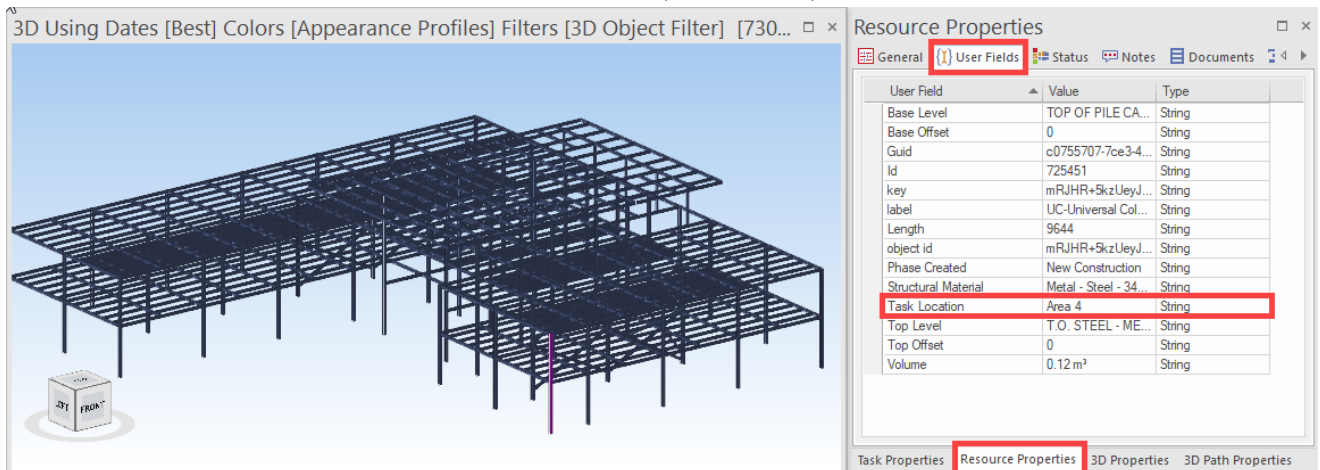
Previously when we imported the 3D Models (section 5.1), we selected "**Process User Fields**". In this tutorial, we will create **User Fields** for some Tasks to match the existing **User Field** values of certain Resources.

1. In the **3D Filters** → **3D** tab, select **Clear All** to hide all objects, then show **Structural Columns (63)** and **Structural Framing (791)** under the **Structure.dwf** file.
2. In the 3D View, select "Left" on the View Cube Manipulator. This will rotate the 3D View so that you are looking at the front of the building structure.

There are over 850 3D Resources. Rather than assigning each Resource to its respective Task, we can instead create a custom field or **User Field** for each Task to match the **User Fields** already assigned to the 3D Resources.



3. Select any 3D Object shown in the 3D View, then select the **Resource Properties** tab and expand the **User Fields** tab. For this tutorial, we want the value stored in "**Task Location**" (shown below).

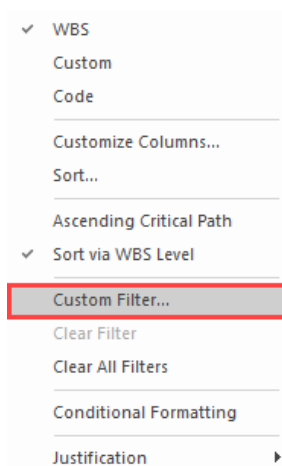


NOTE: The **User Field** values shown above are user defined Object Parameters in the BIM files. Upon **3D Import**, these parameters are created as **User Fields** in SYNCHRO using the command "**Process User Fields**".

4. In the **Navigator** ribbon → **Project Data** panel → open the **User Fields** window.
5. Right click in the **User Fields** window list panel and select **Add**.
6. In the **Add User Field** dialog, set the **Name** to “*Task Location*”, the **Category** to “*Task*” and the **Type** to “*String*”. Leave **Calculation Type** as “*Don't calculate*”. Then press **OK**

TIP: It is possible to create **Formulas** to calculate User Field values based on Task, Resource or 3D Properties and other User Fields. See SYNCHRO Help for directions and a full list of syntax.

7. You can create a custom column filter to only show all the tasks with the work “Area” within it. Right click in the **Name** column header → **Custom Filter**.
8. Select **Operation** as “*contains*” with the **Value** as “*Area*”.



9. In the Task List, find **Structural Framing, Area 1**, **Structural Framing, Area 2**, **Structural Framing Area 3**, and **Structural Framing, Area 4** under the Summary Task **Metals**.
10. Right click in the Column Headers to Customise Columns and show the **User Field** → **Task Location** next to the tasks in the Task List. (If need be, please reference section 3.2.1: Customising Columns). Your Task List should look like this:

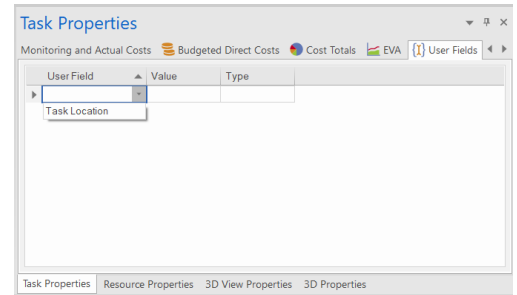
ID	Name	Task Location	Duration	Start	Finish
44	Metals		195d	9:00 AM 3/30/2016	5:00 PM 12/27/2016
46	ST0... Structural Framing, Area 1		8d	9:00 AM 4/18/2016	5:00 PM 4/27/2016
47	ST0... Structural Framing, Area 2		8d	9:00 AM 4/28/2016	5:00 PM 5/9/2016
48	ST0... Structural Framing, Area 3		10d	9:00 AM 5/10/2016	5:00 PM 5/23/2016
49	ST0... Structural Framing, Area 4		9d	9:00 AM 5/24/2016	5:00 PM 6/3/2016
50	ST0... Plumb/ Bolt / Weld Area 1		5d	9:00 AM 4/28/2016	5:00 PM 5/4/2016
51	ST0... Plumb/ Bolt / Weld Area 2		5d	9:00 AM 5/10/2016	5:00 PM 5/16/2016
52	ST0... Plumb/ Bolt / Weld Area 3		5d	9:00 AM 5/24/2016	5:00 PM 5/30/2016
53	ST0... Plumb/ Bolt / Weld Area 4		5d	9:00 AM 6/6/2016	5:00 PM 6/10/2016

11. Left click in the **Task Location** column cell of the **Structural Framing, Area 1** task, type in “Area 1”.

12. Select the **Task Location** column cell for “Area 1”, hover over the bottom right corner until the crosshair appears, then drag down to increment the numeric value.

NOTE: Holding **Ctrl** while dragging copies the value rather than incrementing.

13. Task **User Fields** can also be defined in the **Task Properties** window under the **User Field** tab. Select the task **Plumb/Bolt/Weld Area 1** and go to **Task Properties** → **User Fields**.

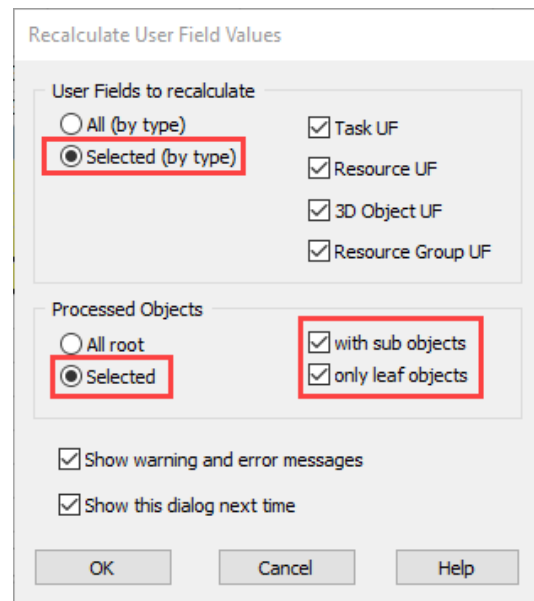
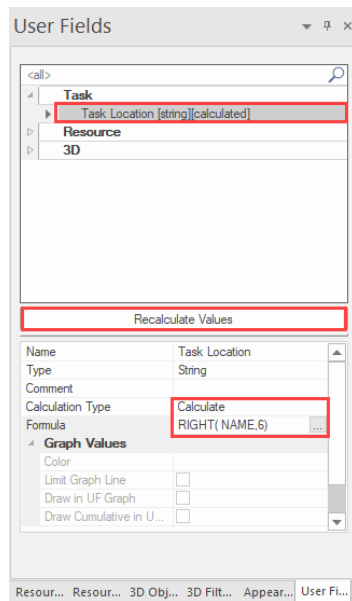


14. Right click in the table and select **Add Value** or press the **Insert** key on your keyboard. A new row will be added to the table.

15. Select “**Task Location**” from the drop-down in the User Field column. Type in the **Value** as “Area 1”.

16. You can also use **Calculated User Fields** formulas to automatically extract the “Area” information from the Task Name. In the **User Fields** window, select “**Task Location**” and change the **Calculation Type** to “**Calculate**” and write the **Formula** – **RIGHT(NAME,6)**

17. Select the Tasks **Plumb/Bolt/Weld Area 2 - 4**, and click **Recalculate Values** to run the formula.



18. Your Task List should now look like this:

ID	Name	Task Location	Duration	Start	Finish
44	Metals		195d	9:00 AM 3/30/2016	5:00 PM 12/27/2016
46	ST0... Structural Framing, Area 1	Area 1	8d	9:00 AM 4/18/2016	5:00 PM 4/27/2016
47	ST0... Structural Framing, Area 2	Area 2	8d	9:00 AM 4/28/2016	5:00 PM 5/9/2016
48	ST0... Structural Framing, Area 3	Area 3	10d	9:00 AM 5/10/2016	5:00 PM 5/23/2016
49	ST0... Structural Framing, Area 4	Area 4	9d	9:00 AM 5/24/2016	5:00 PM 6/3/2016
50	ST0... Plumb/ Bolt / Weld Area 1	Area 1	5d	9:00 AM 4/28/2016	5:00 PM 5/4/2016
51	ST0... Plumb/ Bolt / Weld Area 2	Area 2	5d	9:00 AM 5/10/2016	5:00 PM 5/16/2016
52	ST0... Plumb/ Bolt / Weld Area 3	Area 3	5d	9:00 AM 5/24/2016	5:00 PM 5/30/2016
53	ST0... Plumb/ Bolt / Weld Area 4	Area 4	5d	9:00 AM 6/6/2016	5:00 PM 6/10/2016

In the next section, we will use these assigned **User Field** values to **Auto Match** 3D Resources to these eight tasks.

12.2. Creating an Auto-Matching Rule

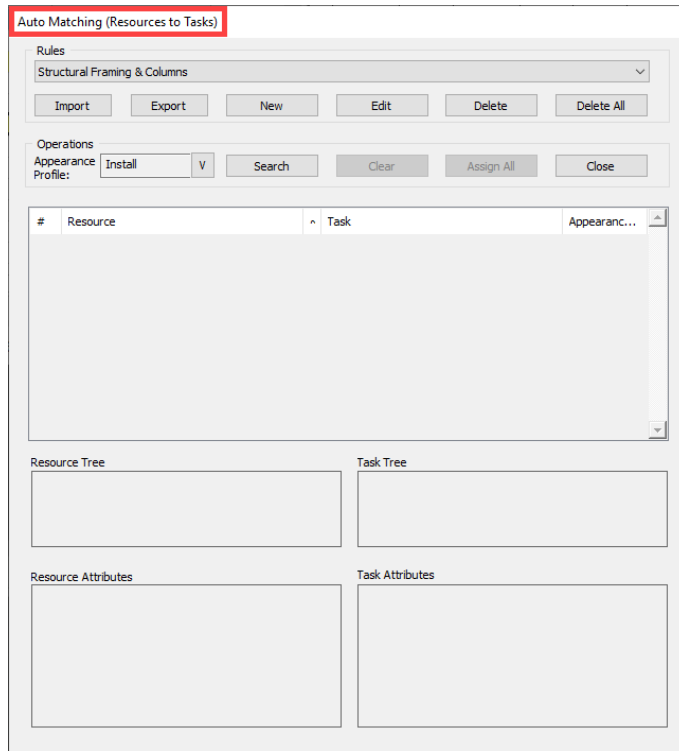
We will now create an **Auto-Matching** rule to assign multiple 3D Resources to the appropriate Tasks by matching their **User Field** values.

1. Select all Resources shown in the 3D View: **[Structural Columns (63) and Structural Framing (791)]**
2. Left click on Task **Structural Framing, Area 1**, hold down Shift and select **Structural Framing, Area 4**.

NOTE: Please ensure you do not de-select the 4 Tasks and 854 Resources selected. You can see how many Task/Resources/3D are selected in the Status bar at the bottom of the window

For Help, press F1 Enough memory [Filter On] Selected [4][854][854] 10:13 AM 7/7/2015 Private Project Transactions: 17 100% — +

3. Open **Assign Resources → Auto Matching → Resources to Tasks** to display the Auto Matching Dialog.



NOTE: Please see [Appendix D: Auto-Matching](#) for more information pertaining to this function not explicitly described in this tutorial.

4. Select **New** to add a new **Auto-Matching** rule in the **Add New Rule...** dialog (shown below).
5. **Name:** *"Structural Framing & Columns"*.
6. Since we have purposely selected the 3D Resources and Tasks we want to link, enable **Use only Selected Resources** and **Use only Selected Tasks** under **Summary_Options**.

NOTE: Selecting **Use only Selected Tasks / Resources** will limit the search criteria. If these options are not selected, all 3D Resources and Tasks in the project will be searched for a match.

7. Under **Relations**, select **Many-to-Many** since we want to match and assign more than 800 3D Resources to four Tasks.
8. Under **Expression**, press **Add**.

You can now define the matching criteria of your **Auto-Matching** Rule in the **Add New Term...** dialog. For the purposes of this tutorial, please set the following values:

9. Under **Resource Attribute**:
 - i. First Drop-Down= **User Field**.
 - ii. User Field Drop-Down = **Task Location**.
10. Under **Task attribute**:
 - i. First Drop-Down= **User Field**.
 - ii. User Field Drop-Down = **Task Location**.
11. Please set **Algorithm =Exact** since we want an exact match between Task and 3D Resource User Fields.
12. **Operator = AND**
13. Press **"Save"**.
14. You will now see your rule in "Expression".
15. Select **OK** at the bottom of the **Add New Rule...** Dialog.

Add New Rule...

Name: Structural Framing & Columns

Summary options

- ☒ Use only Selected Resources
- ☒ Use only Selected Tasks
- ☐ Ignore Assigned Resources
- ☐ Ignore Tasks with Assignments
- ☐ Merge Similar Groups
- ☐ Ignore Summary Tasks

Relations

- ☐ None
- ☒ One-to-One
- ☐ Many-to-Many

Expression

AND (User field: Task Location = User field: Task Location)

Operator

- ☒ AND
- ☐ OR
- ☐ AND NOT
- ☐ OR NOT
- ☐ True if Undef

Resource attribute

- ☐ Search Parents
- User Field
- User Field
- Task Location
- Type: ☒ Equipment ☒ Human ☒ Location ☒ Material

Task attribute

- ☐ Search Parents
- User Field
- User Field
- Task Location
- ☐ Use entire nested Code Value

Algorithm

- ☒ Exact
- ☐ Substring
- ☐ Longest Common Substring

Options

- ☐ Separators:
- ☐ Case Sensitive

Min Length: 1

Min Digits: 0

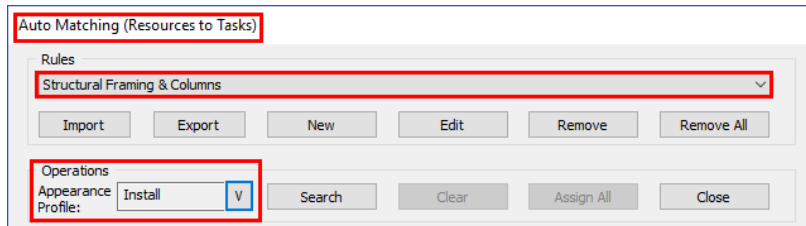
OK Cancel Help

12.3. Auto-Match Resources to Tasks

We will now run our **Auto-Matching** rule “**Structural Framing & Columns**” in the **Auto Matching** window.

16. Select “**Structural Framing & Columns**” from the Rules Drop-Down.

17. Make sure **Operations** → **Appearance Profile** is set to **Install**.



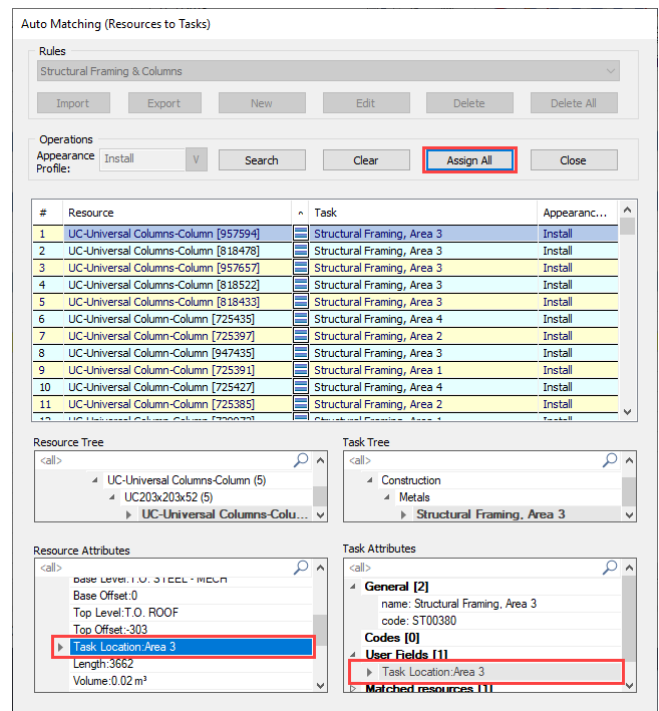
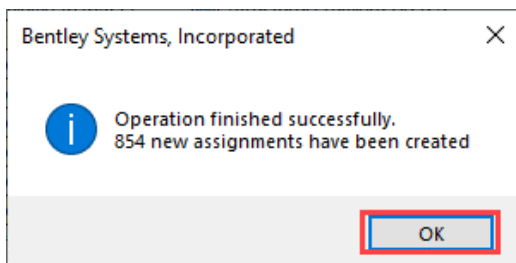
18. Select **Search** to display the **Auto-Matching** results.

19. Select an item from both **Resource** and **Task** columns to populate the dialog windows beneath the search results.

20. To confirm your **Auto-Matching** results, check one or two Resource/Task pairs to ensure the following values are equal:

- Resource Attributes** → **User Fields** → **Task Location**.
- Task Attribute** → **User Fields** → **Task Location**.

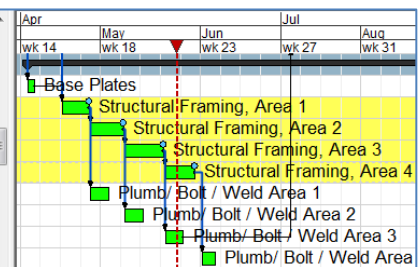
21. Select **Assign All** to receive this window. Press OK.



22. In the **Task List** the **3D Resources** column should be populated for the tasks **Structural Framing, Area 1-4**.

23. Select the tasks **Plumb/Bolt/Weld Area 1-4** and repeat steps 16-21 using the **Maintain** Resource Appearance Profile in Step 17.

ID	Name	Task Location	Duration	Start	Finish	3D Resource
50	Metals		190d	9:00 AM 4/6/16	5:00 PM 12/27/16	(854)
51	ST00350 Base Plates		3d	9:00 AM 4/6/16	5:00 PM 4/8/16	
52	ST00360 Structural Framing, Area 1	Area 1	8d	9:00 AM 4/18/16	5:00 PM 4/27/16	121
53	ST00370 Structural Framing, Area 2	Area 2	8d	9:00 AM 4/28/16	5:00 PM 5/9/16	242
54	ST00380 Structural Framing, Area 3	Area 3	10d	9:00 AM 5/10/16	5:00 PM 5/23/16	281
55	ST00390 Structural Framing, Area 4	Area 4	9d	9:00 AM 5/24/16	5:00 PM 6/3/16	210
56	ST00400 Plumb/ Bolt / Weld Area 1	Area 1	5d	9:00 AM 4/28/16	5:00 PM 5/4/16	
57	ST00410 Plumb/ Bolt / Weld Area 2	Area 2	5d	9:00 AM 5/10/16	5:00 PM 5/16/16	
58	ST00420 Plumb/ Bolt / Weld Area 3	Area 3	5d	9:00 AM 5/24/16	5:00 PM 5/30/16	
59	ST00430 Plumb/ Bolt / Weld Area 4	Area 4	5d	9:00 AM 6/6/16	5:00 PM 6/10/16	



24. The **3D Resources** columns for tasks **Plumb/Bolt/Weld Area 1-4** and **Structural Framing Area 1-4** will have the same number of assigned Resources, respectively. (i.e. **Structural Framing Area 1** and **Plumb/Bolt/Weld Area 1** will have 121 assigned **3D Resources**).

Adding Equipment

In this section you will learn how to add Equipment to your SYNCHRO Project.

One of the many benefits of 4D scheduling is the ability to visualize space allocation over time. In addition to construction models (buildings, sites, etc.), SYNCHRO gives you the ability to import equipment models such as concrete trucks, cranes, and excavators, and simulate their motion through and around the site.

13. Before starting section 13, please save and close your projects and open *Training Building Assigned.sp*. File location: C:\Users\Public\Public Documents\Shared SYNCHRO Projects\Tutorial Files\SYNCHRO Pro Training\.sp Files

The steps to do this are located in section 8.1.

13.1. Importing Equipment Models

SYNCHRO has a library of equipment model files that you can download for free by clicking the **Equipment Library** icon on the **Support** screen. The equipment models available in SYNCHRO's Equipment Library have been optimized for use in SYNCHRO, but you are welcome to import your own models if desired.

1. Select **File** tab → **Import** → **3D**.
2. Browse to locate the training models. File location: *C:\Users\Public\Documents\Shared SYNCHRO Projects\Tutorial Files\SYNCHRO Pro Training\Models*. By holding down the **Ctrl** key you can select multiple files for import. Select the following files:
 - Detailed Crawler Crane.dwf
 - Excavator.dwf
3. Select **Open**, then **Import**.
4. Activate **Assign to a new Resource**, then **Next**.
5. Change the name to *Equipment*.
6. Set the Resource Type to **Equipment** then **Next**.
7. Activate **Add Resources underneath, don't build tree** and select **Finish**.

The equipment models will be imported to (0,0,0) and will need to be moved to the correct locations.

13.2. Appearance Profiles for Equipment

You can use any **Resource Appearance Profile** when assigning equipment models to tasks, but creating a few especially for equipment may improve the appearance of the 4D sequence.

1. In **Navigator** → **Appearance Profiles**, create a new custom Profile by right clicking and select **Add**.
2. Rename the Profile **Equipment Install** and ensure it is highlighted.
3. In the **General** tab, ensure the **Action** is set to **Install**.
4. In **Active Appearance**, enable **Original Colour** by checking the box next to it (or change the colour if desired)
5. Create 2 more new **Resource Appearance Profiles** with these settings.

Name	Action	Active Appearance
Equipment Remove	Remove	Original Colour
Equipment Temporary	Temporary	Original Colour

These Resource Appearance Profiles may be used as follows:

- **Equipment Install:** for the first task a piece of equipment is assigned to, plus any tasks where the equipment should remain on the site after the end of the task.
- **Equipment Remove:** for tasks when the equipment should be removed from the site at the end of the task
NOTE: Equipment Install & Equipment Remove are typically used in conjunction with each other.
- **Equipment Temporary:** when the equipment is only on the site during the assigned to task – it will not be visible before the task starts or after the task ends.

Editing 3D Objects

In this section you will learn how to manipulate 3D objects by copying and pasting, translating, scaling, and rotating.

SYNCHRO provides control over geometry by allowing you to move, rotate, and scale 3D objects using graphic manipulators.

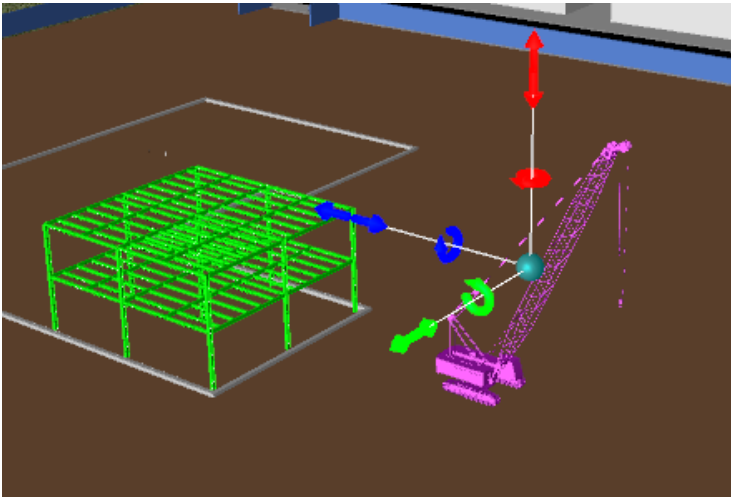
14.1. Move and Rotate (Simple Transform Manipulator)

14. We need to move the Crawler Crane to the location where it will be used. To do this, we will use the **Simple Manipulator**, which gives us the ability to laterally, horizontally, and vertically move the object. We can also rotate the object around an axis (X, Y, or Z) using the **Simple Manipulator**.

1. Unload the **Excavator** so that it's not visible in the 3D View while working with the Crane.
2. Select the **Structural Framing, Area 1** task and select **Plan → Focus → Center**.
3. Select the **Crawler Crane** in the 3D view so that it is highlighted.
4. Right click in the 3D view and choose **Edit → Transform**. The simple manipulator appears on the selected item. If no manipulator shows up, then use **M** key shortcut to change between the 3 manipulators.

NOTE: If the manipulator arrows are difficult to see or too close together, you can change the manipulator size in **Options → 3D View → Manipulator**.

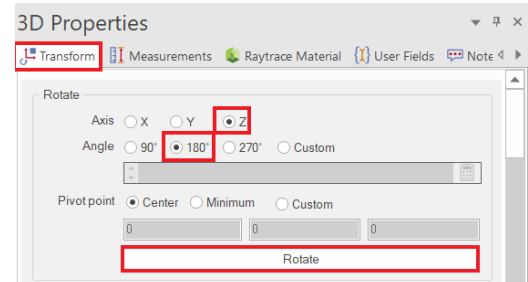
5. To use the manipulator, hover over the required arrow until it grows. Left click and drag to move the object along that axis. A semi-transparent preview of where the object will move to is shown. Release the mouse to place the object.
6. Move the Crawler Crane to the new location as shown:



7. Use the **Manipulator** to rotate the crane 180 degrees around the Z axis so that it is facing the building.



TIP: Alternatively, the **Windows ribbon → 3D Properties** window → **Transform** tab, can be used to rotate a selected object. For the crane, choose **Z** for the **Axis to Rotate**, **180°** for the **Angle to Rotate By**, and **Center** for the **Pivot Point** then select the **Rotate** button.

8. Press **Esc** on the keyboard to exit the manipulator and deselect the object.



14.2. Move, Rotate, and Scale (Advanced Transform Manipulator)

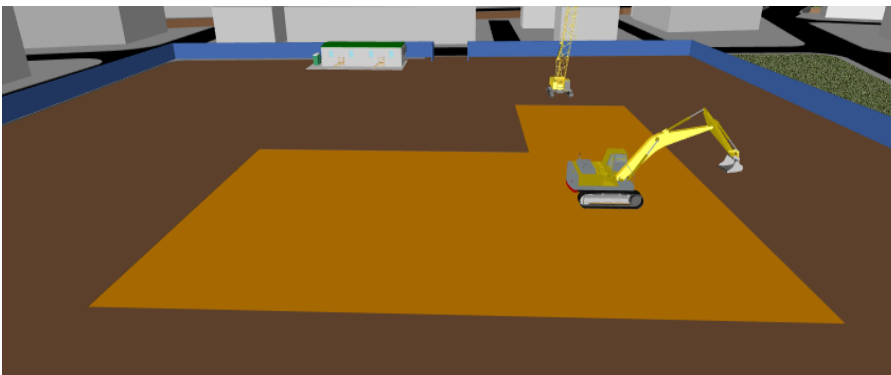
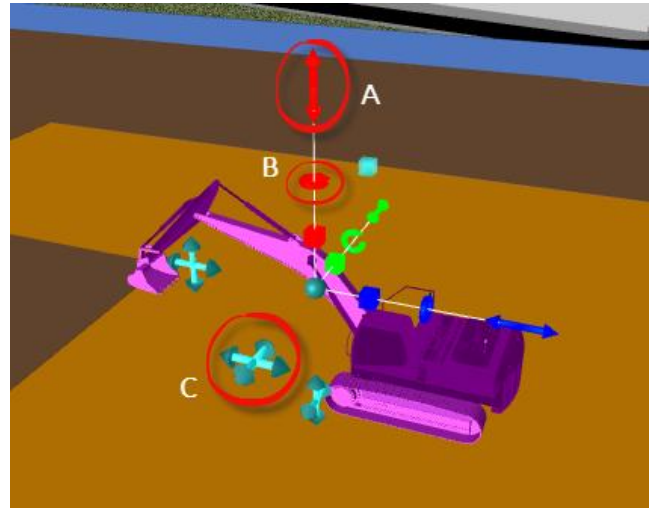
In addition to the **Simple Transform Manipulator**, there is also the option within **Edit** to use the **Advanced Transform Manipulator**. This has all the features of the Simple Manipulator but has the additional options to:

-  use plane axis movement.
- or
-  scale the selected object in a particular axis or overall.

To use the **Advanced Transform Manipulator**, select the required icon with left mouse button, then hold and move mouse to either translate or scale.

We will use the **Advanced Transform Manipulator** to move the **Excavator** to the correct location.

1. Load the **Excavator** from **3D Object** window.
 2. Select the **Foundation Excavation** task. In the **Plan** tab → **Focus** panel → **Start**, moves the Focus Time to the beginning of the excavation task.
 3. Select the **Excavator** in the 3D View.
 4. Right click in the 3D view and select **Edit** → **Transform** or use the **Ctrl+M** key shortcut to enable **Transform** mode, then Right click again and select **Edit** → **Switch Transform Manipulator**, or use **M** key shortcut.
 5. Use the Z axis translation icon (“A” in the image above) to move the excavator so it is sitting on top of the excavation surface.
 6. Use the Z axis rotation icon (“B” in the image above) or the **3D Properties** tab → **Rotate** tab to rotate the excavator 90° clockwise.
 7. Use the XY plane manipulator (“C” in the image above) to move the excavator to the edge of the excavation.
- The excavator should be located as shown below:



14.3. Align

Instead of manually moving the geometry to a rough location, we can use **Align** tab to precisely snap the Excavator to the top of the Excavation geometry.

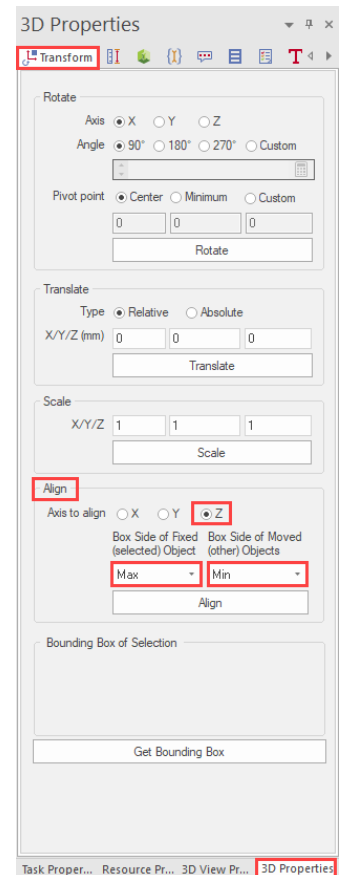
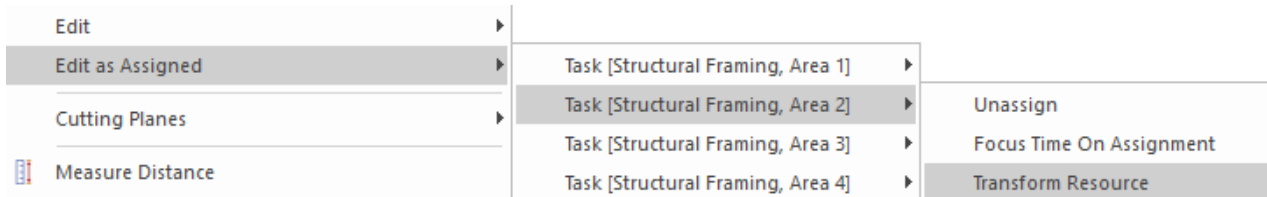
1. Select the **Excavator** and then select the **Excavation** geometry. The *first* selection defines which object will be moved to the *last* object selected.
2. Go to **Windows** → **3D Properties** → **Transform** → **Align**.
3. In the **Align** tab, specify the **Axis to Align the Boxes** (alignment is based upon the bounding box of the selected elements).
4. Specify whether near side (**Min**) of the box or far side (**Max**) of the bounding box should be aligned.
5. Select the **Align** button to align selection

14.4. Select the Crawler Crane and assign Edit as Assigned

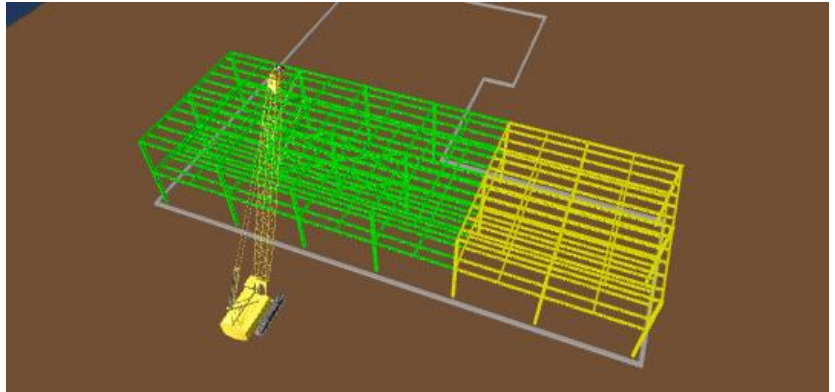
The **Edit** manipulator must be applied to an object before it has been assigned to any tasks. After an object has been assigned to a task, it can be moved using the **Edit as Assigned** manipulator. The **Edit as Assigned** manipulator allows you to vary the location, rotation, or scale of an object separately for each of the tasks it is assigned to.

The same Crawler Crane is to be used on all four **Metals** → **Structural Framing** tasks. It will need to be located in a different location for each of these tasks, so we will use the **Edit as Assigned** command.

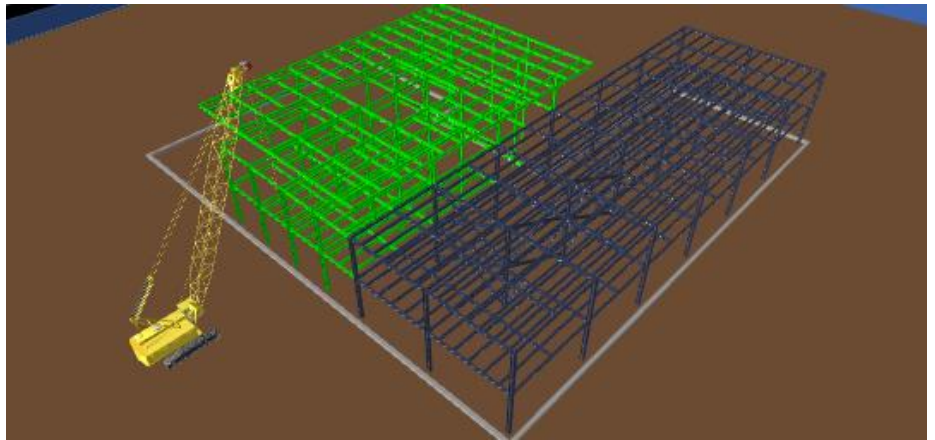
6. Select the **Crawler Crane** and assign it to **Structural Framing, Area 1; Structural Framing, Area 2; and Structural Framing, Area 3** using the **Equipment Install** Resource Appearance Profile.
7. Select the **Crawler Crane** and assign it to **Structural Framing, Area 4** using the **Equipment Remove** Resource Appearance Profile.
8. Select the **Crawler Crane** and right click in the 3D window and hover over **Edit as Assigned**. You will see a list of the tasks the selected 3D Resource is assigned to.
9. The Crawler Crane is already in the correct location for **Structural Framing, Area 1**, so select **Edit as Assigned** → **Task [Structural Framing, Area 2]** → **Transform Resource**.



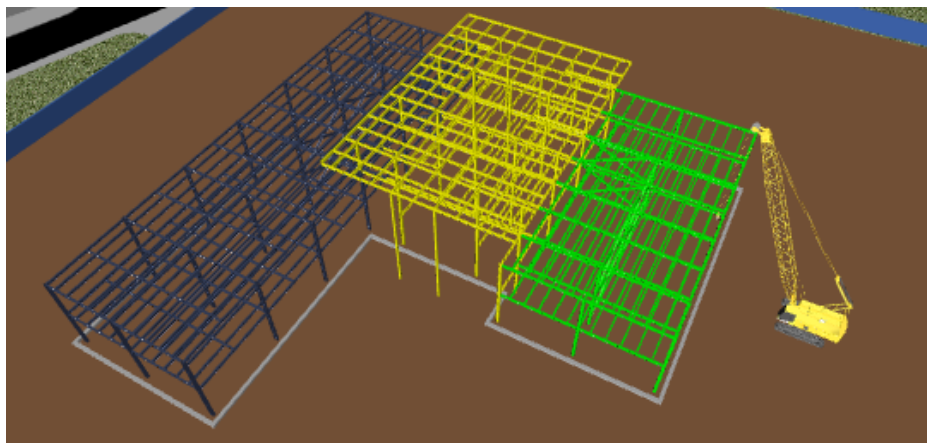
10. The **Focus Time** will snap to the centre of the task and the Manipulator will appear on the 3D resource. Use the M key to switch to the **Advanced Manipulator**, then use the XY plane manipulator and the Z axis rotation icon to move the crane to the centre of the active (green) section of framing and rotate it so it is facing the building as shown to the right.



11. Repeat steps 9 and 10 for **Structural Framing, Area 3** (shown right):



12. Again, repeat steps for 9 and 10 for **Structural Framing, Area 4** (shown right):



13. Beginning before the start of **Structural Framing, Area 1**, drag the **Focus Time** through all four Structural Framing tasks to see how the crane appears on site at the beginning of the first task, moves to a new location for each task, and then disappears from the site at the end of the last task.

3D Paths

In this section, you will learn how to create and edit a simple 3D path.

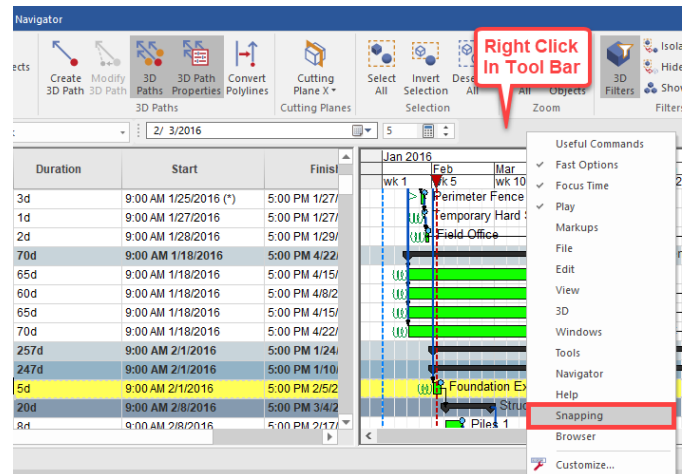
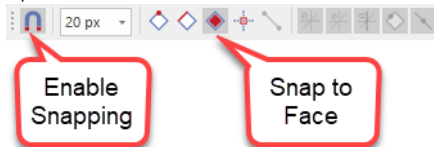
3D Paths can be created to show the planned movement of a piece of equipment or other object. We will create a 3D Path to show the **Excavator** moving during the **Foundation Excavation** task.

15.1. Create 3D Path

1. Select the **Foundation Excavation** task. In **Plan** tab → **Focus** panel → **Center**, moves the Focus Time to the middle of the excavation task.
2. In order to create a more accurate path, we can turn on **Snapping**. Right click in the **Tool Bar** under the Ribbon and enable the **Snapping** toolbar.

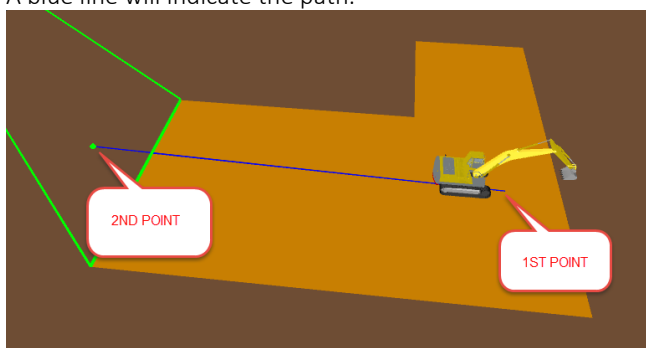
NOTE: The Snapping toolbar can also be opened by selecting the **Enable Snapping** command in the **3D** tab → **Edit** panel → **Enable Snapping**.

3. Ensure that **Enable Snapping** and **Snap to Face** are the only options turned on.



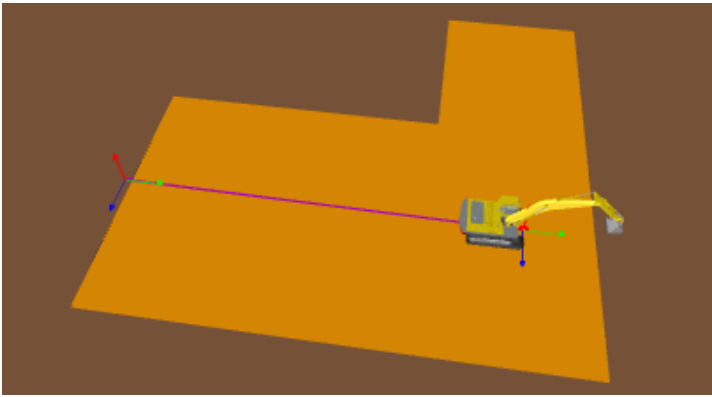
TIP: Before creating a 3D Path, click in the 3D window and press **Esc** on the keyboard to deselect all 3D objects. If an object is selected when a 3D Path is created, the first point on the path will be the center of the objects' bounding box.

4. Create a **3D Path**, **3D** tab → **3D Path** panel → **Create 3D Path** or right click in the 3D view and select **Create** → **3D Path** from the context menu.
5. As you move the cursor, object faces will be outlined in green and a green dot will preview where you can start the path. Move the cursor so that it is over the orange Excavation surface. Double left click to place the first point in front of the Excavator.
6. Double left click at the opposite end of the Excavation on the brown ground surface to place the second point. A blue line will indicate the path.



NOTE: To continue adding points to a path, continue double clicking where each vertex should be

7. Right click to finish the path.
8. Enter **Foundation Excavation** for the Path **Name**, then select **OK**.
9. The path will be listed in **Navigator** → **3D Paths** window and will be displayed in the 3D window.



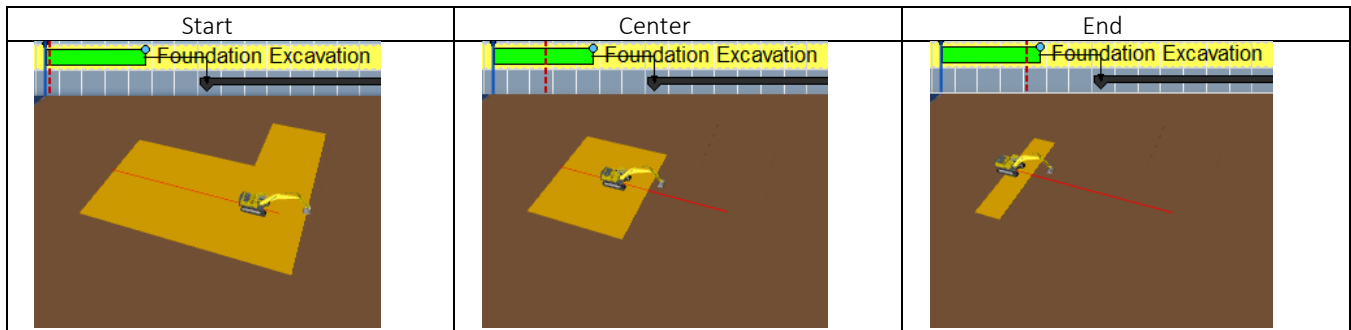
15.2. Assign 3D Path to a Resource

After a **3D Path** is created, it must be associated with a particular **Resource** that is assigned to a particular task. When that association is made, the resource will move along the path over the duration of the assigned task.

1. Select the **Excavator** in the 3D view and assign to the **Foundation Excavation** task using the **Equipment Temporary** custom **Appearance Profile** since this is the only task the excavator will be used for
2. Select the **Foundation Excavation** task, and expand **Task Properties → Resources**. You will see a list of the Resources assigned to the selected task.
3. Expand **Equipment** and select **Excavator.dwf** at the bottom level of the Resource tree so that it is highlighted in the list and in the 3D window
4. Scroll down in the **Task Properties → Resources** tab to see the **3D Path** panel.
5. From the drop-down list which is currently set to **<Empty>**, choose the **Foundation Excavation** path
6. Change the **Alignment** to **Z Max** so that the Excavator travels on top of the path.

3D Path	
3D Path	Foundation Excavation
Alignment	On Top (Z Max)
Centre	0.00, 0.00,
Reverse Direction	<input type="checkbox"/>
Adjust for Task Percent Compl...	<input type="checkbox"/>
Pause During Non-working Time	<input type="checkbox"/>
Motion Start	0.00
Motion End	100.00

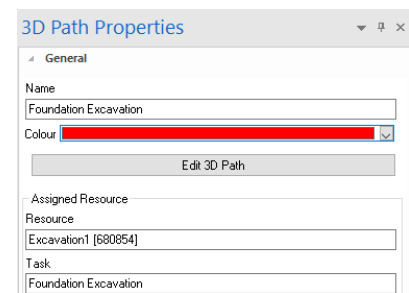
7. Click in the 3D window and press **Esc** on the keyboard to deselect the Excavator.
8. Drag the Focus Time through the **Foundation Excavation** task to see the Excavator move along the path
9. We can also apply a growth simulation to the Excavation so that the earth appears to be removed as the Excavator moves.
10. In **Navigator → Appearance Profiles**, right click the **Remove** System Profile and select **Add** which will create a new **Custom Profile** with the same settings in the General tab (ie. Action=Remove and Active Appearance Colour=orange). Name the new Profile **Excavation**.
11. In the **General** tab, set the **Growth Simulation** to **Front – Back**.
12. Select the Excavation 3D object and with the **Foundation Excavation** task selected, in **Task Properties** tab → **Resources**, change the **Appearance Profile** to **Excavation**.
13. Click in the 3D window and press **Esc** on the keyboard to deselect.
14. Now as you drag the Focus Time through the **Foundation Excavation** task you will see the earth being excavated as the excavator moves.



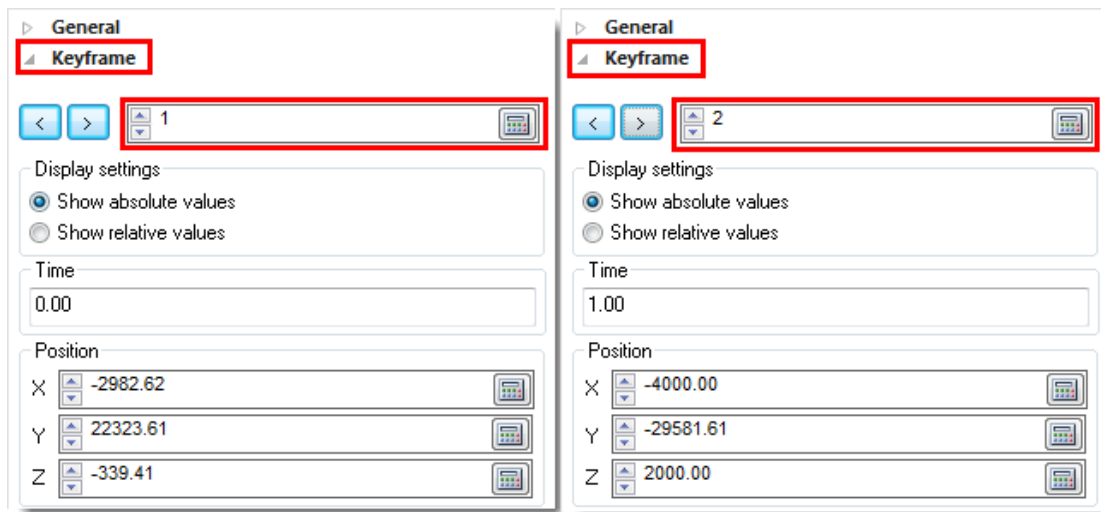
15.3. Edit 3D Path

When you create a **3D Path**, each point along your path is stored as a “Keyframe”. You can edit the values of these Keyframe coordinates to modify your path.

1. In Navigator 3D Paths, ensure that the **Foundation Excavation** path is selected
2. Open **3D Path Properties** from the 3D ribbon → 3D Paths panel
3. In the **3D Path Properties** → **General** tab, make sure the name is “Foundation Excavation”.

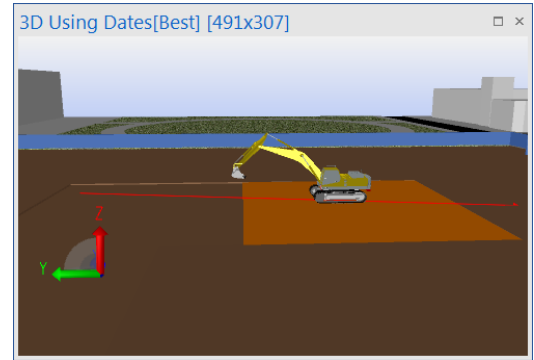


4. In the **3D Path Properties** → **Keyframe** tab, Keyframe 1 displays the starting point of the 3D Path and Keyframe 2 displays the ending point.

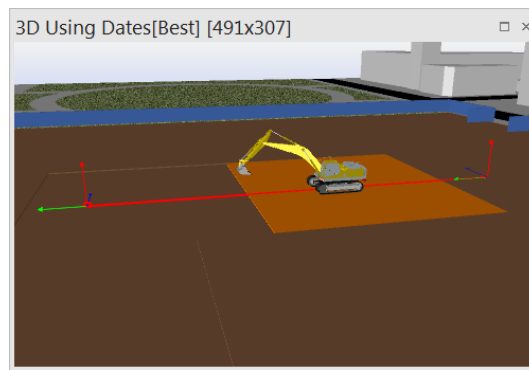
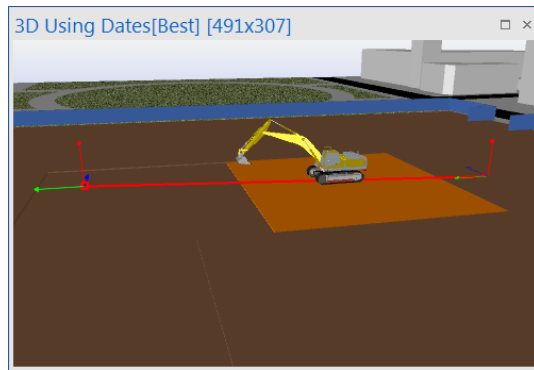


For this tutorial, we want the excavator to travel along a straight path to follow the R-L growth for the task **Foundation Excavation**.

5. Make sure your Axis Indicator is on if it is not already: In **3D View Properties**→**General**→**Visual Indicators** enable **Axis Indicator**.
6. In the **3D** ribbon →**Display Setting** panel, uncheck the box next to **View Cube Manipulator** to ensure you are looking at the axes. As you can see, we want the excavator to travel along the Y-Axis.
7. Check the box to show **View Cube Manipulator** again



8. Below you can see the original 3D Path(left) which is at an angle to the axis vs. the desired 3D Path (right) which is parallel to the axis.

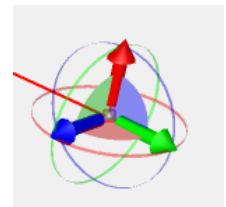


We need to change the X and Z values of Keyframe 2 to equal the values in Keyframe 1 for our 3D Path to travel along a straight line in the Y-Axis; only the Y value should vary.

9. Copy the X and Z values from Keyframe 1 and paste them over the X and Z values in Keyframe 2.
10. Keyframe 2 should now have the same X and Z coordinates as Keyframe 1, but a different Y Coordinate.
11. Move the Focus Time through the task to see the excavator move along the edited path.
12. To hide the 3D Path indicators in the 3D window, disable **3D Paths** in **3D View Properties**→**General**→**Visual Indicators**.



NOTE: You can also edit 3D Paths using the **3D Path Manipulator**. In the **3D Paths** tab right click on **Foundation Excavation** and select **Modify 3D Path**. You will see a Manipulator that you can drag, which will automatically update the coordinates of each Keyframe. Press the esc key in the 3D View to get rid of the 3D Path Manipulator.



Copy and Create 3D Objects

In this section, you will learn how to copy existing 3D objects in your SYNCHRO Project, or create brand new objects within the 3D View window.

16.1. Copy & Paste

16. SYNCHRO gives you the ability to copy and paste any object regardless of whether it was created in SYNCHRO or imported. This can be useful if you decide to add duplicate objects such as site offices or equipment after the model has been imported.

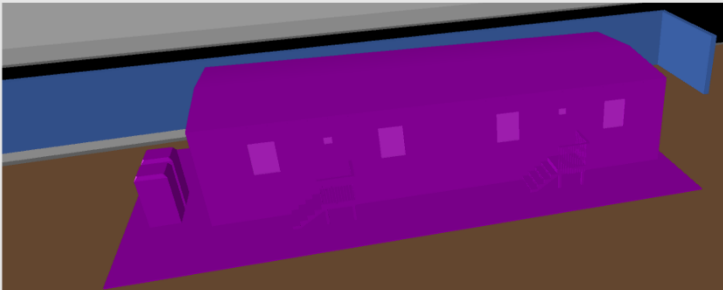
As an example, suppose it is decided that an extra site office is needed to accommodate the BIM team, but this office was not included in the original geometry file. We can simply copy one of the existing offices and move it to the new location.

1. In the **3D Filters** → **3D** tab, select **Clear All** to hide all objects, then show the **Site** file.
2. Select the tasks **Field Office** & **Temporary Hard Standing**, then right click on one of the tasks to **Select Assigned Resources**:

ID	Name	Duration	Start	Finish	3D Reso...
1	Office Building, Core & Shell	323d	9:00 AM 1/4/16	5:00 PM 3/29/17	(4826)
2	Pre Construction	20d	9:00 AM 1/4/16	5:00 PM 1/29/16	(17)
3	ST0... Notice to Proceed	0d	9:00 AM 1/4/16 (*)		
4	ST0... Building Permit	20d	9:00 AM 1/4/16	5:00 PM 1/29/16	
5	ST0... Award Subcontractors	10d	9:00 AM 1/4/16	5:00 PM 1/15/16	
6	ST0... Perimeter Fence	3d	9:00 AM 1/25/16 (*)	5:00 PM 1/27/16	13
7	ST0... Temporary Hard Standing	1d	9:00 AM 1/27/16	5:00 PM 1/27/16	1
8	ST0... Field Office	2d	9:00 AM 1/28/16	5:00 PM 1/29/16	3
9	Material Procurement	70d	9:00 AM 1/18/16	5:00 PM 4/22/16	

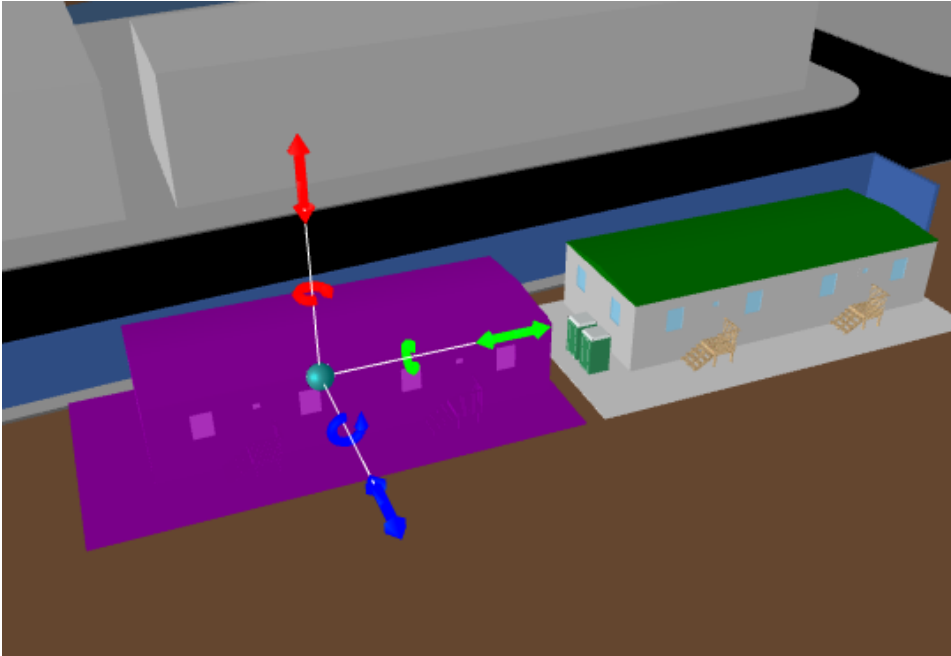
Support Gantt

3D Using Dates [Best] Colors [Appearance Profiles] [1364x540]



3. Right click in the 3D view and select **Copy** from the context menu.
4. Right click again and select **Paste**.
The copied site office & temporary hard standing will be created in the same location as the original site office and we will need to assign it a resource.
5. The **Resource Wizard** is displayed. Select **Assign to a new Resource**, then select **Next**.
6. Rename **BIM Office**, change the **Type** to **Material**, and then select **Next**.
7. Select **Assign to this Resource, don't build tree**, and then select **Finish**.
The copied site office will appear in the same position as the original one and we will need to move it to a new location.
8. With the **BIM Office** still selected, right click in the 3D view and choose **Edit** → **Transform**

- Move the new office to a new location as shown:



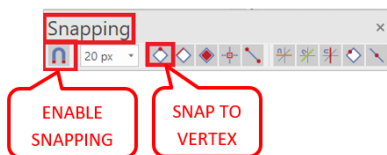
- Press **Esc** on the keyboard to exit the manipulator and deselect the object.
- Use the **Install** Appearance Profile to assign the **BIM Office** to the **Field Office** task.

16.2. Creating Objects

SYNCHRO is not a CAD authoring tool, but it does provide the ability to model a few simple objects (sphere, cylinder, box, and irregularly shaped extrusion). This can be useful to quickly model temporary site logistics such as material laydown areas.

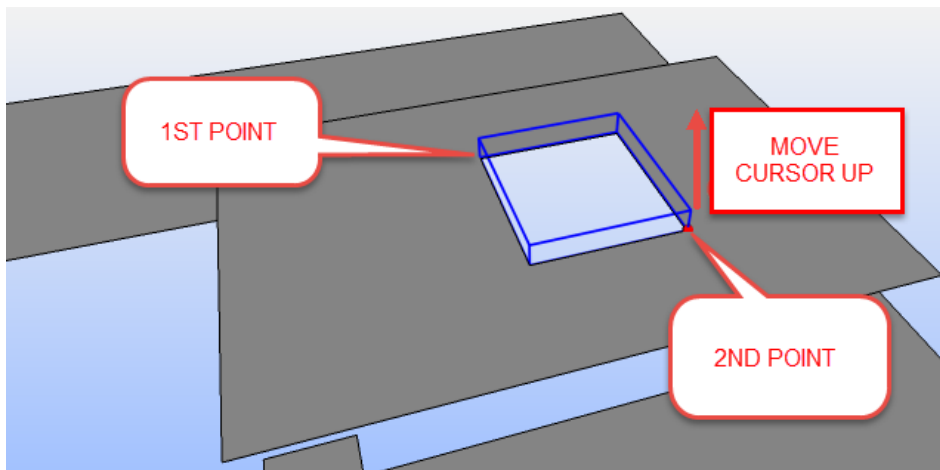
There is no 3D object for the **Temporary Roof at Skylight** task so we will create one in SYNCHRO. This will sit over the top of the opening on the high roof.

- In the **3D Filters** → **3D** tab, select **Clear All** to hide all objects, then show **Roofs** in the **Architecture** file.
- Move the **Focus Time** to the end of the project so all the objects are shown.
- We will ensure the correct snapping options are enabled. Snapping allows for precise input of object geometry. Disable all functions except for **Enable snapping** & **Snap to vertex**.

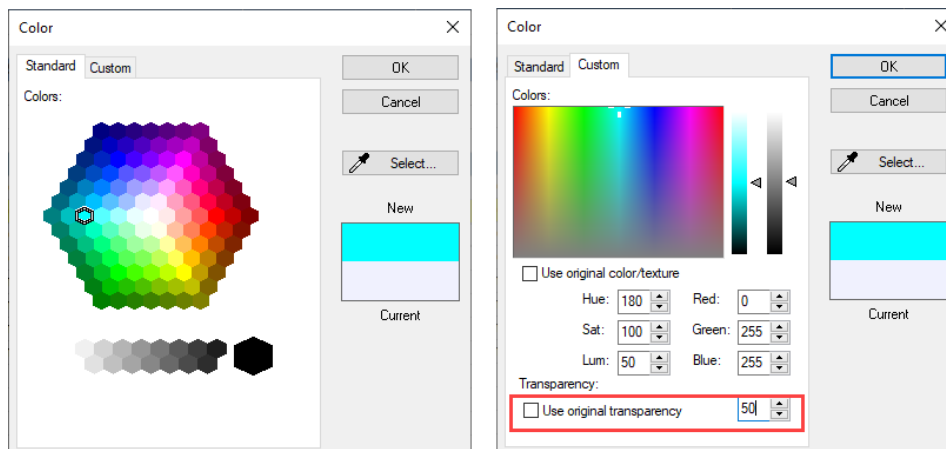


NOTE: To see the uses of other **Snapping Functions**, please visit the SYNCHRO **Help** file. To access the help documentation, select **Help** in the upper right corner of the screen or **Navigator tab** → **Options** → **Help**.

- Right click in **3D View** and select **Create** → **Box**.
- In the 3D window move the cursor to the corner until the red marker appears (as shown below) and left click to define the first corner.
- Then move the cursor to the opposite corner until the red marker appears and left click again to define width/length, then move the cursor up the define a height.



7. Enter **3D Object Name...** appears - change **New Box** to **Temporary Roof**. Select **OK**
8. At the **Resource Wizard** screen select **Assigned to a New Resource**, then **Next**.
9. At the **Enter Resource details** screen, select **Next**.
10. At the **Resource Creation** screen, select **Assign to this Resource**, don't build tree, and select **Finish**.
11. Select the **Temporary Roof** in the 3D View, right click and select **Edit → Colour**.
 - a. On the **Standard** tab, you can simply change the colour or use **Select** to pick a colour from an object in the 3D window.
 - b. On the **Custom** tab, you can change the colour and transparency by using the sliders to the right or the numeric entry.



12. In the **Standard** tab, change the colour to a light blue
13. In the **Custom** tab, disable **Use original transparency** and set the transparency to 50%, then select **OK**.
14. Click in the 3D View then press **Esc** on the keyboard to deselect the box and see the colour
15. Select the **Temporary Roof** object and assign to the **Temporary Roof at Skylight** task using the **Install** Resource Appearance Profile.

NOTE: Even though the roof is temporary, we are using the **Install** Profile because the task is for the *installation* of the Temporary Roof. The Temporary Roof will be assigned using a **Remove** Profile to remove the Temporary Roof when the Skylight is installed. The **Temporary** Profile should be used only when an object is used exclusively for the duration of the task it is assigned to.

Synchronising 3D Models

In this section, you will learn how to synchronise from an updated 3D Model file, check for new objects and assign them to tasks after synchronising.

When a design revision is made outside of SYNCHRO, it is possible to modify the 3D Models and still retain the assigned links between the tasks of the schedule and the objects of the model. This is called synchronising.

17.1. Optimizing 3D Synchronisation

In order to retain the previously established links between the current model and the project schedule inside of SYNCHRO upon synchronizing the updated model file with the current SYNCHRO Project, the updated model needs to be prepared to accommodate the design revisions. For optimal results, follow these four guidelines.

1. **Export** – All the objects that were originally imported into SYNCHRO will need to be exported from the CAD system again. Any objects that are deleted in the updated CAD file will be deleted in SYNCHRO upon synchronisation.
2. **Import** – All new objects will import into SYNCHRO when you synchronise, but they will need to be assigned to tasks.
3. **GUIDs** – All modified 3D data needs to have the same name and Global Unique ID (GUID) number so SYNCHRO recognizes it as the same item and will retain its assignment. GUIDs are created automatically by the CAD authoring system (or SYNCHRO plugins).

NOTE: You can change the geometry of an object as long as you don't delete it and then recreate it, which would assign a new unique ID, making it impossible to synchronise with the original object using GUIDs. Splitting an object into parts in the CAD system creates separate objects with new ID numbers, which will need to be assigned after synchronisation. An alternate user-defined unique identifier (e.g. unique part number User Field assigned in CAD authoring tool) can be used to synchronise instead of GUID if desired – this may be useful if the 4D model is advancing from early concept stages to later detailed stages and much of the geometry is being recreated or split – see the Help in SYNCHRO Pro for more information.

4. **File Name** – You can export the updated files from the CAD program with any file name, the original and revised models do not need to have the same file names for synchronisation.

TIP: If an object has been subdivided in SYNCHRO, those subdivisions will remain as long as the object ID in the CAD file is unchanged.

17.2. Synchronising 3D Models

1. To begin **synchronisation**, select the **Navigator** tab → **Project Data** panel → **External Data**.

NOTE: In the General panel, details about the original and last updated files can be checked.

2. Right click on *[Architecture.dwg] [Import] [mm/dd/yyyy]* and select **Synchronise From**.
3. **Browse** to *ArchitectureUpdated.dwg*, select **Open** and then **Next**. File location: *C:\Users\Public\Documents\Shared SYNCHRO Projects\Tutorial Files\SYNCHRO Pro Training\Models*
4. When synchronising a 3D Model, you will be presented with the same import settings that were set when you first imported the file. These settings should match the initial import settings in Section 5.1.
5. Select the **synchronise** button.

17.3. Identifying 3D Object Changes

After Synchronization, a report will appear summarizing the changes made (shown right). From this **Synchronisation Report**, we can see:

- a. 3D Objects have been deleted, (Notice: there are more old 3D Objects than new).

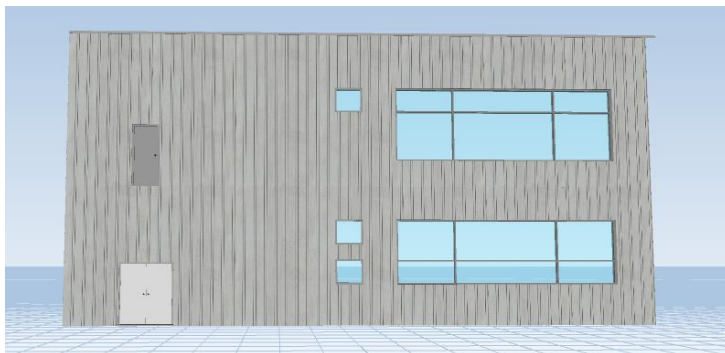
NOTE: When a 3D Object is deleted upon Synchronisation, the Object is removed from any Tasks it was assigned to.

- b. 65 Resources have lost their (3D) representations.

NOTE: This does not necessarily mean the associated 3D Objects were deleted; they may have been merged with other 3D Objects in the CAD file.

- c. No 3D Object Subdivisions were lost.
- d. 3D Objects that were deleted or merged in the CAD file are shown under **Unmatched 3D Object names**.

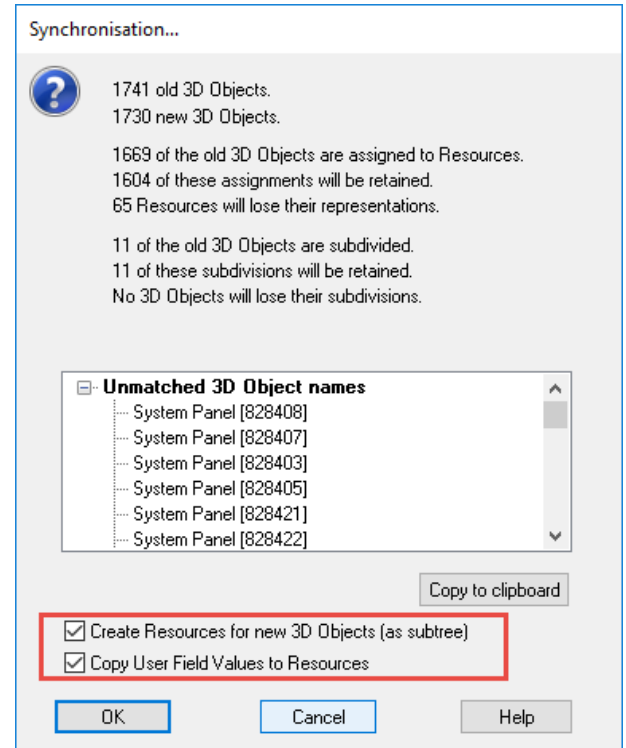
6. Check to **“Create Resources for new 3D Objects (as sub-tree)”** to automatically create Resources for new 3D Objects and put those resources in the existing resource tree. (Located at the bottom of the dialog). Select **OK**.
7. In **Navigator** tab → **4d Visualization** panel → **3D Filters** tab → **3D** tab, select to only show *ArchitectureUpdated.dwfx*
8. Drag the **Focus Time** back to the beginning of the project.
9. Right click in the 3D window and select **Zoom** → **Zoom All**.
10. You should see the below 3D Objects floating in mid-air. These 3D Objects were *added* during **Synchronisation** and have not yet been assigned to tasks.



NOTE: Any 3D Objects that have been added during **synchronisation** will not automatically be assigned to tasks. The easiest way to locate these objects is to go to the beginning of the project before anything has been installed.

For the purposes of this tutorial, please assign the exterior walls to the task **Exterior Metal Siding/ Backup Framing (Right)** and the exterior doors to the task **Exterior Doors, Frames, Hardware**.

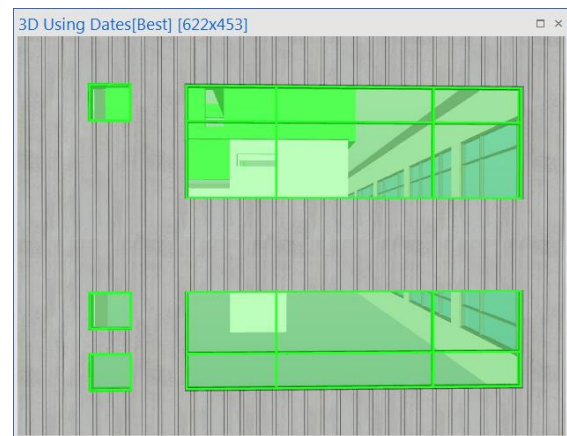
11. Select the windows and assign them to the task **Punched Windows (Right)**.



	ID	Name	Duration	Start	Finish	3D Resources
74		▲ Doors and Windows	98d	9:00 AM 8/19/16	5:00 PM 1/3/17	(1304)
75	ST00560	Exterior Doors, Frames, Hardware	4d	9:00 AM 10/3/16	5:00 PM 10/6/16	3
76	ST00570	Interior Doors, Frames, Hardware	6d	9:00 AM 12/27/16	5:00 PM 1/3/17	18
77	ST00580	Glass Entry Doors	7d	9:00 AM 9/7/16	5:00 PM 9/15/16	1
78	ST00590	Glass Curtain Wall (Front)	20d	9:00 AM 8/19/16	5:00 PM 9/15/16	812
79	ST00600	Punched Windows (Left)	4d	9:00 AM 9/16/16	5:00 PM 9/21/16	187
80	ST00610	Punched Windows (Back)	6d	9:00 AM 9/22/16	5:00 PM 9/29/16	276
81	ST00620	Punched Windows (Right)	1d	9:00 AM 9/30/16	5:00 PM 9/30/16	
82	ST00630	Punched Windows (Mechanical Room)	1d	9:00 AM 10/17/16	5:00 PM 10/17/16	6
83	ST00640	Glass Railings	4d	9:00 AM 12/27/16	5:00 PM 12/30/16	1

12. Right select the **Punched Windows (Right)** task in the Gantt chart, select **Focus Time on Task → Center**. You should see the following:

The new 3D Objects created during synchronisation have been correctly assigned, however this does not account for all 3D Object modifications that resulted from synchronisation. Remember, only 11 Objects were deleted, but 65 Objects lost their Resource assignments.



Let's compare the same section of the model before and after synchronisation. (For the purposes of this tutorial, please use the images below for this comparison). Notice below:



- In the **Original Model** (above left) there are 4 window pane sections (top & bottom)
- In the **Updated Model** (above right), there are only 3 of these window pane sections (top & bottom).

SUMMARY: The merging of the 2&3 window Pane sections accounts for the 3D Objects the recorded as deleted in the **Synchronisation Report**. If you select the individual Window Panes, as well as the metal borders, you will see that one window pane section is comprised of multiple 3D Objects. Ultimately, if the **Synchronisation Report** records deleted 3D Objects, this does not necessarily mean the Objects no longer exist.

Baselines & Synchronising Schedules

In this section, you will learn how to create a baseline of a current schedule and compare different schedules in side-by-side 3D windows. You will also learn how to Synchronise from an updated schedule.

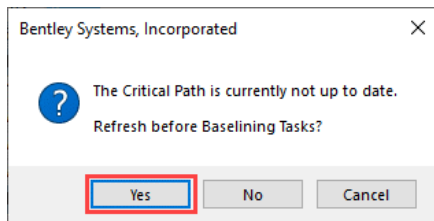
One of the benefits of SYNCHRO is the ability to quickly and easily bring in updates from an external scheduling program and see those changes reflected in the 4D model. If changes or progress updates have been made to the original source schedule;

- 18.e.g. in P6 or Microsoft Project, the updates can be brought into SYNCHRO using the **Synchronise From** command in **Navigator** ribbon → **Project Data** panel → **External Data**. This process is similar to Synchronising an updated 3D model file.

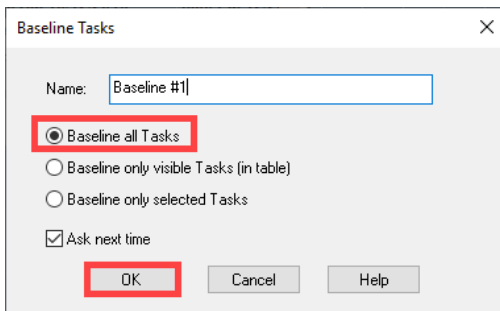
Before synchronising from the updated schedule, a **Baseline** (or copy) of the current schedule can be made in SYNCHRO. A baseline can be used to compare planned against actual in SYNCHRO. The Baseline saves the dates and durations for all selected tasks. After creating a Baseline, it can be displayed in the Gantt Chart in a separate colour. Additionally, the Baseline Start and Baseline Finish dates can be viewed in the Task List.

18.1. Creating a Baseline

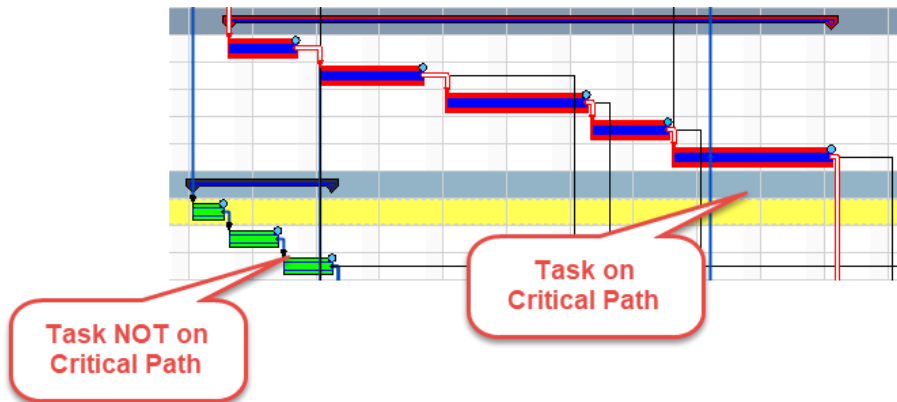
- To create a baseline, you have the option to select certain tasks to be baselined – this allows you to create a baseline of only part of a schedule if desired. To baseline the entire schedule, right click in the Task List and choose **Baseline Tasks** from the context menu.
- When the following message appears, select **Yes** to calculate the Critical Path.



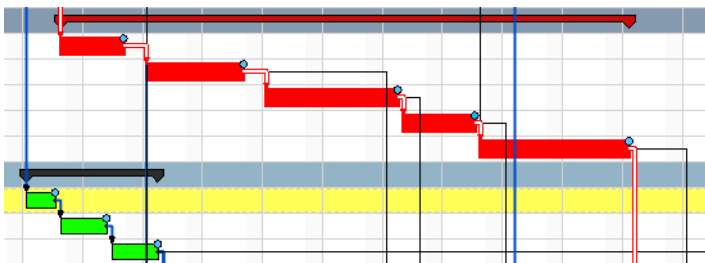
- The following dialog will appear. Choose **Baseline all Tasks** and then **OK**.
NOTE: The second option would result in a selection that excludes tasks hidden by a filter or a collapsed summary task.



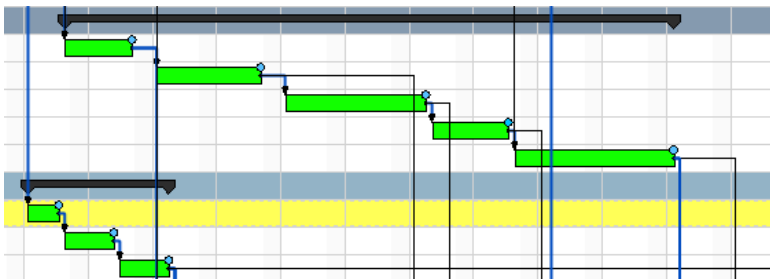
4. In the current schedule, the critical path tasks are white outlined in red, whereas tasks not on the critical path are solid green as shown below. The Baseline is directly over the current schedule, with critical tasks in solid blue, and non-critical tasks outlined in blue but hollow.



5. To turn off the **Baseline** display in the Gantt Chart go to the **Plan** tab → **Display** panel → **Gantt Display Options** → un-check **Baselines** and then OK



6. To turn off the Critical Path display, toggle off **Compute Critical Path** in the **Plan** tab → **Schedule** panel → **Compute Critical Path**.



The screenshot shows the 'Gantt Display Options' dialog box. The 'Task Grouping' section has 'WBS' selected. The 'Bar Colors' section has 'Task Status' selected. The 'Show Links' dropdown is set to 'On Screen'. The 'Indicators' section has several checkboxes: 'Spotlight' (unchecked), 'Hidden Link Warnings' (unchecked), 'Non-working Time' (checked), 'Planned Dates' (checked), 'Upstream Floats' (checked), 'Downstream Floats' (checked), 'Task Names' (checked), 'Progress Labels' (checked), 'Constraint Markers' (checked), 'Resource Markers' (checked), 'URL Markers' (checked), 'Early Tasks Progress Line' (checked), 'Late Tasks Progress Line' (checked), 'Proposed Dates' (checked), and 'Late Dates' (unchecked). The 'Baselines' checkbox is un-checked and highlighted with a red box.

18.2. Synchronising Schedules (Programmes)

To begin Synchronisation, select the **Navigator** tab → **Project Data** panel → **External Data**.

NOTE: All files imported or exported will be listed here. If you've imported multiple schedules, make sure you select the correct one.

Right click on *[Training Project Schedule.xml]* *[Import]* *[dd/mm/yy]* and select **Synchronise From**.

Browse to *Training Project Schedule Updated.xml*, select **Open** then **Next**. File location:

1. *C:\Users\Public\Documents\Shared SYNCHRO Projects\Tutorial Files\SYNCHRO Pro Training\Schedule*

When Synchronising a schedule, you will be asked to choose **Synchronise**, **Consolidate**, **Integrate**, or **Skip** for each of the different schedule attributes.

2.

3.

4.

Microsoft Project synchronize from

How would you like to import this file?

☒ Use the Selected Task to merge the data into the current Project

☐ Append the data to the end of the current Project

Choose how you would like to process each object

Object	Command
Tasks	Integrate
Links	Consolidate
Task constraints	Synchronise
Costs	Synchronise
Calendars	Integrate
Resources	Integrate
Resource assignments	Integrate
Activity codes	Integrate
Activity code assignments	Consolidate
User fields	Integrate
User field values	Consolidate
Resource codes	Integrate
Resource code assignments	Consolidate

Default Skip all

☐ Use these settings for all new synchronisations of this type

< Back Synchronise Cancel Help

NOTE: Schedule attributes are located in the **Object** column (shown left) and include: *Tasks, Links, Task constraints, Costs, Calendars, Resources, Resource Assignments, Codes assignments, User Fields, and User Field values*.

The Synchronisation options (**Synchronise**, **Consolidate**, **Integrate** or **Skip**) are explained in the chart below.

SYNCHRONISE

If you choose to **Synchronise**, the existing schedule in SYNCHRO will be completely replaced with the updated external schedule.

Outcome: External schedule takes precedence over SYNCHRO schedule when synchronising according to the following rules:

- Attributes **ADDED** externally → **ADDED** in SYNCHRO
- Attributes **DELETED** externally → **DELETED** in SYNCHRO
- Attributes **MODIFIED** externally → **MODIFIED** in SYNCHRO
- Attributes **ADDED** or **MODIFIED** in SYNCHRO → **OVERRIDDEN**

NOTE: The option to **Synchronise** is not available for P6 global objects (such as Calendars, Resources, Risks and Activity Codes) since these cannot be deleted.

CONSOLIDATE

If you choose to **Consolidate**, any schedule changes made externally or in SYNCHRO will still exist, **NOTHING IS DELETED**.

Outcome: Merges the External and SYNCHRO Schedules when synchronising

- Attributes **ADDED** externally → **ADDED** in SYNCHRO
- Attributes **MODIFIED** externally → **MODIFIED** in SYNCHRO
- Attributes **ADDED** or **MODIFIED** in SYNCHRO → **MAINTAINED**

INTEGRATE

If you choose to **Integrate**, any modifications made to the **selected** external schedule in SYNCHRO will be overridden. However, any additions to the schedule in SYNCHRO will be maintained.

Outcome: External schedule takes precedence over SYNCHRO schedule for all Attributes not originally created in the external schedule.

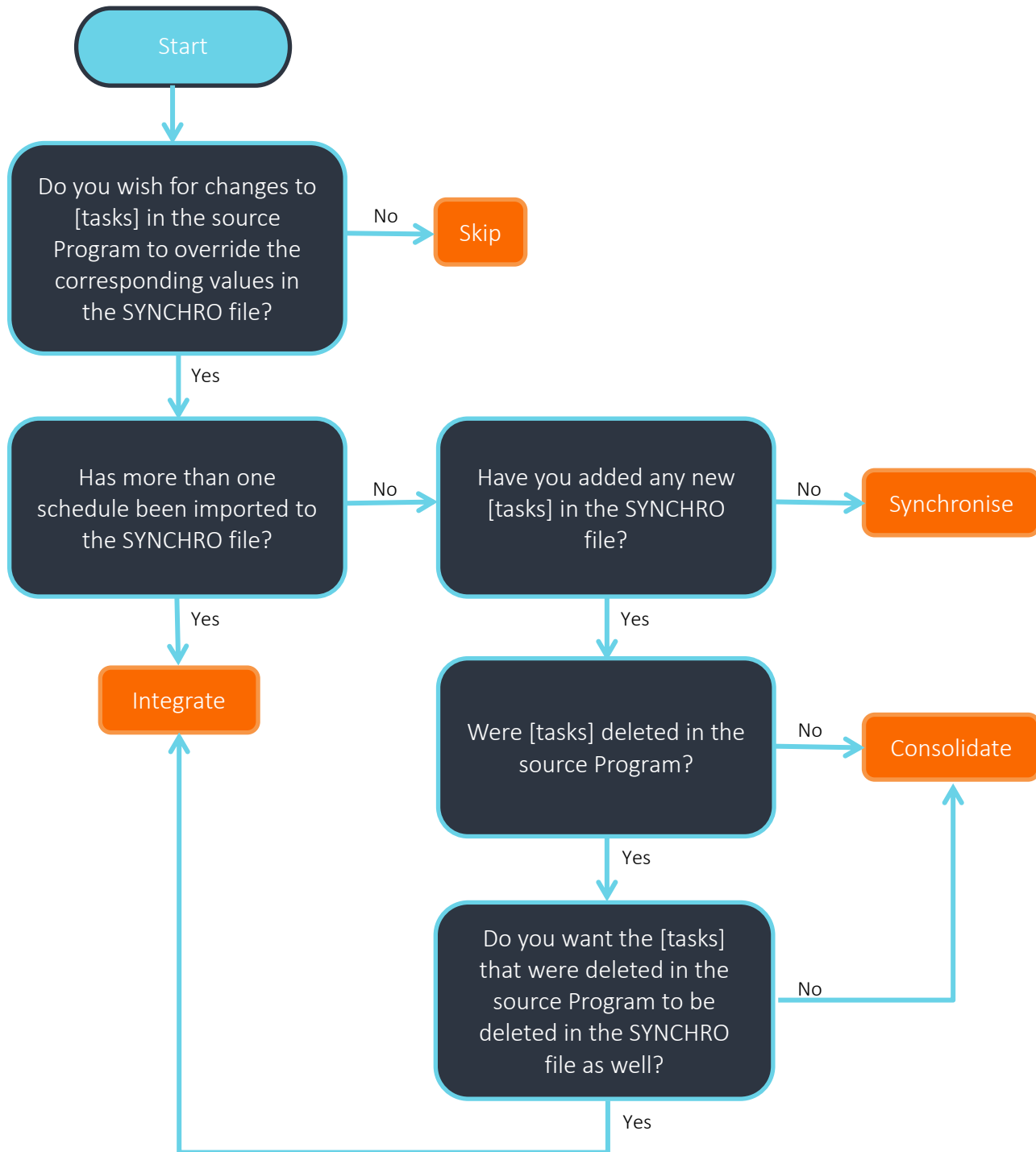
- Attributes **ADDED** externally → **ADDED** in SYNCHRO
- Attributes **DELETED** externally → **DELETED** in SYNCHRO
- Attributes **MODIFIED** externally → **MODIFIED** in SYNCHRO
- Attributes **ADDED** in SYNCHRO → **MAINTAINED**
- Attributes **MODIFIED** in SYNCHRO → **OVERRIDDEN**

NOTE: **Integrate** only affects schedule attributes associated with the selected schedule being Synchronised. Thus the option to **Integrate** is most commonly used when multiple schedules have been imported into SYNCHRO so no project data is lost upon Synchronisation. **Integrate** is the default choice for Resources and Resource Assignments. The option to **Integrate** is unavailable for Microsoft Project XML.

SKIP

If you choose to **Skip**, the associated attribute will not be modified or updated.

Use the following flowchart to determine whether to Skip, Synchronise, Consolidate, or Integrate each attribute. For each attribute (eg. Links, Calendars, etc.) substitute the attribute name wherever "[tasks]" appears in the flow chart.



SUMMARY: Any attribute that you have added or modified in SYNCHRO since importing will need to be considered. For example, if you have not created any tasks, calendars etc. in SYNCHRO but have just created Resources and Resource Assignments, those are the only two options that you will be required to Consolidate or Integrate instead of Synchronise to ensure that Synchronisation works correctly and that all assignments are retained.

See "[Appendix F: Synchronisation Scenarios](#)" for further information and to test your knowledge of these options.

Since we have added new tasks and links, created resources from 3D objects, and assigned resources to tasks, we should not use Synchronise for these options or else the changes made in SYNCHRO will be overridden with the changes in the **Training Project Schedule Updated.xml**. We can **Skip** attributes that are not contained in the schedule. Select **Skip All**, and then set your Synchronisation options as shown. **Integrate** will merge updates from the XML with new tasks created in SYNCHRO.

5.

Select the **Synchronise** button.

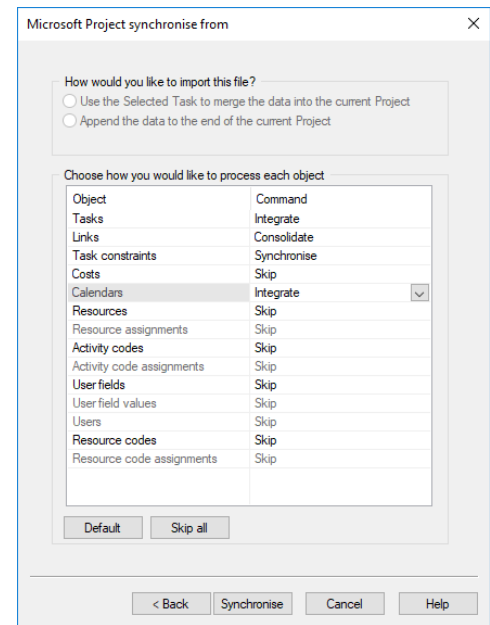
The **Synchronisation Report** indicates what has been updated. You can save this report for future reference if desired by selecting **Select All** followed by **Copy to Clipboard**.

6.

Select **Finish** to exit the report.

7.

8.



The **Data Date** has been updated (as indicated in the Gantt Chart by the blue dotted line)

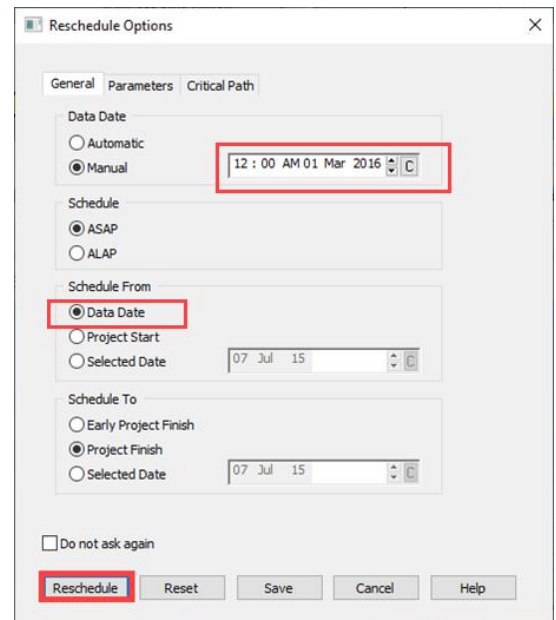
Select **F9** on the keyboard to access **Rescheduling Options**.

9.

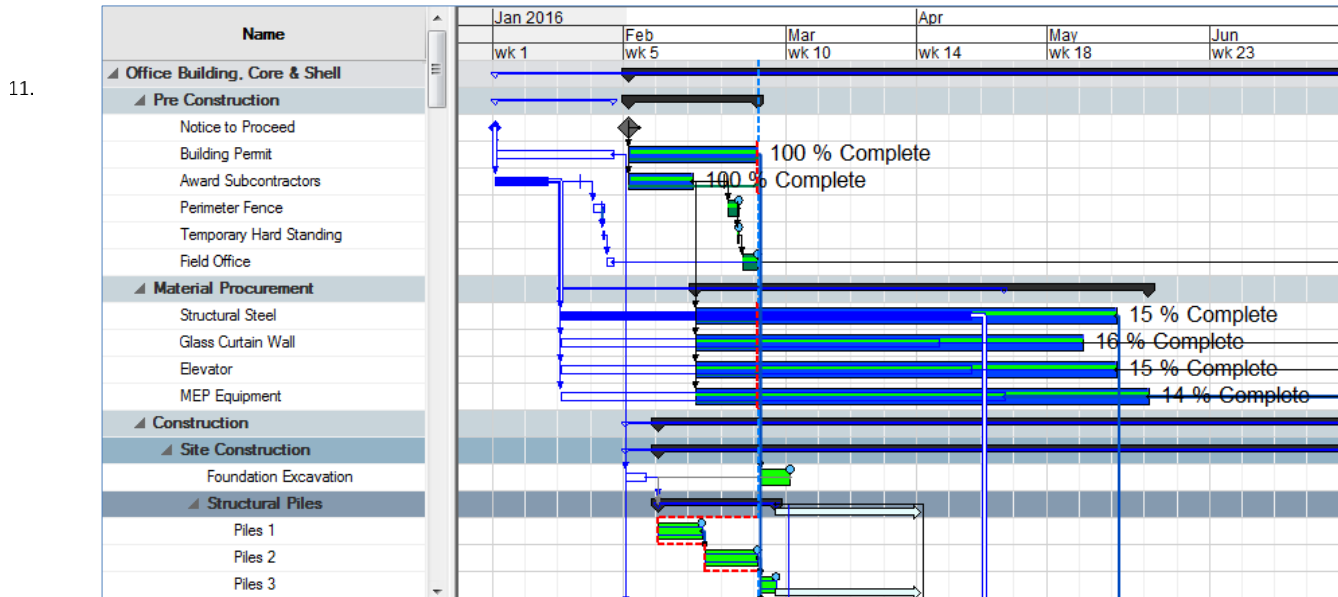
Ensure that **Schedule From** is set to **Data Date**. You can also view the new **Data Date**.

10.

Press **Reschedule** to update the tasks that were created in SYNCHRO



In **Navigator → Baselines and Scenarios**, select the **Original Schedule** to display it in the Gantt Chart and see how the schedule has changed. You can see that the **Notice to Proceed** has been delayed about a month, lag has been added between **Award Subcontractors** and the **Material Procurement** tasks have been updated for actual Progress.



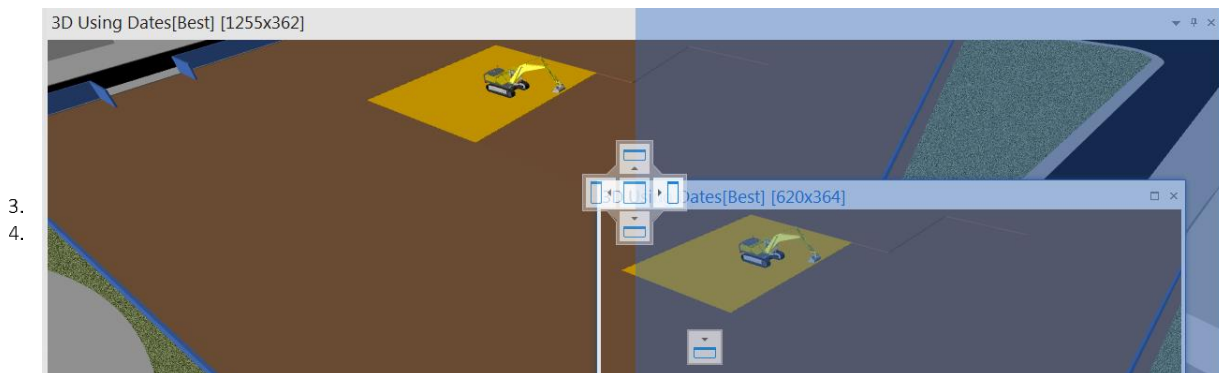
18.3. Compare Baselines using 3D Views

In addition to seeing the changes to the baseline in the Gantt Chart, it is possible to visually compare the baseline against the updated schedule in side-by-side 3D windows. Each open 3D Window can independently be set to use either Best, Actual, Planned, Proposed, Baseline or Original dates. This allows for the comparison of different baselines, baseline vs. planned, baseline vs. actual, actual vs. planned, etc.

1. From the **Windows** ribbon → **Common** panel select **3D** to create another 3D View (which is typically positioned above the first 3D View).
2. Left click in the title bar of the new 3D window and drag the new 3D window over the first 3D window, and release the mouse button over the right side of the smart window placement icon.



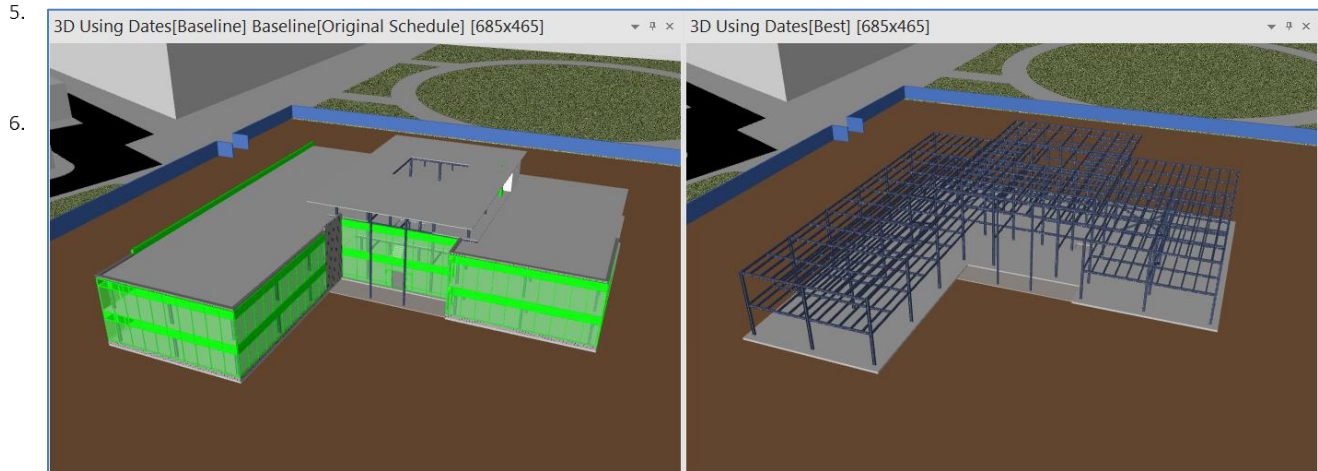
A preview of where the window will be placed will be shown before you drop it in place.



Right click one of the 3D views and select **Camera → Link All** so that the camera angle in both windows is the same. Modify one of the 3D views so that you can see the whole building.

→ Left-click in the first 3D View to select it. Then in **3D View Properties** → **General** → **Dates & Colours**, set **Dates to Use** to **Baseline**. From the Baseline field below, select **Original Schedule**. This will display the geometry in the window according to the baseline dates. The other window should be set to **Dates to use** → **Best Dates** by default which will show the current schedule.

Move the Focus Time through the Project to review how the new schedule (below right) compares to the baseline (below left). The **Dates to Use** setting for each window is displayed in the window title bar.



Click the **"X"** in the top of the 3D window using Baseline dates to close it.

7.

Cutting Planes

In this section you will learn how to create a cutting plane, which allows you to see a section or plane of your model in the 3D Window.

Cutting planes may be used for example, to view inside of a building or underground when working in SYNCHRO, when playing the Focus Time, or when exporting an animation.

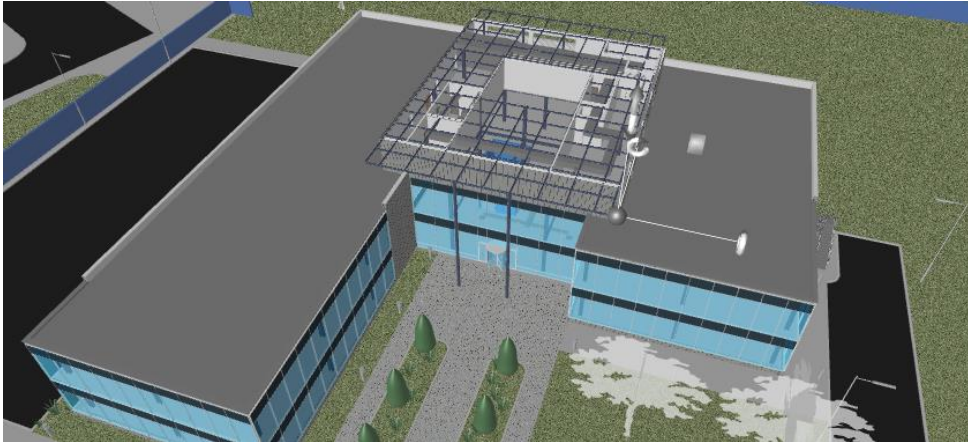
19.

Ensure that the **Focus Time** is at the end of the Project and all objects are shown.

Right click in the 3D window and select **Cutting Planes → Cutting Plane Z**.

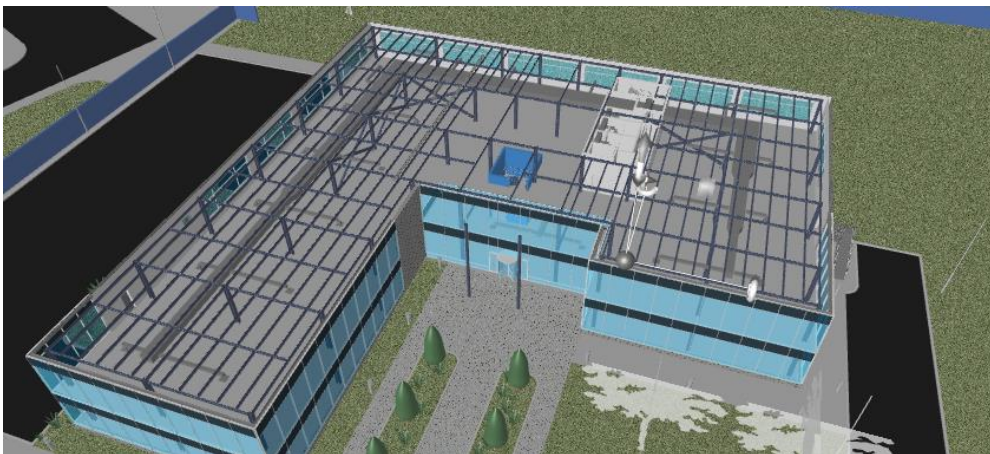
Left click to place the cutting plane on the roof which will appear as shown below.

- 1.
- 2.
- 3.



NOTE: To set a **Cutting Plane**, you must click on an object, not in empty space.

4. A simple manipulator appears. Move the cursor over the manipulator until the vertical icon 'grows' then hold down the left button and drag the cutting plane up and down in the Z direction, so that you can see into the Level 1 space.



In the **3D View Properties** window → **Cutting Planes** tab, notice the **New Cutting Plane** listed.

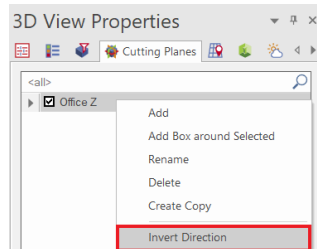
Left click on **New Cutting Plane** and rename it to **Office Z**.

The plane can be turned on/off by enabling/disabling the check box.

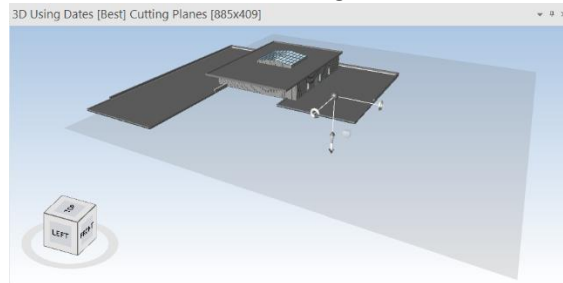
The **Show Plane** and **Show Manipulator** check boxes allow you to hide these visual indicators in the 3D view, while still applying the cutting plane.

This may be useful when exporting an animation, for example.

Right click on **Office Z** and you will see the following options.

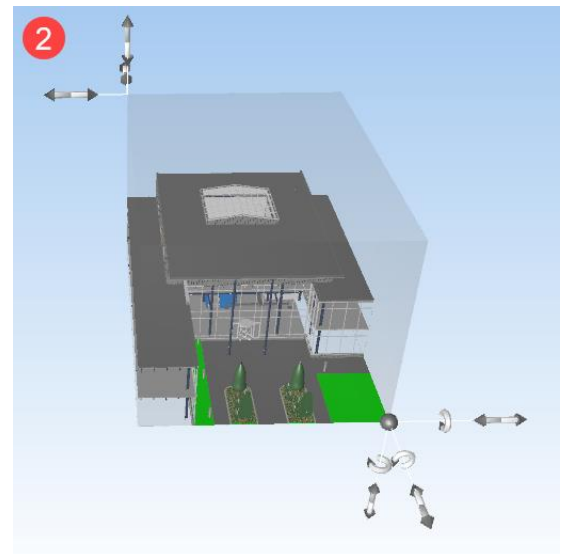
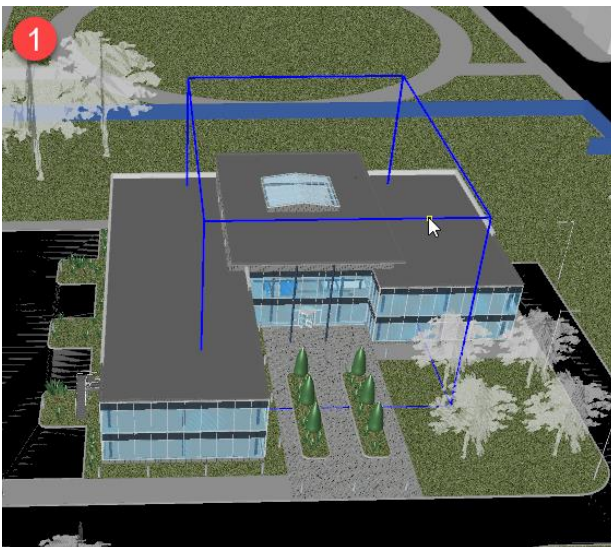
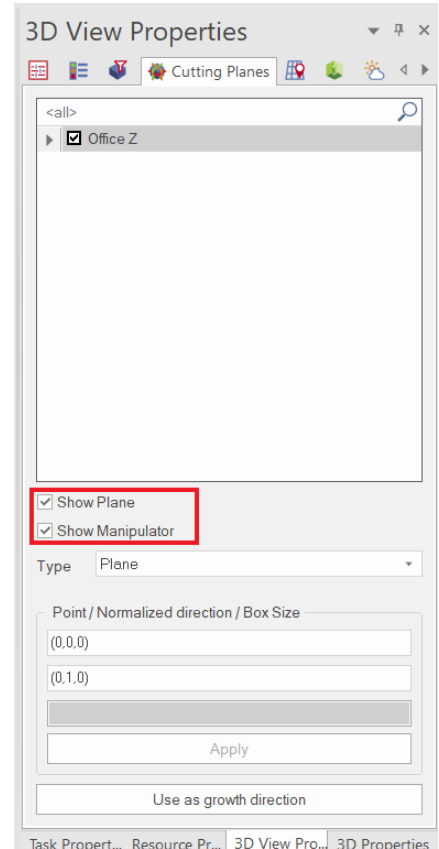


Select **Invert Direction** to change the direction of the cutting plane.



Invert Direction once again to revert back.

NOTE: X and Y cutting planes can also be created, cutting planes can be rotated off-axis, and multiple cutting planes can be applied simultaneously using a **Cutting Box**. Right click in the 3D window and select **Cutting Planes** → **Cutting Box**. Left click to draw the opposite corners of a square and then a third time to define the height. A cutting box is created which can be edited using the manipulator shown



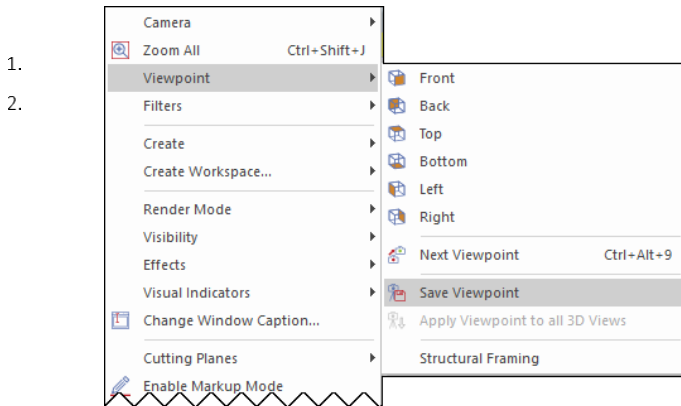
Viewpoints

In this section, you will learn how to create and save a Viewpoint.

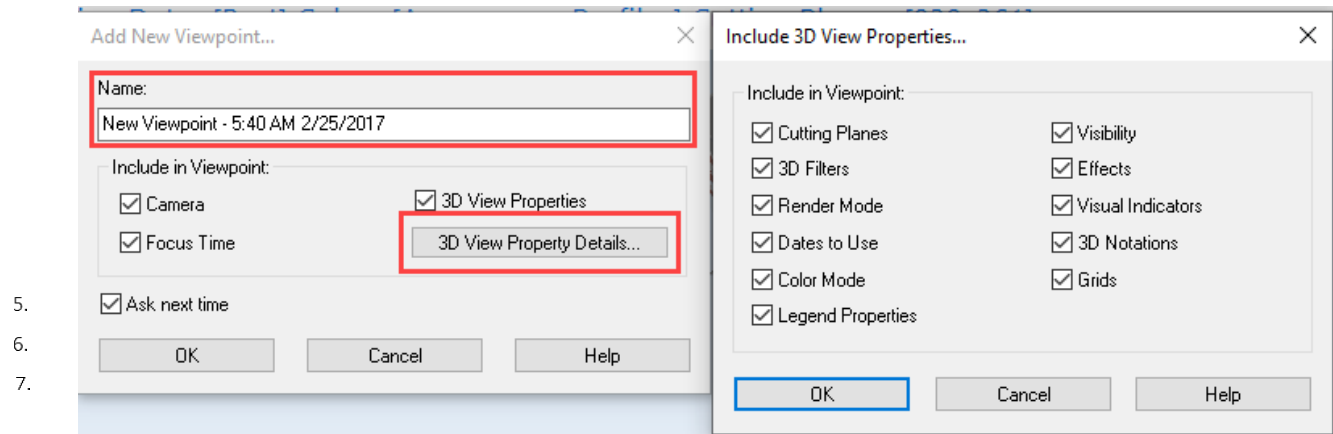
Viewpoints can store **Focus Time**, **Camera Angle**, and **3D View Properties** including applied **3D Filters**, and **Cutting Planes**. A saved **Viewpoint** can be reactivated at any point in one or all 3D windows. This can be useful for returning to a particular time or view after updating a schedule or model to see what has changed, or to quickly jump to points of interest when presenting to stakeholders.

Adjust the camera angle to a desired view and move the Focus Time to a particular moment in time.

Right click in the 3D window and choose **Viewpoints** → **Save Viewpoint**



3. A dialog will be raised. Change the name to something descriptive
4. Press **3D View Property Details...** to open a second dialog to choose which properties to save with the Viewpoint. For properties not saved with the Viewpoint, the current property will not be changed when the Viewpoint is applied. This can be useful for example if you want to save only a camera angle (e.g. the location of a webcam on the site) and return to it many times, or if you want to save only the 3D View Properties that you like to use for presenting review sessions.



When finished, press OK

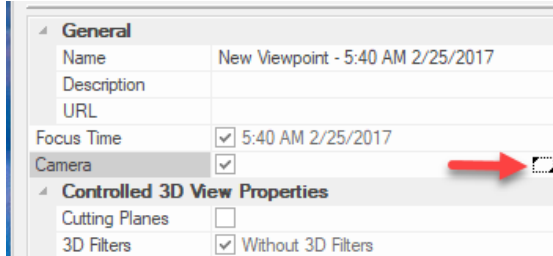
This will create a new viewpoint in **Navigator** ribbon → **Viewpoints** window

To see how Viewpoints work, change the Focus Time in the Gantt Chart, and then edit camera angle and turn off the Cutting Plane in the 3D window.

To return to the saved Viewpoint, in the **Navigator** ribbon → **Viewpoints** window simply double click on the Viewpoint name, or select the Viewpoint name and press the **Activate in selected 3DView** button located below the list of Viewpoints

NOTE: If you update the Camera Angle, Focus Time, or any of the 3D View Properties and wish to resave with the new values, select the property you wish to update and then press the button as shown below -

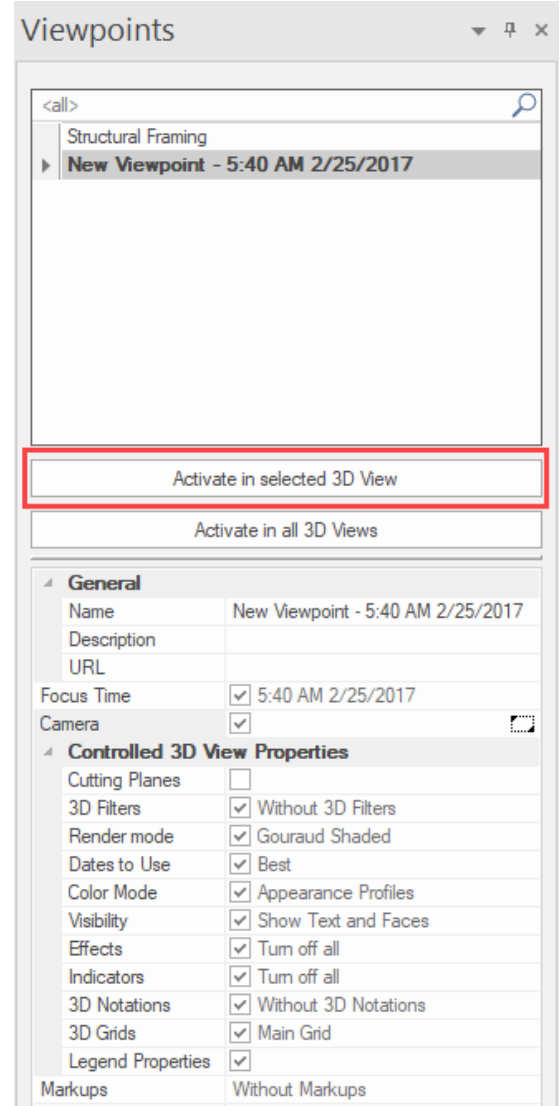
8.



General	
Name	New Viewpoint - 5:40 AM 2/25/2017
Description	
URL	
Focus Time	<input checked="" type="checkbox"/> 5:40 AM 2/25/2017
Camera	<input checked="" type="checkbox"/>
Controlled 3D View Properties	
Cutting Planes	<input type="checkbox"/>
3D Filters	<input checked="" type="checkbox"/> Without 3D Filters

You can turn on/off any of the features for a selected viewpoint under **Controlled 3D View Properties**.

9.



Viewpoints

<all>

Structural Framing

▶ New Viewpoint - 5:40 AM 2/25/2017

Activate in selected 3D View

Activate in all 3D Views

General	
Name	New Viewpoint - 5:40 AM 2/25/2017
Description	
URL	
Focus Time	<input checked="" type="checkbox"/> 5:40 AM 2/25/2017
Camera	<input checked="" type="checkbox"/>
Controlled 3D View Properties	
Cutting Planes	<input type="checkbox"/>
3D Filters	<input checked="" type="checkbox"/> Without 3D Filters
Render mode	<input checked="" type="checkbox"/> Gouraud Shaded
Dates to Use	<input checked="" type="checkbox"/> Best
Color Mode	<input checked="" type="checkbox"/> Appearance Profiles
Visibility	<input checked="" type="checkbox"/> Show Text and Faces
Effects	<input checked="" type="checkbox"/> Turn off all
Indicators	<input checked="" type="checkbox"/> Turn off all
3D Notations	<input checked="" type="checkbox"/> Without 3D Notations
3D Grids	<input checked="" type="checkbox"/> Main Grid
Legend Properties	<input checked="" type="checkbox"/>
Markups	Without Markups

Animations

In this section, you will learn how to create and edit an animation and export it to a video.

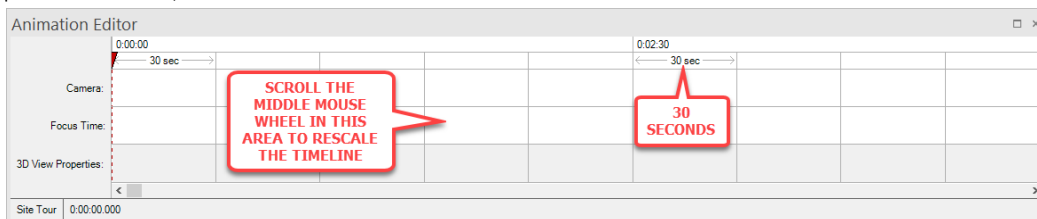
21. Having created your 4D schedule within SYNCHRO it is also possible to create a scheduling animation that can be communicated to third parties or exported as a video and used as presentation material (without the need to install SYNCHRO). Animations can show an overview of the whole project, or you may prefer to create an animation that focuses on a few tasks or a few days of construction (e.g. a particularly complicated sequence). Animations can also be used to export a series of still images and tables over a period of time for inclusion in a report.

21.1. Creating an Animation

For practice, we will create a basic overview animation that spans the entire duration of the project with a camera that slowly spins around the outside of the building.

In order to avoid clipping the sides of the view when exporting the animation, set the 3D window to roughly the same aspect ratio as the desired output before creating the animation. To do this, undock the 3D window by double clicking in the header bar or left clicking and dragging.

1. In **3D View Properties** → **General**, expand **3D Window Size** and set the **Width** to **800** and **Height** to **450** (or approximately 16:9 ratio to suit the size of your screen).
2. From the **4D Review** ribbon → **Animations** panel open the **Animations** window. In the **Animations** window, right click and select **Add** to create a new animation.
3. Select the **New animation**, right click to rename it **Site Tour** and ensure that it is highlighted.
4. From the **4D Review** ribbon → **Animations** panel, open the **Animation Editor**.
5. Move the cursor into the Animation Editor (do not left click!) and roll the mouse wheel to rescale to the required timescale, in this case 30 seconds.
- 6.




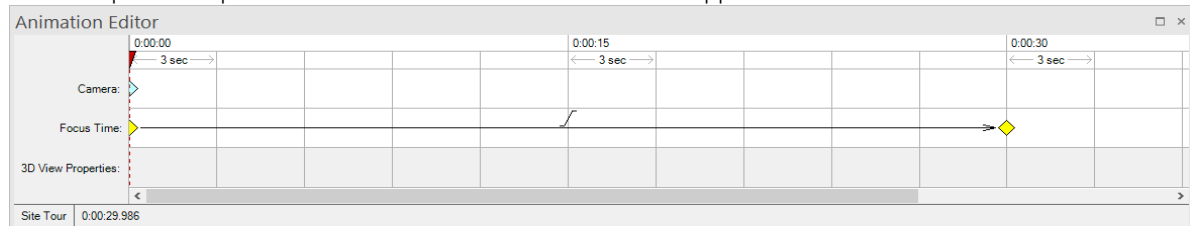
Animations are made of a series of **Keyframes** which define the viewpoint (camera-angle, position and zoom) and contents (Focus Time), and 3D View Properties of the 3D window at a given point in time within the Animation.

7. A **Keyframe** is added by left-clicking in the **Camera**, **Focus Time**, or **3D View Properties** channels in the **Animation Editor**. The added Keyframe records the current settings of the camera, Focus Time, or 3D View Properties. Camera
8. Keyframes are marked by a blue diamond in the Camera animation channel. Focus Time Keyframes are marked by a
9. yellow diamond. 3D View Properties Keyframes are marked by a brown diamond
- 10.
11. To define the start of the animation; move the **Focus Time** in the **Gantt Chart** to just before the start of the project. **Left Click** in the focus time channel of the animation editor at 0 sec. A yellow Keyframe marker will appear. To define the end of the animation move the focus time in the Gantt chart to just after the end of the project. **Left Click** in the focus time channel in the animation editor at 30 sec. Another yellow Keyframe marker will appear. Select and drag the red **Focus Time Marker** in the animation editor to review the stored timeline. This can also be done with the options in the **4D Review** ribbon → **Play Mode** panel → **Play Animations**. Then in the **Player** panel click **Move to Start** followed by **Play**.

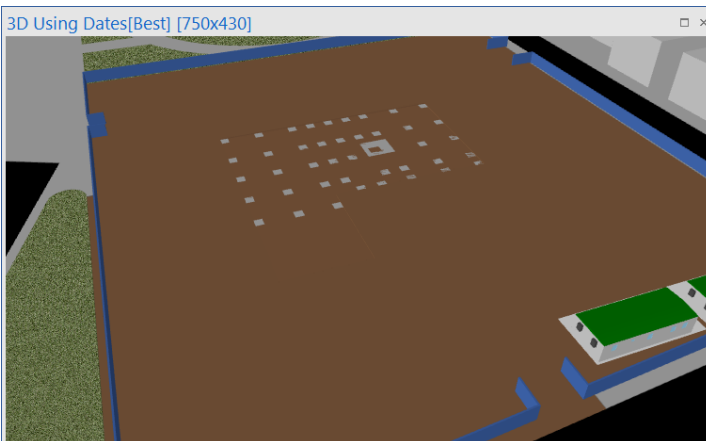
Modify the 3D window to show the entire site as shown.



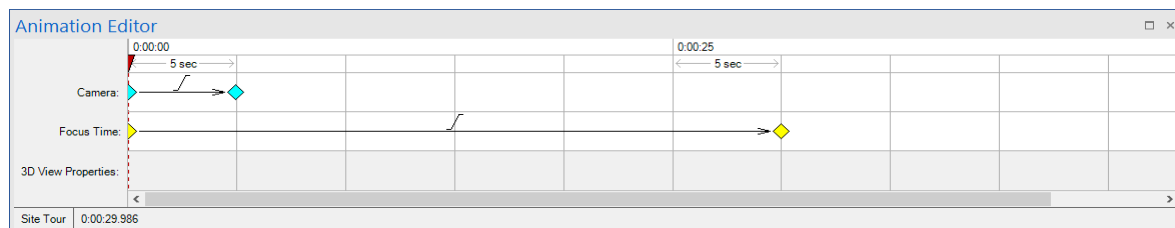
To create a Camera viewpoint left click in the camera channel of the animation editor at 0 sec. This defines the view at a particular point in time. A blue Camera marker  will appear.



Move the **Focus Time Marker** in the **Animation Editor** (not the Gantt Chart) forward to about 5 seconds. Modify the 3D view by zooming into the work area as shown.

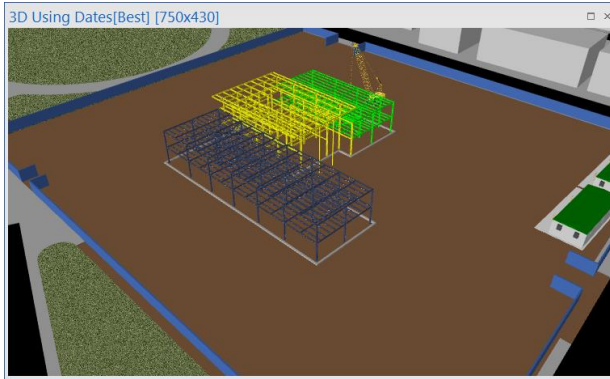


Left click in the camera channel of the animation editor at 5 seconds to set this view at this time.



Move the **Focus Time Marker** in the animation editor forward to 10 seconds.

Modify the 3D view by orbiting around to the side of the building as shown.



18.

Left click in the camera channel of the animation editor at 10 seconds to set a view at this time.

Repeat steps 17 – 19 four times in order to orbit around the entire building setting camera points every 5 seconds.



19. Review the animation by dragging the **Focus Time Marker** in the animation editor or by going to the **4D Review**
 20. ribbon → **Play Mode** panel → **Play Animations**. Then in the **Player** panel click **Move to Start** followed by **Play**.

21. **TIP:** Click in the 3D window, then press the space bar on the keyboard to play and stop the Animation.

TIP: The 3D View Properties channel can be used to change the 3D View Properties during an animation, for example, to turn off and on Cutting Planes, Legends, or 3D Filters. To learn more about using the 3D View Properties channel, refer to SYNCHRO Help (F1).

21.2. Editing the Animation

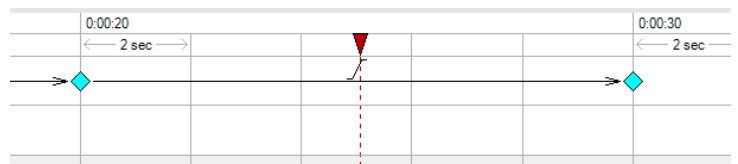
After reviewing the animation you may find that you need to edit some of the camera angles.

1. In the Animation Editor (not the Gantt Chart), move the red Focus Time line to the Camera keyframe you want to edit
2. to edit
3. Right click on the blue marker  in the camera channel and select **Snap To Viewpoint**.
4. Modify the 3D window to get the desired camera angle.
 Right click on the blue marker  in the camera channel and select **Use Current Viewpoint**.

5. **NOTE:** **Snap to Focus Time** and **Use Current Focus Time** work similarly.

You can also edit the animation by adding more points.

6. Drag the **Focus Time** line in the Animation Editor to
7. a point in time in the middle of two of the camera nodes.
 Modify the 3D window accordingly.
8. Left click in the camera channel of the Animation Editor where the **Focus Time Marker** intersects the camera channel.



Sometimes long tasks or gaps in the work may want to be condensed to speed them up and short tasks expanded to slow them down. If this is the case then this can be done in the Focus Time channel.

Add additional **Focus Time** Keyframes at the beginning and end of a sequence you want to speed up or slow down. (i.e. add Keyframe 1 at the beginning of a task and Keyframe 2 at the end of a Task)

To move a Keyframe, hover over it until a double arrow appears. Left click and hold while dragging to move. Move **Focus Time** Keyframes closer together to speed up the activities in between. Move them farther apart to slow down time in the animation.

NOTE: If you move a Keyframe and want following Keyframes to move with it, hold down **Shift** when you are moving the Keyframe.

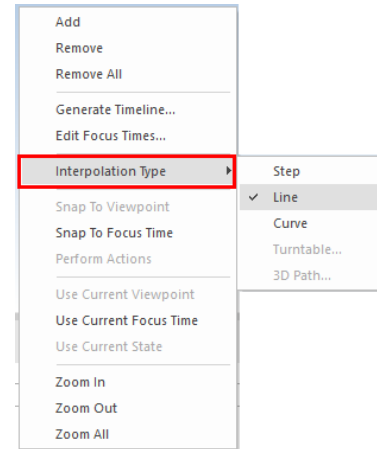
9. **TIP:** If many Keyframes appear to be overlaid, scroll the mouse wheel forward to zoom in on the timeline.

21.3. Interpolation

At the end of the animation you may want to rotate the project for a final overview (or you can use this feature at any time in your animation). This is achieved using a **Turntable** camera interpolation.

Interpolation defines how the Animation transitions between Keyframes. The term interpolation is used to describe the transition from one state to another, which for a **Camera** is from one position and angle to another, or for **Focus Time** is one point in time to another. The **Interpolation Type** dictates how the transition is achieved and includes **Curve**, **Line**, **Step**, **Turntable**, and **3D Path** options. By default, **Interpolation Type** is set to **Line**.

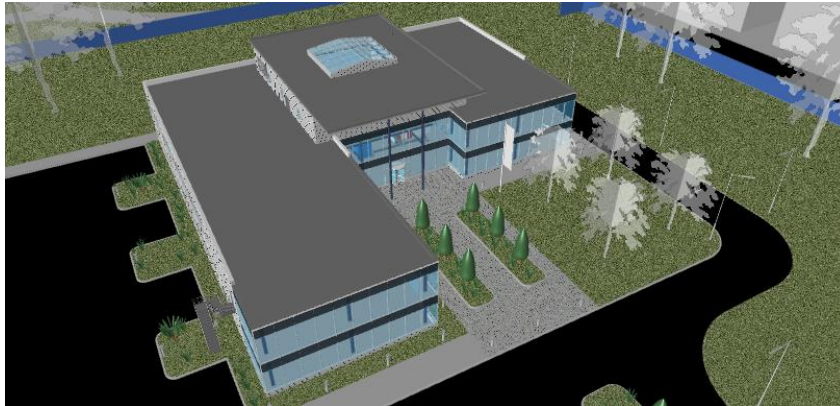
The different **Interpolation Types** are explained in this chart:



Interpolation Type:	Camera Behaviour:	Focus Time Behaviour:
Curve	Linear interpolation along a calculated curve between the 2 points.	N/A
Line	Linear interpolation along a calculated straight line between the 2 points.	Linear interpolation between 2 focus time positions
Step	No interpolation; Jump from 1 st to 2 nd position.	No interpolation; Jump from 1 st to 2 nd focus time position
Turntable	Camera rotation around the currently selected 3D object. When chosen, the Turntable Options dialog is displayed to configure the rotation.	N/A
3D Path	Camera follows the selected 3D Path using the camera angle of the first Keyframe relative to the path. When this Interpolation type is chosen a dialog is displayed to choose the path to follow.	N/A

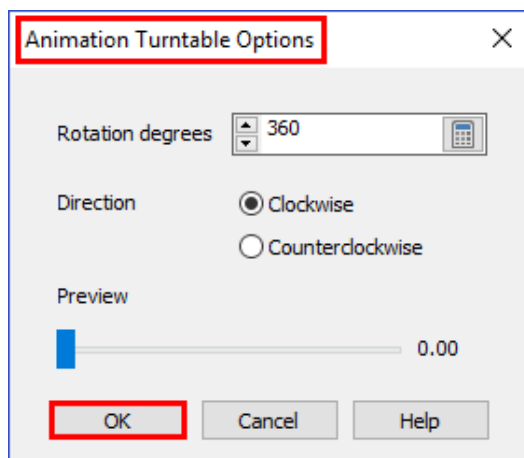
NOTE: Interpolations are always between two neighbouring Keyframes. The interpolation type assigned to the first (left) Keyframe defines the transition to the next(right) Keyframe.

1. To set up a **Turntable** interpolation, select an object in the 3D View that you want to rotate about. The camera will rotate about the centre of the selected object's bounding box.

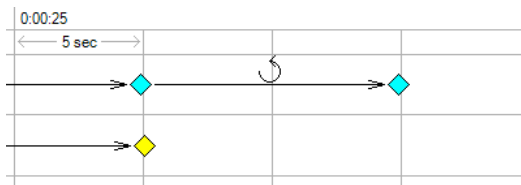


TIP: If you want to spin around the entire model, select an object that is central to the model or spans the whole model (e.g. the Glass Skylight).

2. Find the **Glass Skylight** task in the **Task List**, right click to **Select Assigned Resources**.
3. Right click on the **Camera** node at 30 seconds and select **Interpolation Type → Turntable**.
4. You will be presented with the **Animation Turntable Options** where you can decide on **Rotation degrees**, **Direction** and move the **Preview** bar to review. Keep the settings as default then select **OK**.



5. Decide how long you want the rotation to last for- we will have this for 10 seconds so create another camera point at **40 seconds** in the **Animation Editor**.



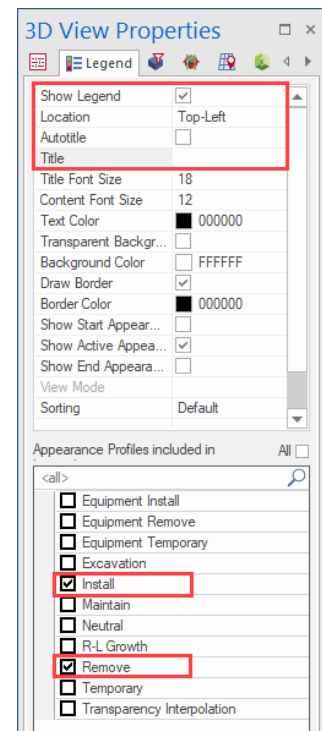
6. Press **Escape** to cancel the 3D selection.
7. Move the **Focus Time** to 30 seconds in the **Animation Editor** and press **Play** in the **4D Review** tab → **Player** panel to see the effect of the Turntable.

21.4. Exporting an Animation

Once an animation has been created, it can be exported as an AVI file which can be shared and played by a video player on any computer.

TIP: Before the animation is exported it is recommended that a small duration of a few seconds is added to the end. Otherwise it will snap back to the beginning once it's been exported.

1. Drag the **Focus Time Marker** to the end of the animation and **Left Click** in the focus time or camera channel of the animation editor at about **45 Seconds**. (This will add 5 seconds to the end of the animation).
2. At this point it's typical that the **Axis Indicator**, **Grid**, and **3D Path** are switched off. In **3D View Properties** → **General** → **Indicators** and uncheck the box next each one to turn them off.
3. If you wish to include a 3D Legend in the exported Animation, you may edit it in **3D View Properties** → **Legend**. For this training:
 - i. Enable **Show Legend**
 - ii. Change Location to **Top-Left**
 - iii. Next to **Appearance Profiles to include in Legend**, uncheck the box for **All**, then enable only **Install** and **Remove** in the list below
4. Select the **Animations** window, right click on the **"Site Tour"** animation and select **Export Animation**.
5. Create a new folder named **Site Tour**. **Open** the folder and press **Save**.



21.4.1. AVI Resolution

6. You will be presented with the **Export Animation** window with **Resolution** options shown:
7. For the purposes of this tutorial, please use:

- i. **Resolution** – (1920x1080)
- ii. **Frame Rate** – 25 [the number of images per second],

NOTE: The higher the frame rate, the better the quality of the video, but it does take longer to export. A good frame rate is 25. A frame rate of 15 is sufficient for a test export

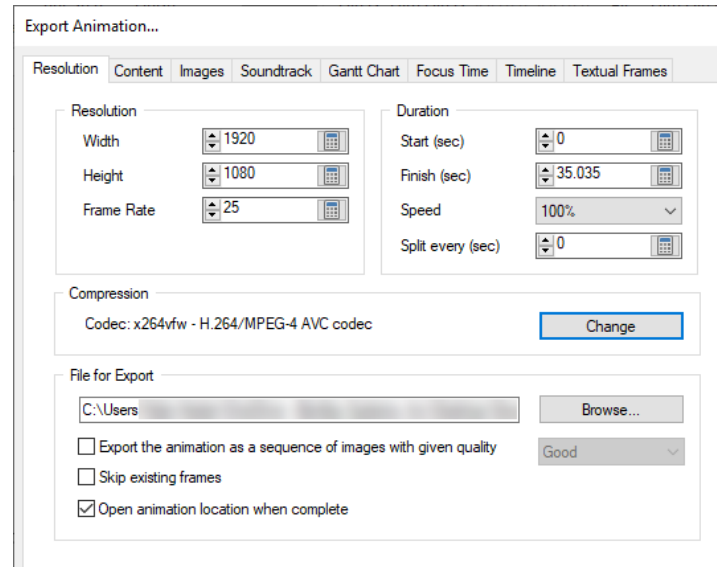
- iii. **Duration** – Split every 0 Seconds

NOTE: The maximum AVI file size is 2 GB. For long animations, or those with high frame rate, splitting the video ensures that the files will not exceed this limit. Splitting the video (e.g. every 10 – 30 seconds) will also allow you to re-export sections of the AVI if you have changed your project. Sections will need to be stitched together in a video editing tool

- iv. **Compression** – Codec: x264vfw - H.264/MPEG-4 AVC codec (If it is not already set to this please select **Change**)

NOTE: This Codec can optionally be installed using the SYNCHRO Pro installer

NOTE: You also have the option to export the Animation in an image format (PNG, JPG, or BMP). Frame rate will determine how many image files are created per second. You can combine the images in an Animation software package if required. If you want to export to a series of image, enable the checkbox **Export the animation as a series of images with given quality** and choose what image quality you wish to use (for JPG only).



21.4.2. Animation Content

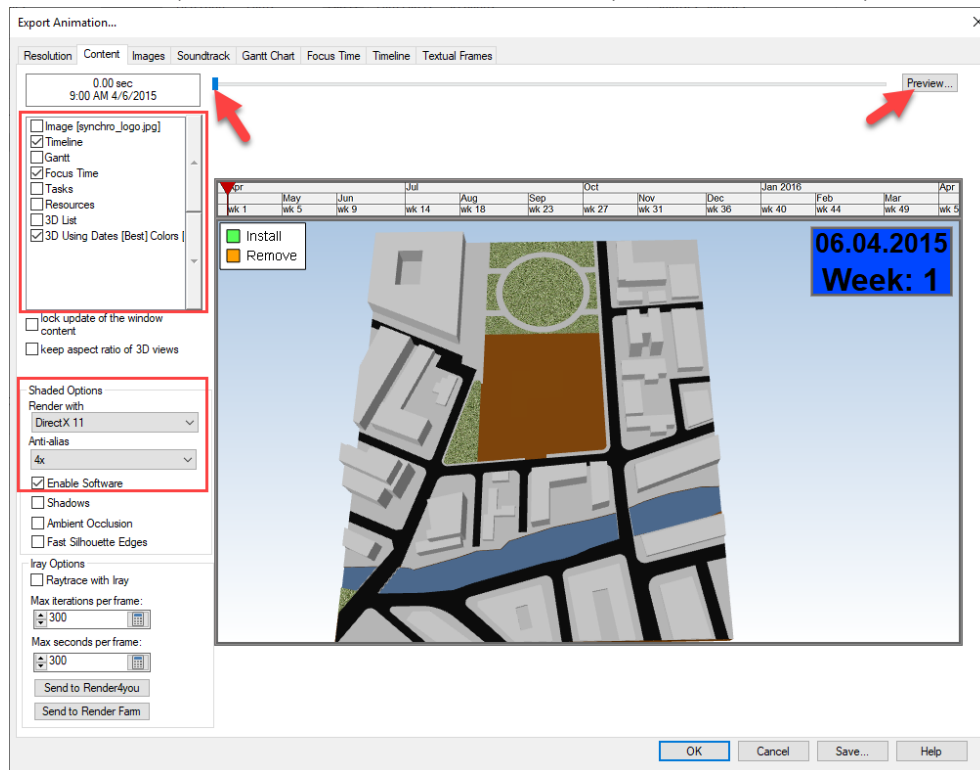
In the **Content** tab, you can choose what to display in the animation.

8. Select the **Content** tab.

TIP: You can resize the size of the Export AVI window by moving the cursor to the edges, holding down the left mouse button, and dragging to suit. A larger window may make it easier to edit the window contents.

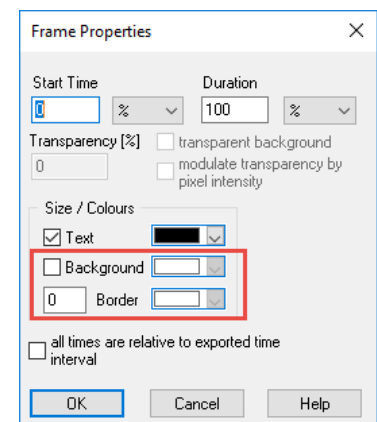
9. Select **3D Using Dates**, **Focus Time**, and **Timeline** then resize and move them in the preview window. If a window is hidden behind another window, select the hidden window in the list on the left and use the up arrow button to move it before the other window in the list – the windows are listed in order of precedence, front at the top to back at the bottom.

NOTE: At the top of the screen is a **Preview** slider which you can move to check your animation before export.



10. From the list, right click on **Focus Time** and choose **Properties**, then uncheck the box for **Background** and set the **Border** to **0**, then press OK. The Focus Time background will look blue, but press the **Preview** button to see the final output.

TIP: You can edit the format of the Focus Time window in the **Export Animation** → **Focus Time** tab



11. Select **DirectX 11** from the **Render with** dropdown box.

NOTE: The Driver options in the drop-down menu depend on which drivers you have installed on your computer. Software will use the SYNCHRO driver to export the AVI. Choose Direct X 11 if you plan to use effects like shadows or textures.

12. Set **Anti-Alias** to **4x** and check the box to **Enable Software**

NOTE: Anti-aliasing increases the quality of the output, but increases the time it takes to export.

13. Other Content options:

- i. **Lock update of the window content** – this enables you to modify the size of the windows without it trying to render every time. Unlock this to see the true view after movement, resizing etc.
- ii. **Keep aspect ratio of 3D views** - enables same aspect ratio as the main 3D windows you created earlier. (16:9 aspect ratio in this case).
- iii. **Iray Options** – available with a separate Iray license, rendering with Iray will provide a much higher quality output.

14. Select **OK** in the **Export AVI** window.
15. After each AVI has completed exporting, double click the file to play the video
16. Close the Animation Editor window by clicking the **"x"** in the upper right window corner.
17. Double click on the 3D window title bar to re-dock the 3D window.

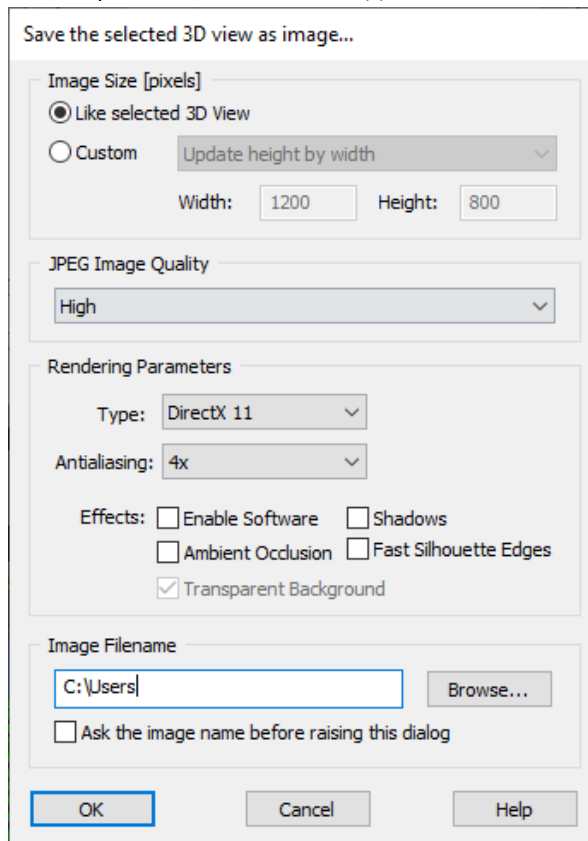
Output

In this section you will learn how to save a Viewpoint as an image, how to print from the Gantt Chart, and how to export the Gantt Chart to a PDF.

22.1. Save as Image

22. You can easily save an image of the 3D window to share with others. There are 2 ways to save an image.
 1. If you have a saved **Viewpoint** that you would like to export as an image, in the **Viewpoints** window, select the Viewpoint name, right click and choose **Save as Image**.
 2. Name the file and choose the file type (PNG, BMP, or JPEG) from the drop-down list.
 3. The **Save as Image** dialog will appear. There are options to change the image size (or keep it the same as the 3D window), set the graphics driver **Type**, **Antialiasing** (higher values improve quality), and apply **Effects** including **Shadows**.

NOTE: The **OpenGL** driver does not support **Effects**.

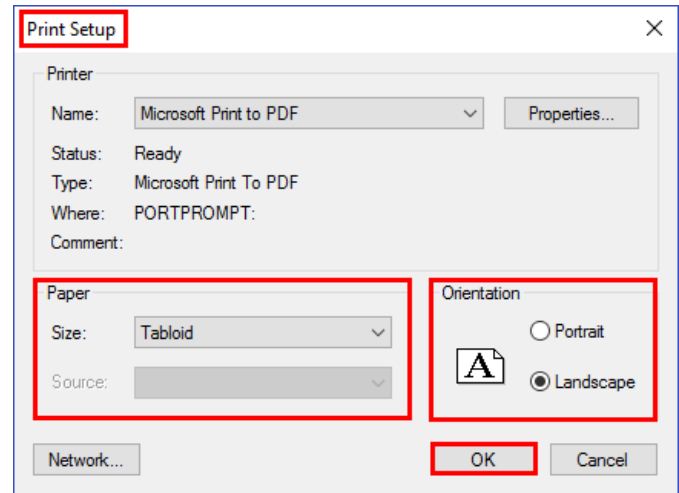


4. Set the options as desired and press **OK** to save the image.
5. You can also save an image of the current 3D window without first creating a Viewpoint, by right clicking in the 3D window and choosing **Save as Image** from the context menu.

22.2. Printing the Gantt Chart

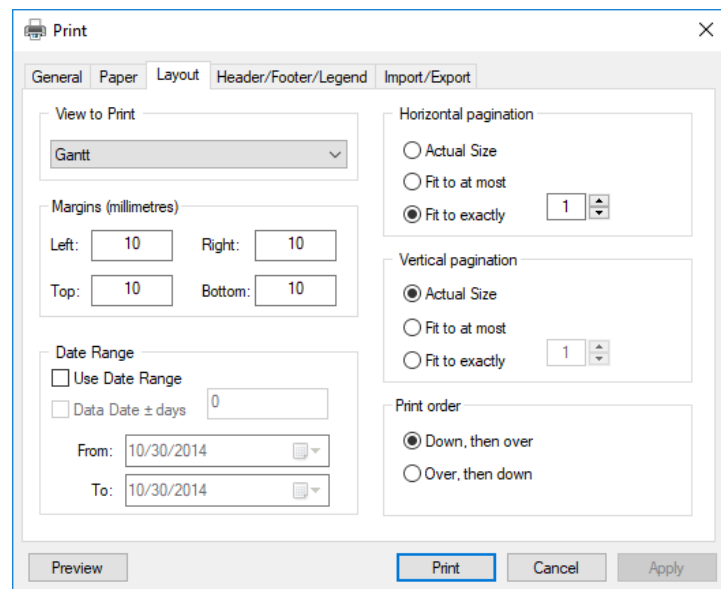
The Gantt Chart can be printed from SYNCHRO to share with others without the need to share the SP file.

1. When printing the Gantt Chart, what you see is what you get, so use **Customise Columns** in the Task List to choose which columns to include in the printout.
2. Expand or Collapse the WBS and adjust the Gantt Zoom as desired before printing
3. Before printing, set up the printer and page layout by selecting **File tab → Print Setup**.
4. For printing the Gantt Chart, set the **Orientation** to **Landscape**.
5. Set the **Paper Size** for printing as desired e.g. **Tabloid** (11" x 17").
6. Press **OK** to finish setup.
7. Select **File tab → Print**.
8. In the Print dialog, choose the **Layout** tab.
9. Ensure that **View to Print** is set to **Gantt**.

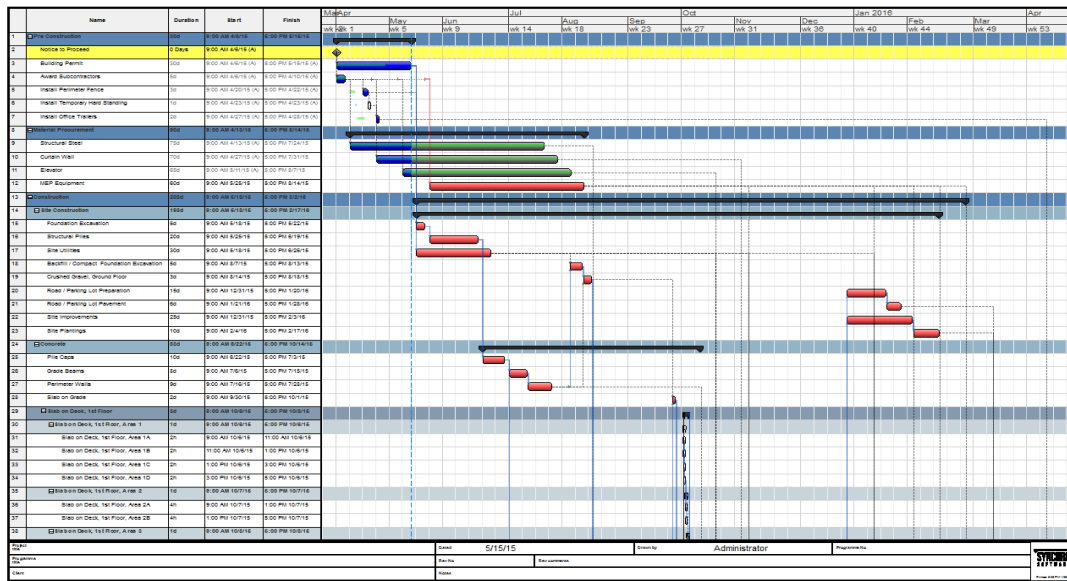


NOTE: From the **View to Print** drop-down you can also select other open windows to print including 3D.

10. When printing the Gantt Chart, **Fit to Exactly: 1** is a good choice for the **Horizontal pagination** and **Fit to: Actual Size** for **Vertical pagination**.
11. A **Date Range** can be applied to the schedule if desired (eg. to export a 3 week look ahead). To print the whole schedule, leave this option disabled.
12. Select **Apply** to save changes to this dialog before previewing or printing.
13. If desired, a **Header, Footer**, and/or **Legend** can be added to the printout in the Legend tab.
14. Select **Preview** to view the Gantt Chart before printing.
15. From the preview window, select **Print** to return to the Print dialog.
16. Select **Print**.



17. The printout will look similar to below:



22.3. Export 3D PDF

SYNCHRO gives you the ability to export a 3D View of the project as a 3D PDF, which can be manipulated in any PDF compatible programs, such as Adobe Reader. This can be used to share the 3D Model with others electronically without having to share the SYNCHRO Project file.

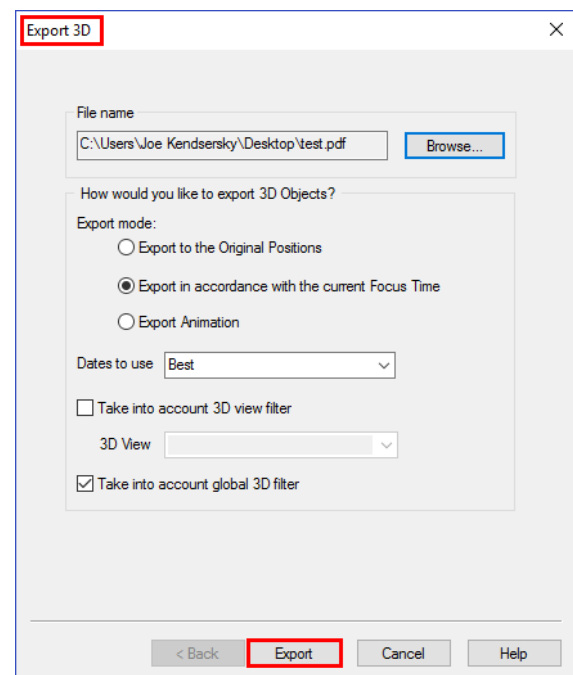
1. Move the Focus Time in the Gantt Chart to show any view you would like to export.
2. In **File** tab, select **Export** → **3D**.
3. In the Export 3D window, select **Browse** to choose where you would like to save your 3D PDF.
 - i. Choose a file name.
 - ii. Set "Save as Type" to 3D PDF(*.pdf).
 - iii. Select "Save".
4. Select the following Options
 - i. Export Mode: Export in accordance with the current Focus Time.
 - ii. Dates to use: Best.
 - iii. Check: Take into account global 3D Filter.

NOTE: By enabling Global 3D Filter, you will only export 3D Objects that are loaded in the project in the **3D Objects** tab.

5. Select Export.

NOTE: You cannot export an animation in 3D PDF format.

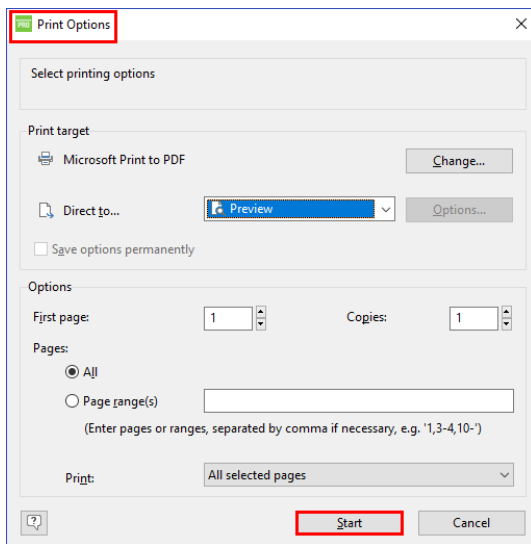
6. When the 3D PDF has finished exporting, open your file inside of a PDF compatible program to view the 3D Model.



22.4. Schedule Health Check Report

SYNCHRO Pro has the ability to run a health check report on a Project. This runs a series of 11 tests and provides a schedule showing any Missing Resources, Missing Logic, Missed Tasks etc. The Schedule Health Check report is based on the first 11 points of the [DCMA 14-point Assessment](#).

1. To run a health check report on a project, in the **Reports** tab → **Schedule** panel → **Schedule Health Check**.
2. The Report can be printed or exported in a variety of formats, either directly to a printer or to the screen to preview the results before they are printed. Choose the desired format from the Direct to... dropdown menu. Choices include: Printer, Preview, PDF, and Excel (among others)
3. To generate a report select Start.



4. The generated report includes:
 - The project file location.
 - A list of the 11 tests and results color coded for pass (green), fail (red), or not applicable (white).
 - A full list of all tasks or links that meet the criteria for each test.

Synchro Schedule Health Check				
Project: C:\Users\Joe Kendersky\Documents\Joe K\Synchro\Synchro Tutorial				
Test	Description	Goal	Result	
1	Missing Logic	Tasks without predecessors or successors	< 5%	3.96%
2	Leads	Relationships with negative lag	0%	0.00%
3	Lags	Relationships with positive lag	< 5%	2.19%
4	Relationship Types	Relationships other than FS type	< 10%	1.64%
5	Hard Constraints	Incomplete tasks with hard constraints	< 5%	1.04%
6	High Float	Incomplete tasks with at least 44 days float	< 5%	3.13%
7	Negative Float	Incomplete tasks with negative downstream float	0%	0.00%
8	High Duration	Incomplete tasks with at least 44 days duration	< 5%	5.21%
9	Invalid Dates	Tasks with forecasted dates before the Data Date and/or actual dates past the Data Date	< 1	7
10	Missing Resources	Incomplete tasks without scheduling resource assignments	N/A	97.92%
11	Missed Tasks	Tasks with actual finish dates later than baseline plan finish dates	< 5%	N/A

ID	Name	Value
1: Missing Logic		
ST00020	Notice to Proceed	
ST00760	Glass Skylight	
ST00780	Temporary Hoist	
ST00980	Project Turnover	
5: Hard Constraints		
ST00020	Notice to Proceed	Mandatory Start
6: High Float		
ST00990	Piles 1	232d
ST00995	Piles 2	232d
ST01000	Piles 3	232d
8: High Duration		
ST00080	Structural Steel	75d
ST00090	Curtain Wall	70d
ST00100	Elevator	65d
ST00110	MEP Equipment	60d
ST00780	Temporary Hoist	90d
9: Invalid Dates		
ST00020	Notice to Proceed	
ST00120	Foundation Excavation	

Data date: 5:00 PM 5/15/2015 Report Date: 10:00 AM Page 1 of 4

Appendix A: 3D File Formats

SYNCHRO can import the following file formats into version 6.3:

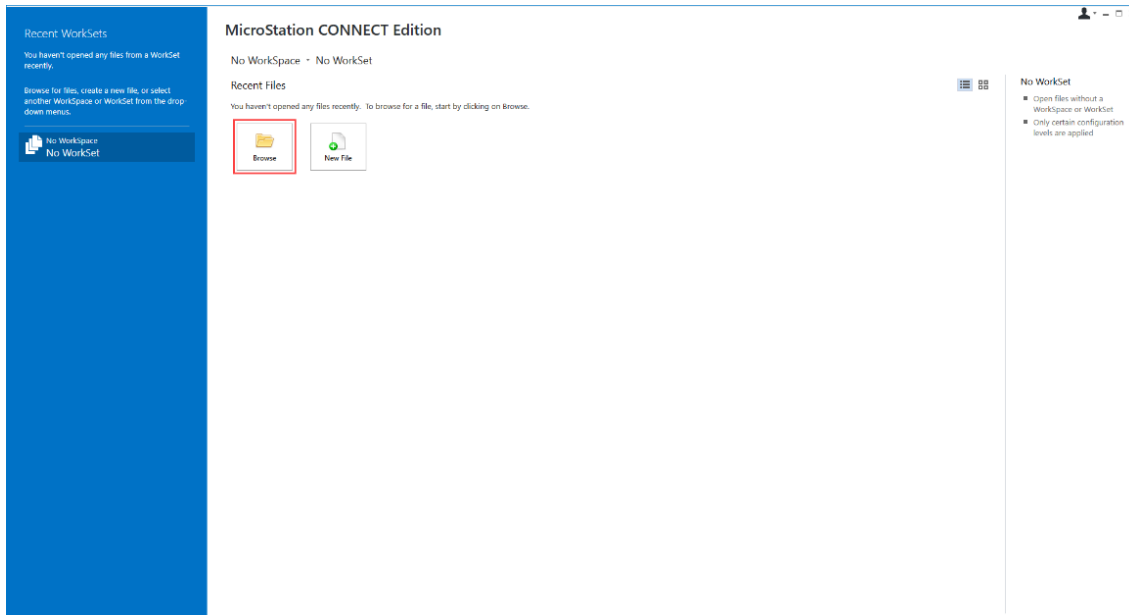
Product:	File Extension(s):	Version(s):	Note(s):
ACIS	SAT, SAB	up to 2019	
Alias Wavefront	OBJ	All Versions	
23. AutoCAD	DWG, DXF	R14 - 2018	
Autodesk	DWF, DWFX	up to 2012	
Autodesk FBX	FBX	6.0 - 7.5	
Autodesk Inventor	IPT, IAM	Up to 2020	
Bentley I-Model	I.DGN	1	
Bentley iModel 2.0	BIM		*With SYNCHRO 4D license
Bentley Microstation	DGN	V7, V8, V8 XM, V8i, V8i (SELECTseries 2), V8i (SELECTseries 3), V10 (CONNECT)	Plug-in module is available for Microstation V8i (SELECTseries 2 and 3) and V10 (CONNECT)
CATIA V4	EXP, DLV, MODEL, SESSION	up to 4.2.5	
CATIA V5/V6	CATProduct, CATPart, CATDrawing, CATShape, CGR	R4 - V5-6 R2019 (R29)	
Collada	DAE	up to 1.5	
Dassault Interchange Format	3DXML	2011 – 2013	
GL Transmission Format	GLTF, GLB	2.0 only	
HOOPS stream file	HSF		
I-deas	MF1, ARC, UNV, PKG	up to 13.x (NX 5), NX I-deas 6	
IFC	IFC	2x, 2x2, 2x3, 4	Geometry only for 4 (beta version)
IGES part files	IGES, IGS	5.1 - 5.3	
Navisworks	NWF, NWC, [NWD]*	2017-2021	via plug-in module for Navisworks. *IMPORTANT: NWD can be exported to SPX, but does not support future model updates via Synchronise From
Parasolid	xmt_bin, x_b, x_t, xmt_txt	up to v32	
ProE/Creo	PRT, ASM, NEU, XAS, XPR,	Pro/Engineer 19.0 to Creo 6.0	
Revit	RVT	2017-2021	via plug-in module for Revit
Rhino	3DM	4, 5, 6	
SketchUp	SKP	v7, v8, 2013-2020	
Solid Edge	ASM, PAR, PWD, PSM	V19 - 20, ST - ST10, 2020	
SolidWorks	SLDASM, SLDPRT	up to 2020	
STEP part files	STEP, STP	AP203, AP214, AP242	Geometry ONLY
Stereo Lithography	STL	All versions	
UGS JT	JT	up to 10.2	
Unigraphics NX	PRT	V11.0 to NX 12.0, and 1899	
Universal 3D	U3D	ECMA-363, 1st, 2nd & 3rd editions	
VDA-FS	VDA	1.0 - 2.0	
VRML files	VRML, WRL	V1.0 and V2.0 (VRML'97)	
3D PDF, PRC	PDF, PRC	All Versions	

Appendix B: Bentley 3D Workflow

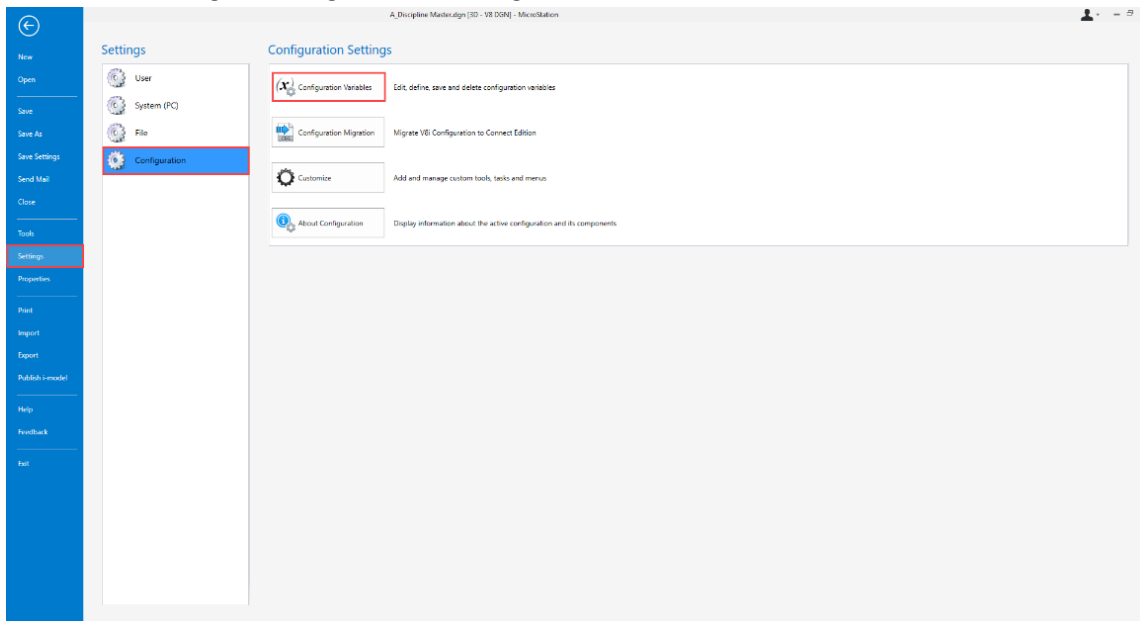
24.1. Using the Bentley Microstation Plugin

1. You can install the plugin from <https://softwaredownloads.bentley.com/en/>
2. Run and install the setup file (double click on the set up file and follow the on screen instructions).
3. Once the Plugin has been installed, open up the DGN in Microstation.

24.

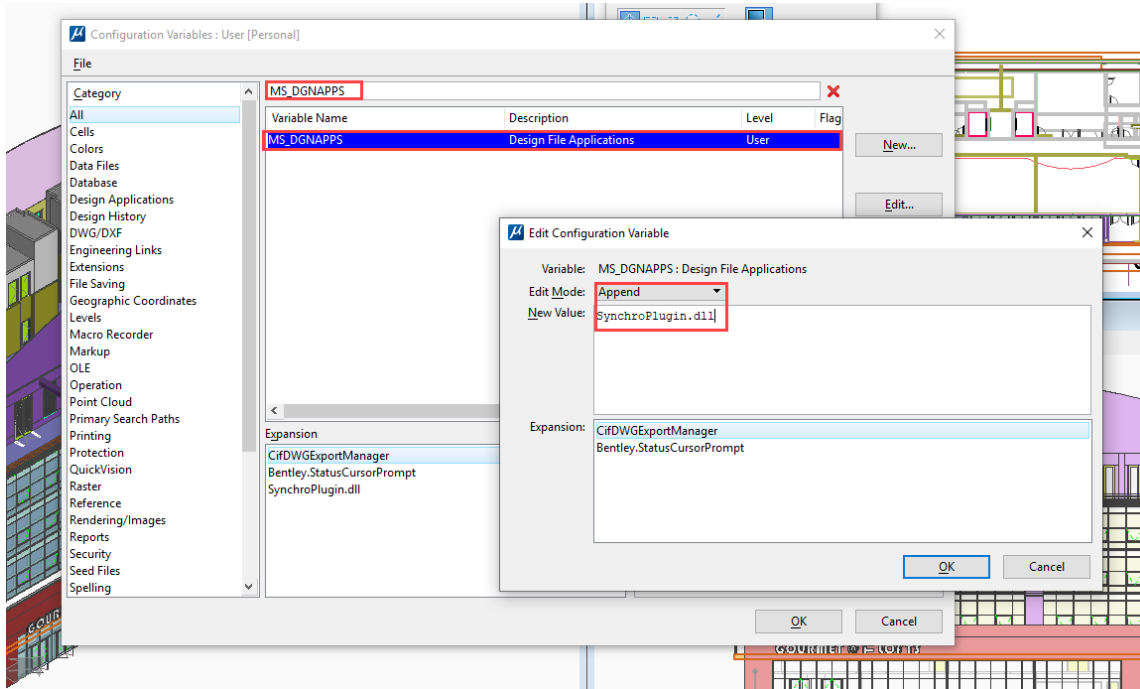


4. Go to File → Settings → Configuration → Configuration Variables.

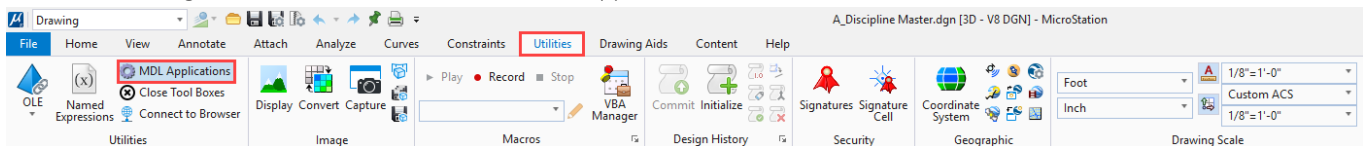


5. Find "MS_DGNAPPS" variable and press edit.

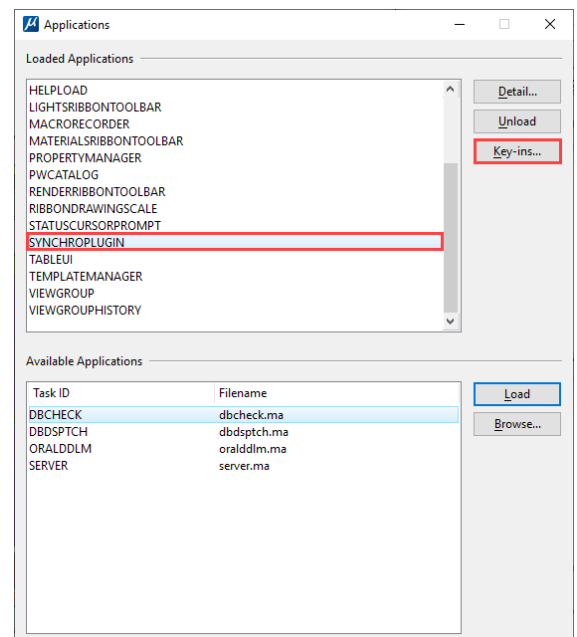
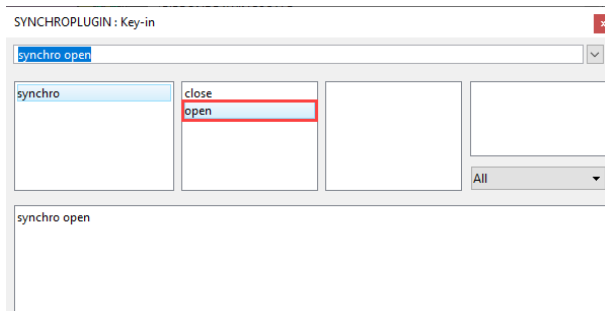
6. Append "SynchroPlugin.dll" value. It will append "MS_DGNAPPS > SynchroPlugin.dll" to your configuration file (C:\Users\...\AppData\Local\Bentley\MicroStation\10.0.0\prefs\Personal.ucf).



7. The next time you run MicroStation, the plugin will be loaded automatically.
 8. In MicroStation, go to Utilities Ribbon and select MDL Applications.



9. Find "SYNCHROPLUGIN" in Loaded Applications list and press Key-ins button. You will have to Load it from the Available Applications section at the bottom, for the first time.
 10. Double click "open".



11. You will now see the SYNCHRO Plugin window. There are a number of export options available to you:

Coordinate System - Can be used to export in world coordinate system or in local \"Global Origin\" coordinates system.

Engineering Components

Element Properties - Can be used to skip the export of Engineering Component properties as SYNCHRO User Fields.

Element Classes - Can be used to export of Engineering Component classes as SYNCHRO 3D Sets.

Hidden Objects

Hidden Elements - Can be used to export hidden elements.

Level Display - Can be used to skip levels that are not added to Level Display in selected 3D view.

Object Tree

Break By Levels - When enabled, 3D elements are grouped by levels.

Break Cells - When enabled, creates separate node for each 3D element under leaf cell.

Limit 3D Object Tree Depth - Enable to limit the maximum depth of 3d object tree.

Limit 3D Object Tree Levels By - This option determines the maximum depth of 3d object tree.

Objects

Construction Elements - Can be used to skip the export of construction elements.

Dimension Elements - Can be used to skip the export of dimension elements.

Named Groups - Can be used to export Named Groups as Synchro 3D Sets

Tags - Can be used to export Tags as Synchro User Fields.

Text Elements - Can be used to skip the export of text objects.

Wireframe Elements - Can be used to skip the export of polylines, lines, circular arcs, circular arcs, circles, elliptical arcs, ellipses, nurbs curves objects.

Optimization

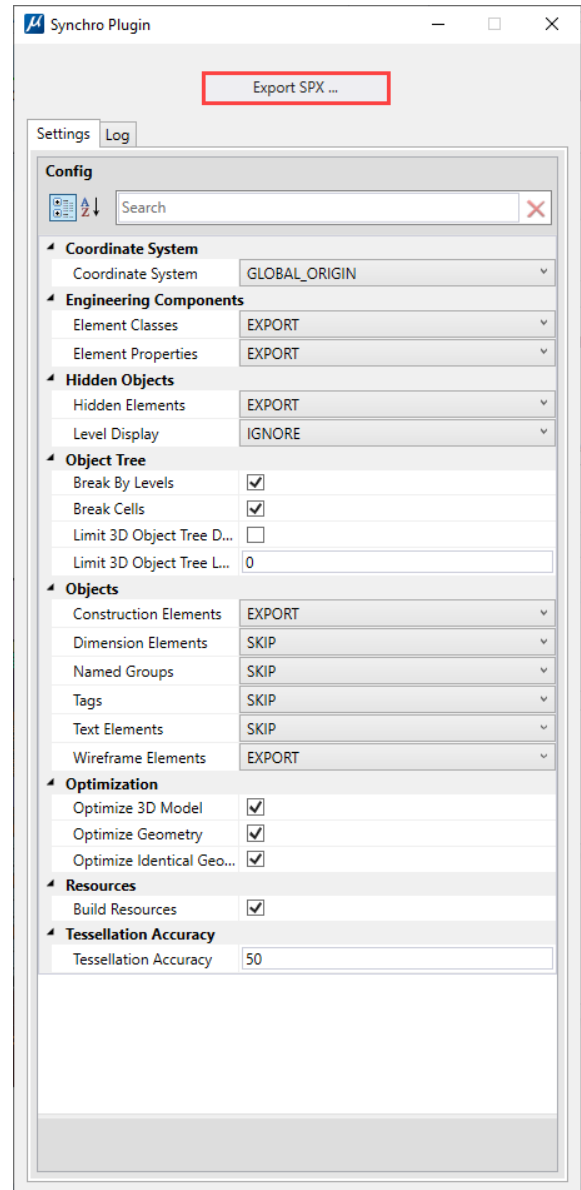
Optimize 3D Model - Enable optimization of 3D model on export.


Optimize Geometry - Enable optimization of geometric objects.

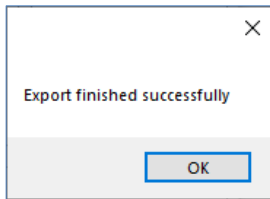
Optimize Identical Geometry - Enable optimization of identical 3D objects

Build Resources - Create resources by 3D entity tree on export

Tessellation Accuracy - Tessellation accuracy (0 - 100).

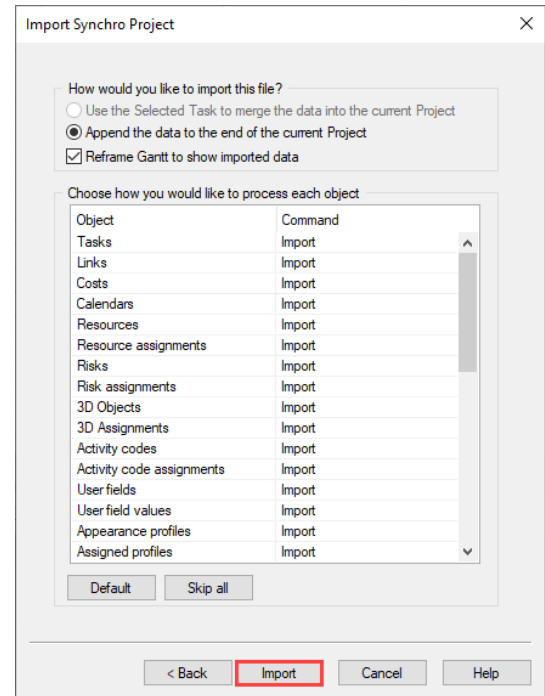
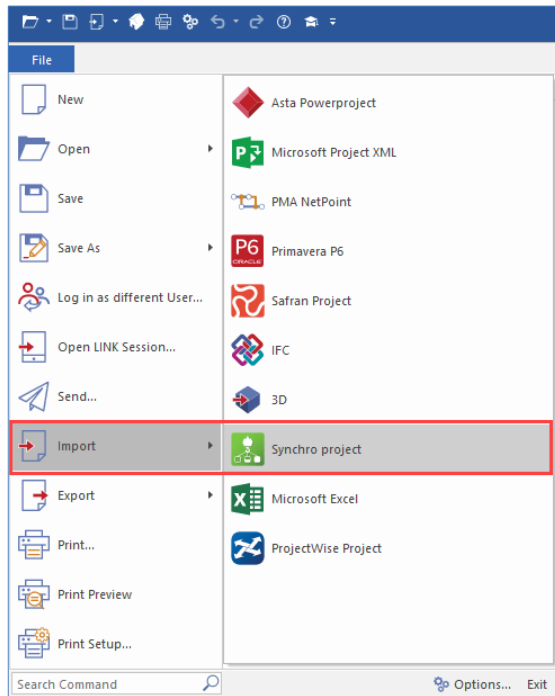


12. Select the options you wish to export in SYNCHRO Plugin window (shown above)  Export SPX...
13. In the Save As window, Select the location of where you wish to save, name the file and select Save.
14. The progress bar will appear to give you the status of the export.
15. When the export is complete, you will receive a message indicating the export finished successfully. Select OK.



24.2. Importing .sp files generated from the Microstation plugin into SYNCHRO

1. Open up SYNCHRO PRO, Select **File** tab → **Import** → **SYNCHRO Project**.
2. In the Import SYNCHRO Project window, locate the .spx file. Select open.
3. Select “Import” to import all available attributes. (If required, attributes can also be skipped)
4. The progress bar will appear to display the status of the import. Upon completion, select Finish.



Appendix C: Revit 3D Workflow

SYNCHRO imports DWF, DWFX, and IFC files, all of which can be exported from Revit. Additionally, you can download the **Revit Plugin for SYNCHRO**, which exports the model as an .spx file.

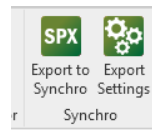
NOTE: Whatever is visible in your **Revit** 3D view is what will be exported.

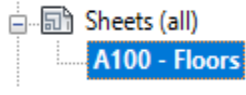
25.1. Using the Revit Plugin

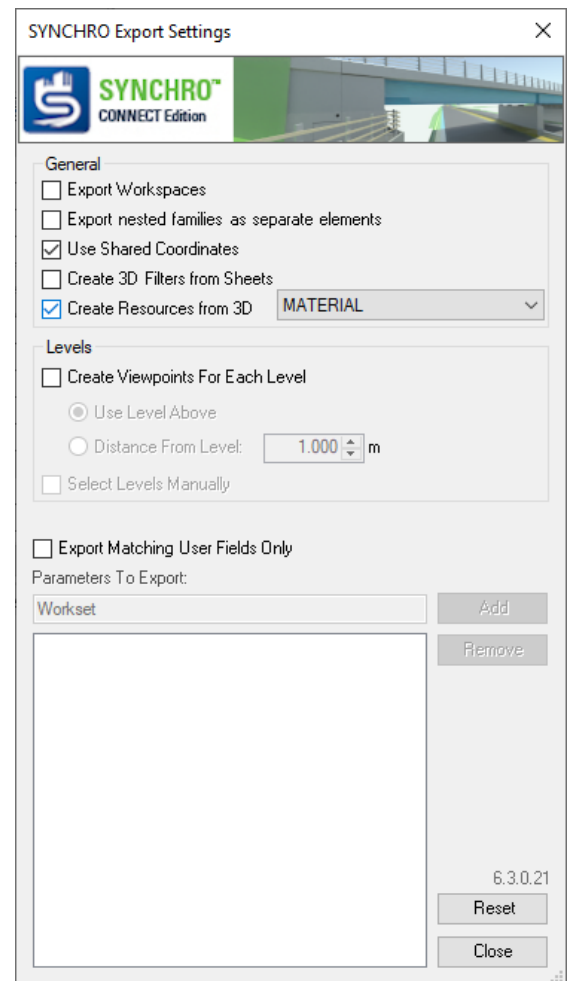
The Revit Plugin enables native RVT files to be exported out of Revit as SYNCHRO Project files (.spx) that can be imported into an existing SYNCHRO Project (.sp) file.

NOTE: The SYNCHRO Revit Plugin works with Revit 2017 and 2018, 2019 and 2020

1. Download the appropriate Revit Plugin from <https://softwaredownloads.bentley.com/en/>
2. Run the installer
3. Once the Plugin has been installed, open the RVT file in Revit.
4. Select **Add-Ins** tab → **Synchro** panel → **Export Settings**
5. The Synchro Export Settings dialog will appear. There are a number of options available to you:



- **Export Workspaces** – If Checked, Revit Rooms are exported as SYNCHRO Workspaces; Otherwise no Workspaces will be exported.
- **Export nested families as separate elements** – If checked, nested families will be broken down to individual families; Otherwise they will be grouped as one object
- **Use shared coordinates** – A Revit project stores internal coordinates for all the objects in a model, which are only known to that particular project. If the position of the project model is to be known to other linked models, users should use shared coordinates.
- **Create 3D Filters from Sheets** – Plugin has the capability to create 3D Filters from Revit Sheets; for example: user created functional sheet in Revit, showing only floors on certain level of the building. By creating 3D Filter from that sheet, user will gain the possibility to filter the same objects in SYNCHRO PRO.
 
- **Create Resources from 3D** – Plugin has the option to create Resources from 3D Objects and assign them to one of 4 Types – Equipment, Human, Location or Material. This can be done at this stage or later in SYNCHRO PRO.
- **Create Viewpoints for Each Level** – If checked, creates Viewpoints in SYNCHRO for each Level in Revit. Each Viewpoint is defined by a cutting plane above and below that level.
 - **Use Level Above** – The viewpoint for a given Level is defined by a Cutting Plane at the elevation of the Level above
 - **Distance from Level** – Alternatively, the viewpoint for a given Level is defined by a Cutting Plane at the specified distance above the Level
 - **Select Levels Manually** – If checked, a dialog will be raised at the time of export to manually select which Levels to create Viewpoints for; Otherwise one Viewpoint will be created for each Level in the project
- **Export Matching User Fields Only** – If checked, all User Field (Revit Parameter) names will be checked against strings presented in a list box (below this option): If the User Field name contains any of the strings from the list, that User Field will be exported; otherwise, it will be ignored. If unchecked, all User Fields will be exported.

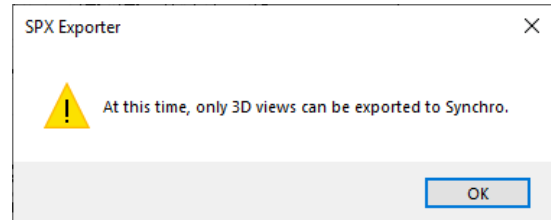


- **Parameters to Export** – Only available when “Export Matching Using Fields” is enabled. To enter a new String, Type it in the Text Box and select the **“Add”** button to the right of the Text Box. Conversely, to Remove a String, highlight the String and select the **“Remove”** button at the top right of the List Box.

NOTE: The values in the List Box are CASE-SENSITIVE. Additionally, any strings added to the List Box will remain there until you manually remove them.

6. Once you have selected your desired Export Settings, Select **“Close”**
7. These Export Settings will be saved for future use.
8. Please set up the 3D View in Revit according to how you wish to export your model – as you would with the DWF/DWFX export.
9. When you are ready to export your model, Select **Add-Ins** tab → **SYNCHRO** panel → **Export to SYNCHRO**.

NOTE: If you attempt to export from a 2D View you will receive the following message (right). Please make sure you are exporting from an active 3D View.



10. The **“Save AS”** window will appear.
11. In the File Name, type the required name and select **“Save”**.

When the export is complete, you will have an .SPX file containing the 3D Geometry from Revit.

Appendix D: Auto-Matching

The Auto Matching feature in SYNCHRO provides a facility to automatically assign Resources to Tasks using custom filters and search rules. The match is based on the Resource Names, Task Names, Task ID, or Task Comment.

Using the Auto Matching function greatly simplifies the task of linking resources to tasks to create a SYNCHRO Project suitable for scheduling and 4D Simulation.

26. To match resources to task using the auto matching feature:

Select the **Assign Resources** tab → **Auto Matching** panel → **Resources to Task**, to display the Auto Matching Dialog.

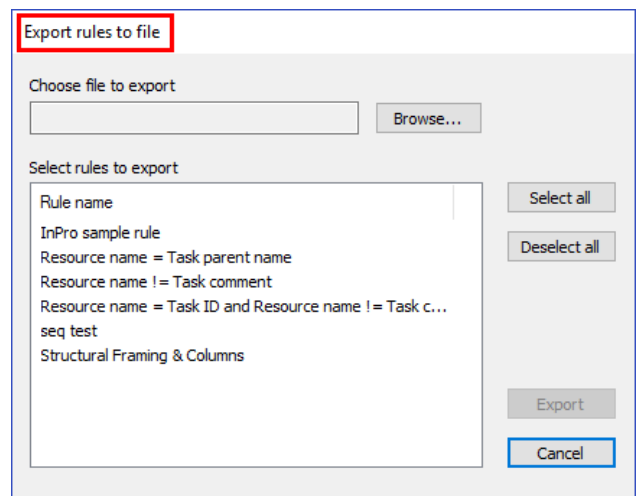
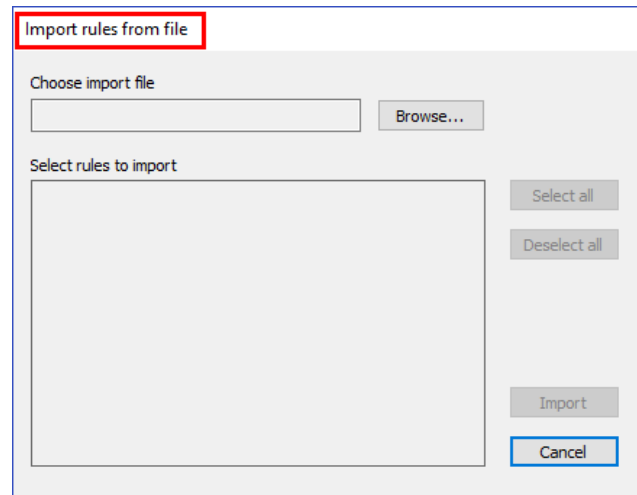
The screenshot shows the 'Auto Matching (Resources to Tasks)' dialog box. The title bar is highlighted with a red box. The dialog is divided into several sections:

- Rules:** A dropdown menu showing 'Structural Framing & Columns'. Below it are buttons: 'Import', 'Export', 'New', 'Edit', 'Delete', and 'Delete All'.
- Operations:** A section with 'Appearance Profile:' followed by 'Install', 'V', 'Search', 'Clear', 'Assign All', and 'Close' buttons.
- Table:** A large table with columns: '#', 'Resource', 'Task', and 'Appearanc...'. The table is currently empty.
- Resource Tree:** A panel on the bottom left for displaying resource hierarchies.
- Task Tree:** A panel on the bottom right for displaying task hierarchies.
- Resource Attributes:** A panel on the bottom left for viewing and editing resource attributes.
- Task Attributes:** A panel on the bottom right for viewing and editing task attributes.

26.1. Auto Matching Window dialog

The dialog contains a number of control sections:

1. **Rules** – defines a rule to match Resources and Tasks
 - **Import** – Can be used to read a previously Exported Auto-Match rules File, via the “Import Rules from File” window.
 - i. Press the **Browse** button to select an XML file containing Auto Match Rules.
 - ii. Press the **Load File** button to read the file and list its content.
 - iii. Select the desired rules to import, and press the **Import** button.
 - iv. Press **Cancel** to close the dialog.
 - **Export** - can be used to save a Rule-Set to an XML File, via the Export Rules dialog .
 - i. Press the **Browse** button to select an XML file to the Auto Match Rules.
 - ii. Select the desired rules to export, and press the **Export** button.
 - iii. Press **Cancel** to close the dialog.



- The **Add** button is used to define a new rule – this will open the “Add New Rule...” window described below.
- **Edit** can be used to modify an existing rule – this will open the **Edit Rule** window which is identical to the **Add New Rule** window (described below) except that it contains the saved rule.
- The **Remove** button will delete the currently selected rule.
- The **Remove All** will delete all currently defined rules.

2. **Operations** – applies the selected matching rule

- **Appearance Profile** – the default Appearance Profile that will be applied to any matches
- **Search** – search the SYNCHRO project using the currently defined rules. After running Search, if there are matches, the Group panel will be populated (outlined right).
- **Clear** – clear any previous search results.
- **Assign All** – to assign all the identified resources to tasks.
- **Close** – exits the Auto Matching window without making any assignments.

Auto Matching (Resources to Tasks)

Rules
Structural Framing & Columns

Import Export New Edit Delete Delete All

Operations
Appearance Profile: Install V Search Clear **Assign All** Close

#	Resource	Task	Appearanc...
1	UB-Universal Beam [763088]	Structural Framing, Area 4	Install
2	UB-Universal Beam [970888]	Structural Framing, Area 4	Install
3	UB-Universal Beam [970890]	Structural Framing, Area 4	Install
4	UB-Universal Beam [727368]	Structural Framing, Area 1	Install
5	UB-Universal Beam [971382]	Structural Framing, Area 4	Install
6	UB-Universal Beam [971568]	Structural Framing, Area 1	Install
7	UB-Universal Beam [764454]	Structural Framing, Area 4	Install
8	UB-Universal Beam [971169]	Structural Framing, Area 4	Install
9	UB-Universal Beam [726629]	Structural Framing, Area 4	Install
10	UB-Universal Beam [763113]	Structural Framing, Area 4	Install
11	UB-Universal Beam [763846]	Structural Framing, Area 4	Install

Resource Tree

- <all>
- Material Resources
 - Office Building
 - Structure.dwf

Task Tree

- <all>
- Office Building, Core & Shell
 - Construction
 - Metals

Resource Attributes

- <all>
- General [2]
 - company: New Company
 - name: UB-Universal Beam [763088]
- Codes [0]
- User Fields [18]
- 3D User Fields [18]
- Matched tasks [1]

Task Attributes

- <all>
- General [2]
 - name: Structural Framing, Area 4
 - code: ST00390
- Codes [0]
- User Fields [1]
- Matched resources [1]
- Assigned resources [0]

3. **Groups** – Review matching search results. Selecting a Resource (or Task) from the Groups panel will populate the Resource (or Task) Tree and Attributes panels. If more than one Resource matches a Task, the Task will be listed only once at the top of the group of the Resources. All Resources in the same group must be assigned using the same Appearance Profile.

4. **Resource Tree & Task** – Displays the selected Resource or Task's location in the Resource Tree or WBS, respectively.

5. **Resource Attributes** – Displays the key attributes of matched Resources including Company Name, User Fields, Matched Resources and Assigned Resources.

6. **Task Attributes** – Displays the key attributes of matched Tasks including Name, Activity Codes, User Fields, Matched Resources and Assigned Resources.

26.2. Add New Rule/ Edit a Rule

To define a new rule:

1. Press the **New** button in the Auto Matching window to bring up the **Add New Rule** window:
2. Enter a Rule **Name**.
3. The **Summary Options**, when applied can be used to set the range of your search.

- **Use only Selected Resources** (and/or) **Tasks** - applies the search rule only to Resources/Tasks that were selected in SYNCHRO *before* opening the Auto Matching window. Leave the options unchecked to search all Resources and Tasks in the project.

- **Ignore Assigned Resources** – excludes Resources that have already been assigned to at least one task from search.

- **Ignored Tasks with Assignments** – excludes Tasks that have at least one Resource assigned to them from search.

- **Merge Resources Groups** – when enabled, groups all Resources that contain a common characteristic used for matching and assigns them to the same group of Tasks.

NOTE: Resources in the group don't match all grouped Tasks.

- **Ignore Summary Tasks** – when enabled, excludes WBS level summary tasks from the search. No new Resource assignments will be made to those tasks.

4. The **Relations** radio buttons can be used to set the default linkage when the search is applied a match is found.

- **None** - a linkage is not applied between matched Resources and Tasks.

- **One-To-One** – Matches are linked on a one-to-one basis. One Resource can be assigned to one Task.

- **Many-To-Many** – Matches are linked on a many-to-many basis. Multiple Resources can be matched to each Task and will be grouped together in the search results in the Auto Matching window. A Resource can also be matched to multiple Tasks.

5. The **Expression** section allows you to define complex search criteria for the rule.

NOTE: At least one search expression must be defined before you can close the dialog, or press **Cancel** to stop the Auto Matching rule creation.

6. Select **Add** to define a new Expression. This will enable the **Term**, **Algorithm**, **Operator**, and **Options** panels below.

The screenshot shows the 'Add New Rule...' dialog box. At the top, the title is 'Add New Rule...'. Below it is a 'Name' field with the text 'New Rule'. The dialog is divided into several sections. The 'Summary options' section contains five checkboxes: 'Use only Selected Resources', 'Use only Selected Tasks', 'Ignore Assigned Resources', 'Ignore Tasks with Assignments', and 'Merge Similar Groups'. The 'Relations' section contains three radio buttons: 'None', 'One-to-One' (which is selected), and 'Many-to-Many'. Below these is a large 'Expression' text area. At the bottom, there is an 'Operator' section with four radio buttons: 'AND' (selected), 'OR', 'AND NOT', and 'OR NOT', along with a 'True if Undef' checkbox. On the right side of the dialog, there are three buttons: 'Add', 'Delete', and 'Delete All'.

26.2.1. Defining Rule Search Expressions

1. The **Term** section allows you to specify the Resource and Task attributes to use in the search, as well as the comparison operators to use:

- The **Resource Attribute** section defines which Resource attribute will be searched (**Name** or **User Field**)
 - i. **User Field** - select desired User Field from the drop-down list.
 - ii. **Search Parent** – allows the search to apply to the parent elements if the attribute does not exist in the current Resource (when the search is applied).
 - iii. **Type** – allows you to select specific Resource Types to be included in the Auto-Matching operation: **Equipment**, **Human**, **Material**, or **Location**.

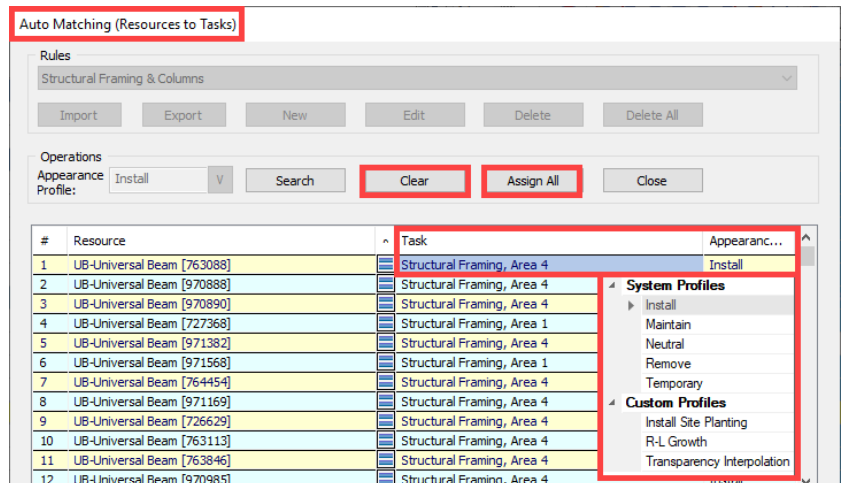
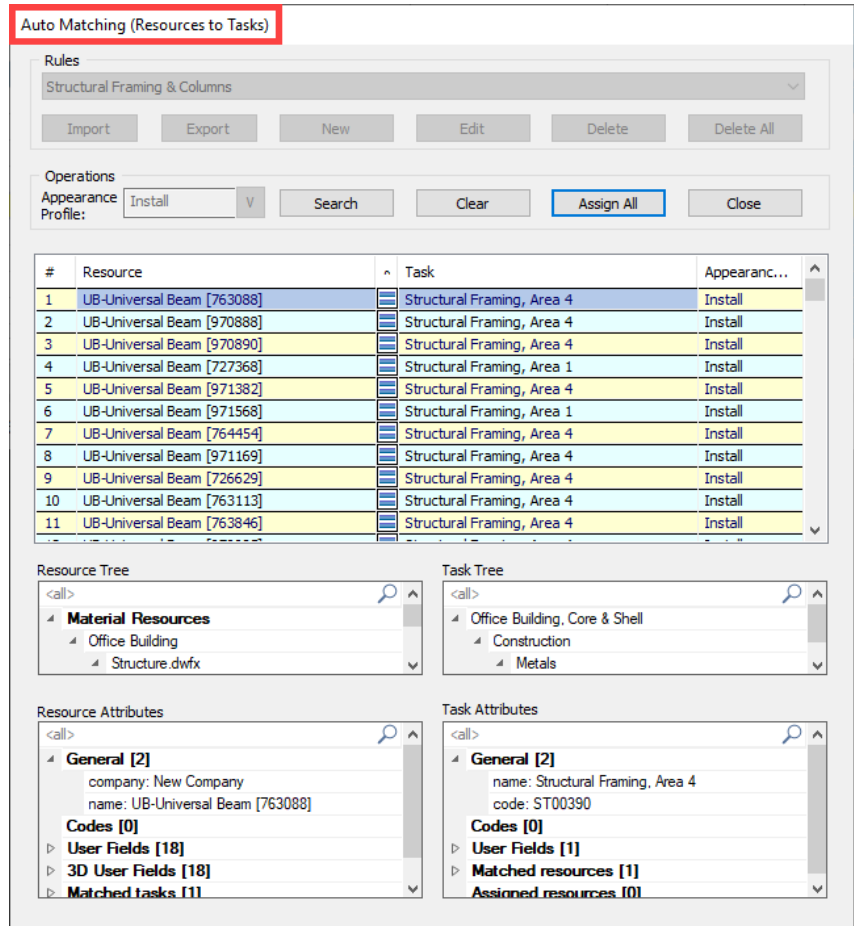
- The **Task Attribute** section defines the which Task Attribute (**Name**, **ID**, **Comment**, **User Field**, or **Activity Code**) will be matched against the defined Resource Attribute.
 - i. **User Field** - Select the required value from the drop-down list.
 - ii. **Activity Code** – select the required code from the drop-down list.
 - iii. **Search Parent** – allows the search to apply to the parent elements if the attribute does not exist in the current Task.
2. The **Algorithm** section defines how the Resource and Task attributes should be matched.
 - **Exact** – matches attributes exactly.
 - **Substring** – returns a match if the Resource attribute occurs within the Task attribute (i.e. “ana” is a substring of “banana” in two different places).
 - **LCS** – Matches the Longest Common Substring between the Resource and Task attributes. The minimum length of this substring is defined by the **Min Length** option.
 3. The **Options** section of the dialog defines additional search criteria:
 - **Min Length** – determines the minimum string length when the LCS matching is performed.
 - **Min Digits** – defines the minimum number of matching characters for a match.
 - **Separator** – If an attribute or field consists of multiple words or phrases, then the **Separators** option may be used to define the delimiters used between each word or phrase. During searches, the Auto-Matching function will test each word or phrase of the attribute, rather than the complete text defined for the attribute.
 4. The **Operator** radio buttons are used to logically define how multiple search expressions will be combined to determine whether or not a match exists. This allows complex search patterns to be defined for a single rule:
 - **AND** – this Expression must be true in order for a match to be found.
 - **OR** – a match will be found if this Expression is true even if the other(s) are not.
 - **AND NOT** – this Expression must be false in order for a match to be found.
 - **True if Undef** - controls whether the term should be evaluated as true if the matched attribute is undefined for a particular attribute.
*(Ex: If the Task Attribute is Activity Code, when **True if Undef** is checked, the Expression will automatically be true for any tasks that do not have an assigned Activity Code).*
 5. Press **Save** to save the current Expressions.
 6. If you wish to continue adding more Expressions, press **Add**.

- The **Remove** button can be used to delete the currently selected Expression. **Remove All** will delete all of the Expressions associated with the current rule.
- When the Rule is finished, press **OK** to close the dialog and return to the Auto Matching window to run a search.

26.3. Auto-Matching Search

Once an Auto Matching rule is defined, you can run the rule to search for matches in your SYNCHRO Project.

- Select the desired **Rule** from the drop down.
- Press the **Search** button.
- The groups list will display the matched Resources and Tasks.
- Right click in the list to select the proposed linking Options:
 - **Group Relations** – defines the proposed linkage (**None**, **One-to-One**, **Many-to-Many**) between the currently selected matched Resources and Tasks.
 - **Overall Relations** – defines the proposed linkage for all the matching resources and tasks.
- The **Resources Tree** displays a sub-tree containing the matched resource starting from the Resource Type.
- The **Task Tree** displays the matched Task and its hierarchy.
- You can change the assigned **Appearance Profile** for each matching group by clicking within the Appearance Profile column (which will display a drop-down list of the available **Appearance Profiles**).
- Press the **Assign All** button to apply your proposed Linkages (assigning all matched Resources to matched Tasks in the list)
- The **Clear** button will clear the list. You can then select another **Rule** in the dialog and repeat the Auto Matching operation again until you reach the desirable result.



Appendix E: Synchronisation -Basic Rules for Scheduling Software

P6

GUID (Global Unique Identifier) is the primary information used to compare Tasks. If the Task is not found in the GUID map, and the option to **Use Activity IDs on Synchronisation** is set in **Options → Synchronisation → Primavera P6**, the IDs are compared. If not found, the Activity is considered a new one. If found; the Task and GUID map are updated.

27. Therefore:

- If the original schedule and P6 database are used to update, SYNCHRO will look for GUID's when synchronising.
- If the original schedule has been copied then updated, a different P6 database has been used, or if the GUIDs are not found, then Activity IDs will be compared, provided they have not been changed.
- It is possible to change the IDs in both P6 and SYNCHRO, as long as GUIDs remain unchanged.
- The schedules can be Synchronised using a different computer and can have a different file name

Asta

When making copies of the original schedules that are created in other systems; the global unique ID of each task will be changed in the process of copying.

Therefore, when a copy is made and introduced into the Synchronisation workflow the change will be made to the original task's own internal UID (unique identifier).

This will result in SYNCHRO not recognising the task as the same, therefore all prior resource assignments will be lost. It is essential that the original import/export schedule is used throughout the workflow. If copies are introduced, it is important that they are only for side reference or saved as an archive as required, but at all times updates and changes are Synchronised between SYNCHRO and the original or original updated schedule.

In essence, the original and updated schedules throughout the workflow process should be from the same source schedule and **NOT** copied versions.

The programme can be Synchronised using a different computer and can have a different file name

Microsoft Project XML

MSP xml uses an attribute called Unique IDs (UID) that is used when synchronising.

You can copy and update a project provided it is the same MSP Project resaved/exported in MSP then UIDs are retained. The projects can be Synchronised using a different computer and can have a different file name.

Appendix F: Synchronisation Scenario (Skip, Synchronise, Consolidate, Integrate)

Summary:

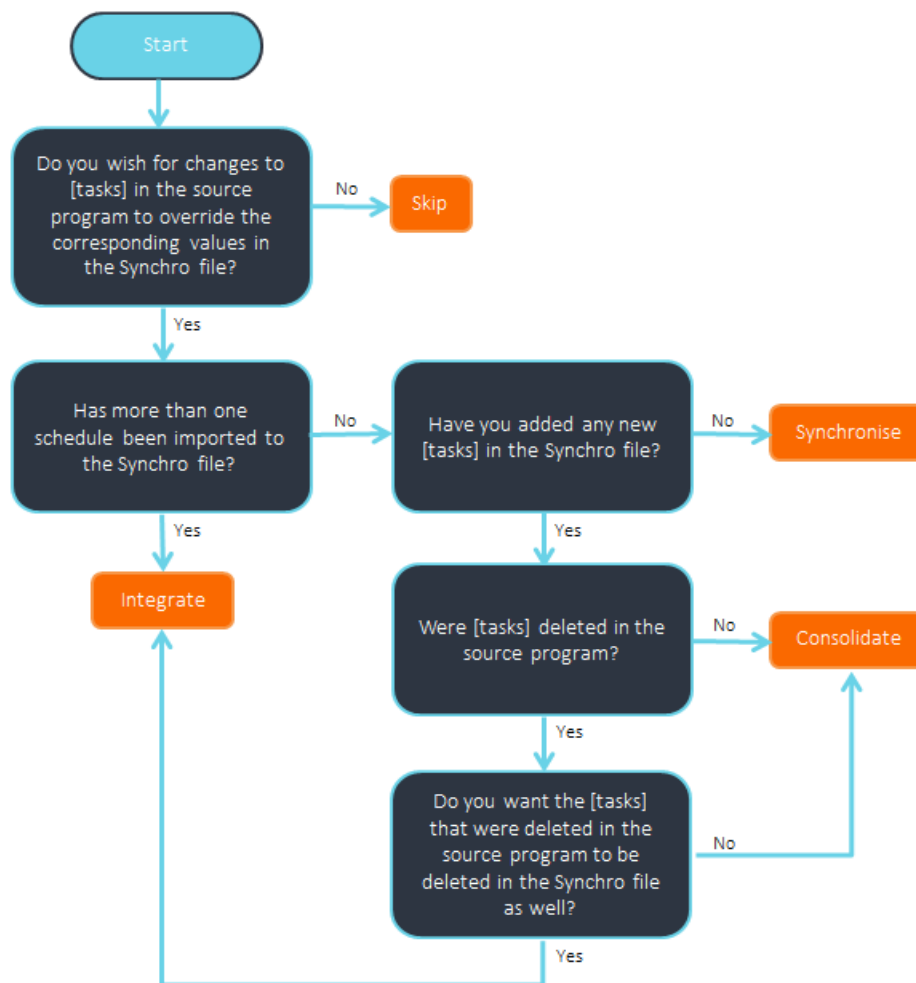
This question looks at your knowledge of synchronisation options in an example scenario.

Question:

Consider the following scenario:

- 28.
1. Company XYZ employs both a professional P6 scheduler and a SYNCHRO specialist. The scheduler creates a schedule in P6 named Schedule1.xer,
 2. The SYNCHRO specialist imports the P6 schedule into SYNCHRO after opening a new .sp file which he saves as Project1.sp.
 3. The SYNCHRO specialist then imports a 3D model into the same .sp file and begins linking the 3D resources to the tasks. For the purpose of animation, he subdivides some of the tasks and creates entirely new tasks for equipment traveling on 3D paths.
 4. Meanwhile the scheduler has updated the durations of some of the tasks in P6, added a few more tasks, and deleted a few tasks as well. The updated schedule file is resaved as Schedule1.xer.
 5. When the SYNCHRO specialist goes to Synchronise Project1.sp with the updated schedule, he opens **Navigator** tab → **Project Data** panel → **External Data**. He right clicks on **Primavera** → **[Schedule1][Import][Date]** and selects **Synchronise from**.
 - 6.

This scenario is illustrated graphically below:



Below are simplified example schedules, with durations in parentheses after the tasks. The left one was created in P6 and imported into SYNCHRO to begin. The middle one is the result of modifications made to the schedule in SYNCHRO by the SYNCHRO specialist, and the right one reflects the changes the scheduler has made in P6.

Original Schedule	Modified Schedule in SYNCHRO	Modified Schedule in P6
Project1 Foundation (10d) Walls (10d) Landscaping (20d)	Project1 Foundation (10d) Walls (10d) Wall 1 (5d) Wall 2 (5d) Landscaping (10d) Truck Move (20d)	Project1 Foundation (15d) Walls (10d) Windows (5d)

a) Primavera P6 synchronise from

How would you like to import this file?

☐ Use the Selected Task to merge the data into the current Project

☐ Append the data to the end of the current Project

Choose how you would like to process each object

Object	Command
Tasks	Synchronise
Links	Synchronise
Task constraints	Synchronise
Costs	Synchronise
Calendars	Consolidate
Resources	Consolidate
Resource assignments	Integrate
Risks	Skip
Risk assignments	Skip
Activity codes	Consolidate
Codes assignments	Synchronise
User fields	Consolidate
User field values	Synchronise
Users	Skip

Default Skip all

< Back Synchronise Cancel Help

b) Primavera P6 synchronise from

How would you like to import this file?

☐ Use the Selected Task to merge the data into the current Project

☐ Append the data to the end of the current Project

Choose how you would like to process each object

Object	Command
Tasks	Integrate
Links	Integrate
Task constraints	Synchronise
Costs	Synchronise
Calendars	Consolidate
Resources	Consolidate
Resource assignments	Integrate
Risks	Skip
Risk assignments	Skip
Activity codes	Consolidate
Codes assignments	Synchronise
User fields	Consolidate
User field values	Synchronise
Users	Skip

Default Skip all

< Back Synchronise Cancel Help

c) Primavera P6 synchronise from

How would you like to import this file?

☐ Use the Selected Task to merge the data into the current Project

☐ Append the data to the end of the current Project

Choose how you would like to process each object

Object	Command
Tasks	Integrate
Links	Integrate
Task constraints	Synchronise
Costs	Synchronise
Calendars	Consolidate
Resources	Consolidate
Resource assignments	Synchronise
Risks	Skip
Risk assignments	Skip
Activity codes	Consolidate
Codes assignments	Synchronise
User fields	Consolidate
User field values	Synchronise
Users	Skip

Default Skip all

< Back Synchronise Cancel Help

d) Primavera P6 synchronise from

How would you like to import this file?

☐ Use the Selected Task to merge the data into the current Project

☐ Append the data to the end of the current Project

Choose how you would like to process each object

Object	Command
Tasks	Consolidate
Links	Consolidate
Task constraints	Synchronise
Costs	Synchronise
Calendars	Consolidate
Resources	Consolidate
Resource assignments	Synchronise
Risks	Skip
Risk assignments	Skip
Activity codes	Consolidate
Codes assignments	Synchronise
User fields	Consolidate
User field values	Synchronise
Users	Skip

Default Skip all

< Back Synchronise Cancel Help

In which of the following windows has the SYNCHRO specialist selected the correct options to Synchronise without losing any of the work that he and the scheduler have conducted since the first version of the schedule was originally imported into Project1.sp?

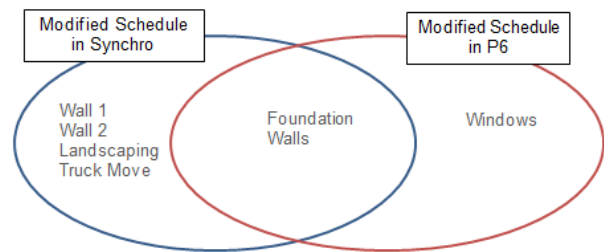
Answer: b)

Explanation:

The attributes of concern in this scenario are **Tasks**, **Links**, **Resources**, and **Resource assignments**. The original schedule has been modified in SYNCHRO, so choosing **Synchronise** for **Tasks** and **Links** will override and replace the modified schedule in SYNCHRO with the updated P6 schedule. All the subtasks and equipment movement tasks created by the SYNCHRO specialist will be lost. Therefore, **a)** is not the correct answer.

The scheduler has deleted tasks. If the **Tasks** and **Links** are consolidated, the tasks that the scheduler has deleted will remain in the consolidated schedule because **Consolidate** keeps the greatest number of tasks compared to the other options: any tasks that are in either schedule (SYNCHRO or P6) will be in the new schedule – no tasks will be deleted from either schedule. You can think of it like a Venn diagram:

Consolidate will keep all of the tasks in both ovals; **SYNCHRONize** would keep all of the tasks in the red oval (including the overlap.) Note: if a task is in both schedules (the overlap in the Venn diagram), the schedule that is being SYNCHRONized **from** will take precedence in determining the task duration and other attributes. Because we do not want the **Landscaping** task in our final schedule, **d)** is not the correct answer.



The same Venn diagram does not work to explain **Integrate** because the action **Integrate** takes depends on which program originated the change relative to the original schedule. For example, even though just looking at the Venn diagram above, you wouldn't guess that **Landscaping** and **Truck Move** would be treated differently when integrating, but the program remembers that **Truck Move** was created in SYNCHRO, whereas **Landscaping** was part of the original schedule that was then deleted in P6. Tasks that were created in SYNCHRO will be retained when **Integrate** is chosen, but tasks that were part of the original schedule, then deleted in P6 (even though they are in the modified schedule in SYNCHRO) will be deleted in the new schedule as well after the **SYNCHRONize from** is carried out. Therefore **Integrate** is the correct option for **Tasks** and **Links**.

If we now look at **Resource Assignments**, we see that **b)** has **Integrate** selected while **c)** has **Synchronise**. **Integrate** will work the same way for Resource Assignments as for Tasks – any assignments made in either program will be retained, as long as a deletion hasn't been made in the source program (in this case, P6). **Synchronise** will override all of the **3D Resource** assignments made in SYNCHRO (the term "Resource" in P6 refers primarily to human resources). Therefore, **c)** is not the correct answer.

The correct answer is **b)**.

The final schedule in SYNCHRO after **Synchronise From** has been performed will be:

Final Schedule in SYNCHRO
Project1
Foundation (15d)
Walls (10d)
Wall 1 (5d)
Wall 2 (5d)
Windows (5d)
Truck Move (20d)

Contact Details

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SYNCHRO Website: <https://www.bentley.com/en/products/brands/synchro>

SYNCHRO Bentley Communities:

https://communities.bentley.com/products/construction/w/construction_wiki

FAQ: https://communities.bentley.com/products/construction/w/construction_wiki/41481/best-practices-and-faq

Submit an Idea for Improvements: <https://communities.bentley.com/products/construction/i/synchro-construction-solution-ideas>