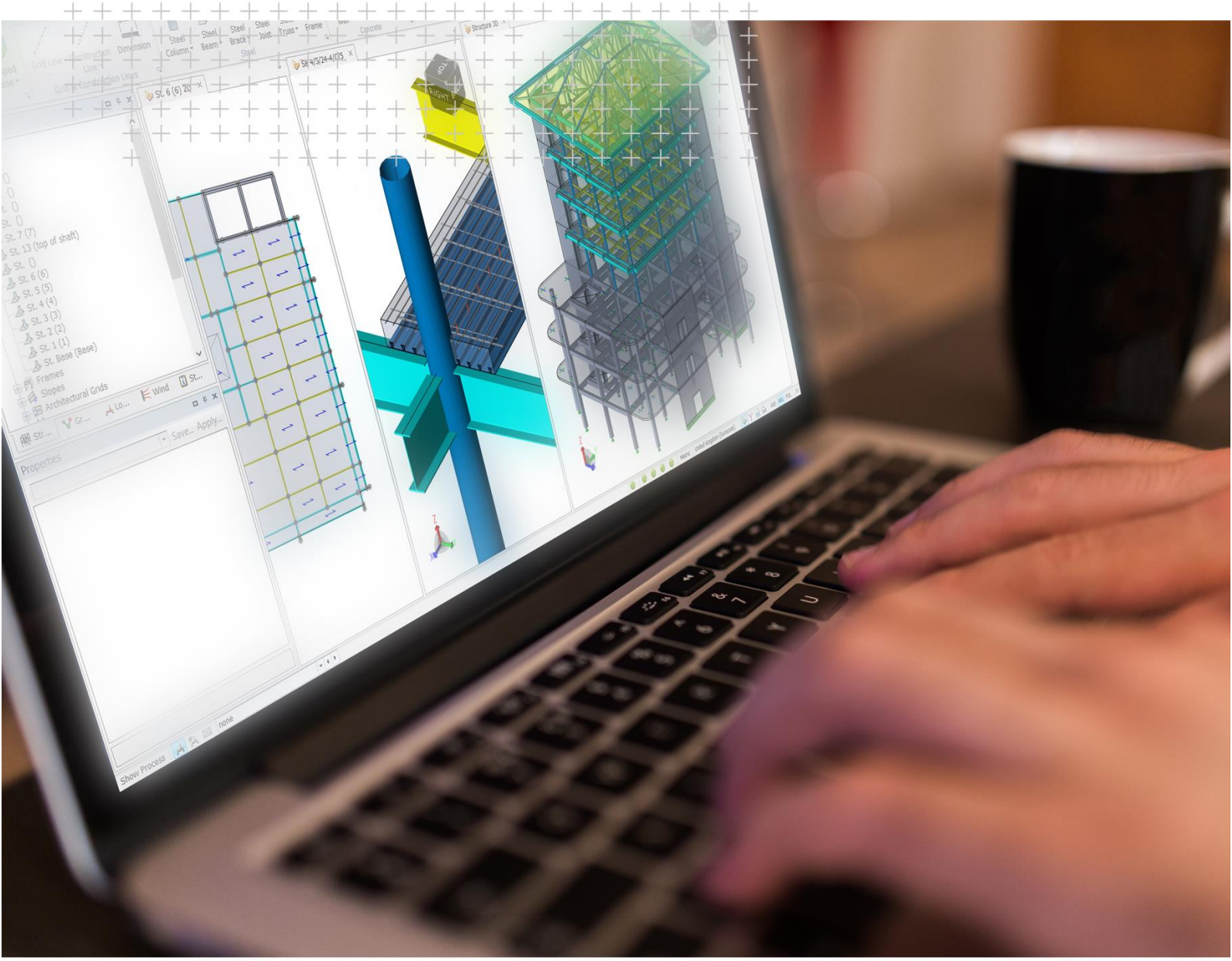

# Tekla Structural Designer

## Integration with Tekla Structures

## Guidance Documentation

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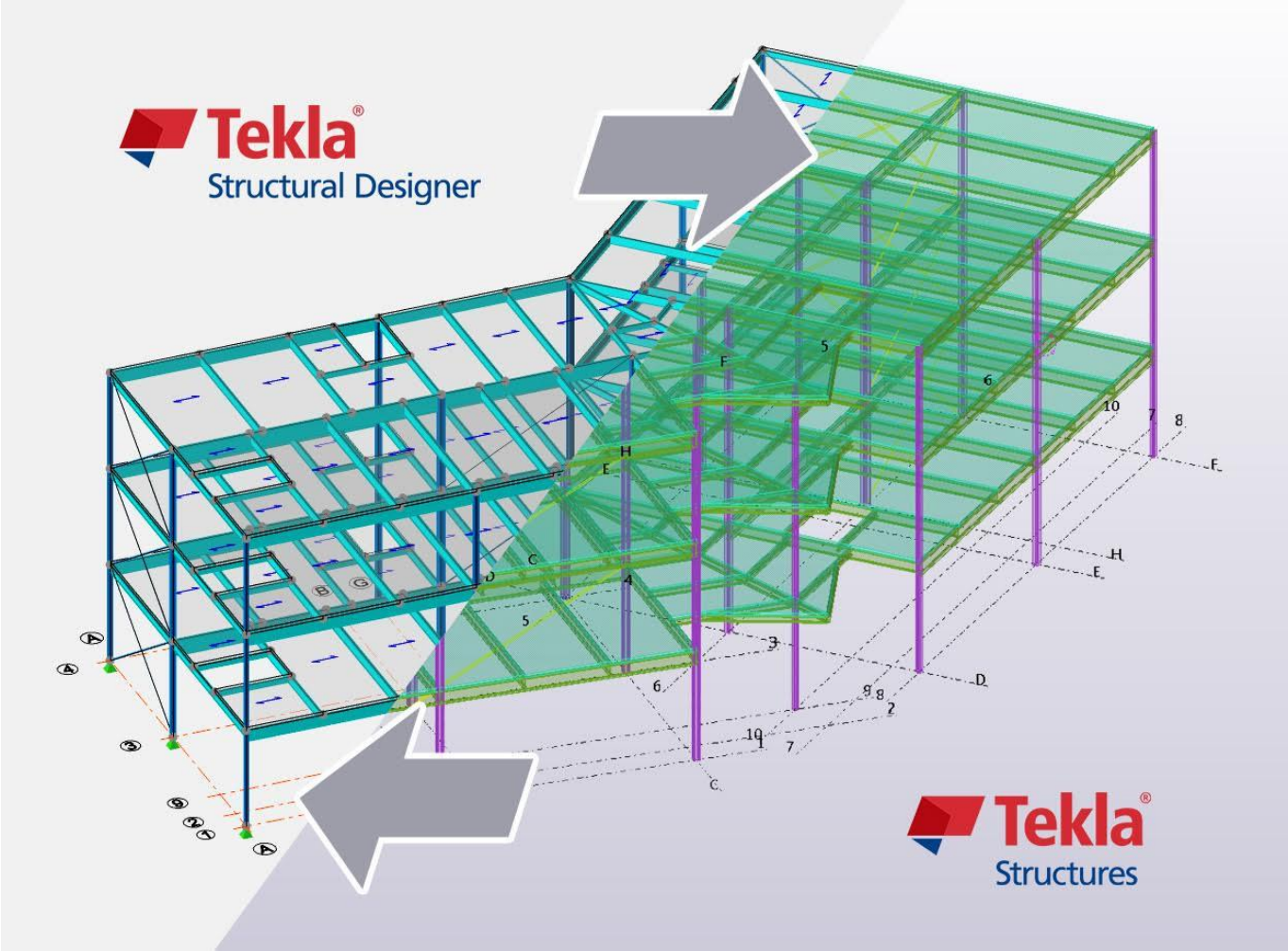
# 1 Overview of Integration




When considering the integration of Tekla Structural Designer and Tekla Structures it is important to understand that the information transferred is essentially the physical information associated with the structure - e.g. geometry, section sizes and grade, number of studs and slab thicknesses etc.
Tekla Structures allows engineers to quickly and easily create accurate structural models complete with information that offer value from design to construction completion. Design data can be imported and enhanced with Tekla Structures for the production of complete, coordinated and constructible drawings and material lists.

The integration process allows users to pass models to and from Tekla Structural Designer and Tekla Structures, updating changes to the physical model whilst also allowing both parties to concurrently update their own versions of the model. As the model is integrated between software applications, the user will find that changes are updated whilst additional items created since the last export operation are maintained within the model.

# 2 Project Workflows

Integration between Tekla Structural Designer and Tekla Structures has been developed to ensure the initial model can be started in either tool without any detriment to the design process. This added flexibility enables companies to align their software solutions closely to their own workflows. (I.e. The initial model can be created in Tekla Structural Designer by the Engineer, or in Tekla Structures by the Technician.)

We would recommend that the Tekla Structures model be used as the **master model** for all geometrical changes. Alterations made to the model geometry are best handled by altering the Tekla Structures model and transferring the changes through to Tekla Structural Designer for redesign.

A typical workflow and the decision making process through the different stages of a project could be as follows:-

## 2.1 Initial Scheme Stage

- The initial model may be started in Tekla Structural Designer or Tekla Structures without any detriment to the process.
- A number of factors may determine which software is used in the initial modelling process, such as availability of staff, or deliverable requirements.
- Unless there are external drivers, Tekla Structures may prove to be the best starting point for the model as it can provide most of the deliverable items at the initial stage.
- The model does not need to cover the complete building, it might be a typical bay or floor for example.
- The generated structure can be designed in Tekla Structural Designer for initial section sizing at the initial stage and synchronized back to Tekla Structures for initial drawings or material list creation.
- Simple drawings can be created at this stage; this can be done in Tekla Structural Designer or Tekla Structures.
- Initial material lists for cost estimates can be generated at this stage.

## 2.2 Detailed Design

- It is not always appropriate to carry models forward from the Initial Scheme Stage to the Detailed Design Stage. It is sometimes better to begin the model again.
- Models can be started in Tekla Structures or Tekla Structural Designer to suit the user. The models can then be transferred to the other modelling system.
- Importantly, the two models can be worked on at the same time, with synchronization of the two models taking place to suit the workflow.
- Within Tekla Structural Designer, the model can be used for a full design of the structure, sway check, lateral (wind) design and a design of connections (if required).
- Within Tekla Structures, drawings can be generated to a Tender stage level and general arrangements submitted to Building Control for approval.

## 2.3 Construction Stage

- Using the model from the Detailed Design stage, much of the Construction Stage process will take place in Tekla Structures so that the integration with other trades can be accounted for.
- The design is not revisited unless the client drives the requirement for change.
- If a re-design of the structure is required, the same synchronization of Tekla Structural Designer and Tekla Structures models can be carried out to suit the user.
- The model will be completed within Tekla Structures and fully detailed drawings for parts can be created along with construction level drawings of the structure.
- Detail integration checks with other trades (e.g. Mechanical and Electrical Engineers) can be carried out at this stage.

# 3 Tekla Structural Designer into Tekla Structures

## 3.1 Creation of the Tekla Structural Designer Model

The Engineer has a number of options available to him when creating a Tekla Structural Designer model.

### 3.1.1 Create model from Scratch.

- Tekla Structural Designer includes typical modelling tools to create grids, columns, beams, walls, floors etc. Importantly each element is modelled as a physical object that can be positioned correctly in space.
- When synchronised with Tekla Structures, the true spacial position is communicated along with items such as sections size, grade, studs, holes etc.
- For a full list of communicated items, see Section 7.

### 3.1.2 Part Models.

- At the early stages of design, it is possible to create part models to investigate a structural scheme.
- For example, the engineer can model just a floor or a bay in Tekla Structural Designer to investigate the best solution to satisfy code compliance and economics.
- Although only a part model, this can still be sent to Tekla Structures. (Note, the physical position of the part model will be communicated to Tekla Structures.)
- For example, if an engineer models a floor but the true level is not yet known, this part model can be sent to Tekla Structures where adjustments can be made. If this model is communicated back to Tekla Structural Designer its position will be updated.
- At the early design stages is it reasonable to stop the bi-directional integration as new refined models are often created later in the design process.

### 3.1.3 Import 2D Drawings.

- It is common early in a project to have a number of 2D architectural drawings outlining the scheme. Tekla Structural Designer has the facility to import 2D DXF drawings.
- The engineer can use these drawings as ghost layouts in the background to aid setting out or to import grids.
- If a common grid is used on the project, it is logical to import this grid into Tekla Structural Designer to ensure the structure is set out in the correct position.
- If a number of separate models are to be created and merged together it is strongly advisable to use a common grid system.
- When importing grids it is also advisable to check the geometry of the grid thoroughly.

## 3.2 Deliverables

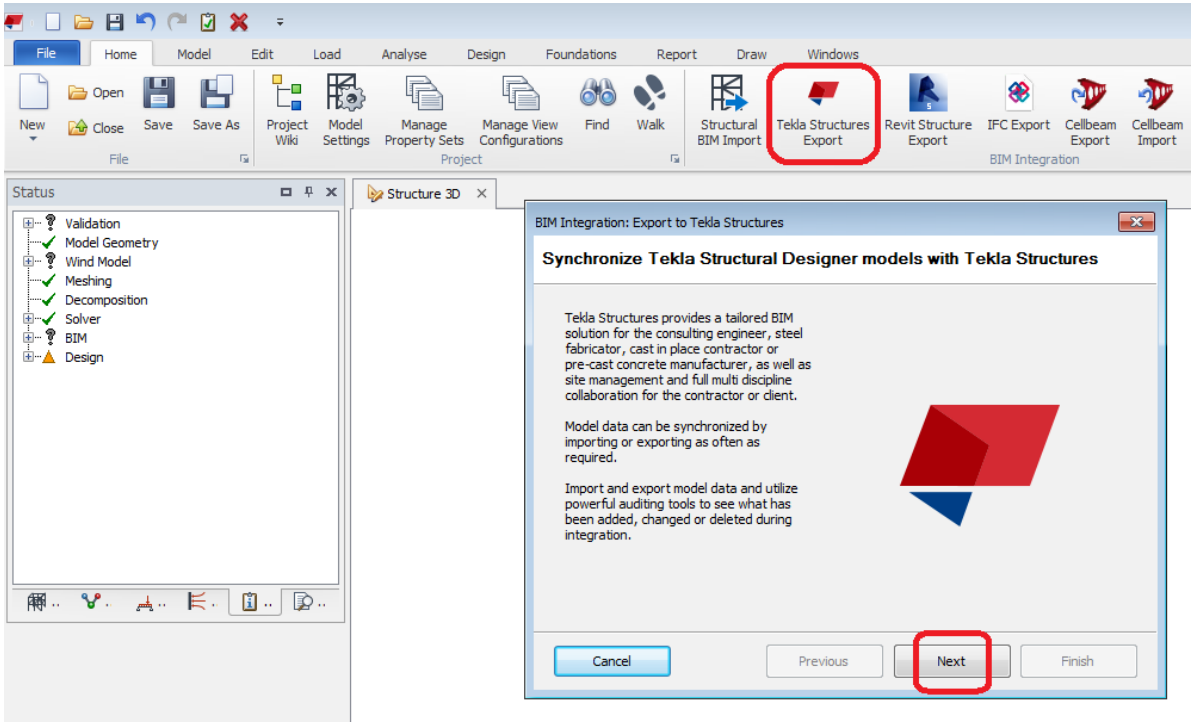
Even at these early stages of a project, Tekla Structural Designer provides a significant number of the deliverables required.

For example:-

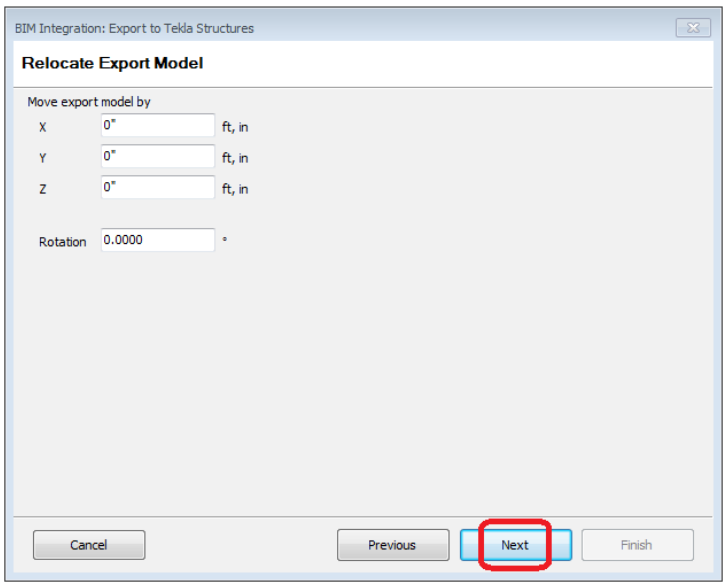
- Comprehensive code compliant scheme design.
- Material take off.
- 2D engineering DXF drawings.
- Member end forces and support reactions.

## 3.3 Exporting a model from Tekla Structural Designer

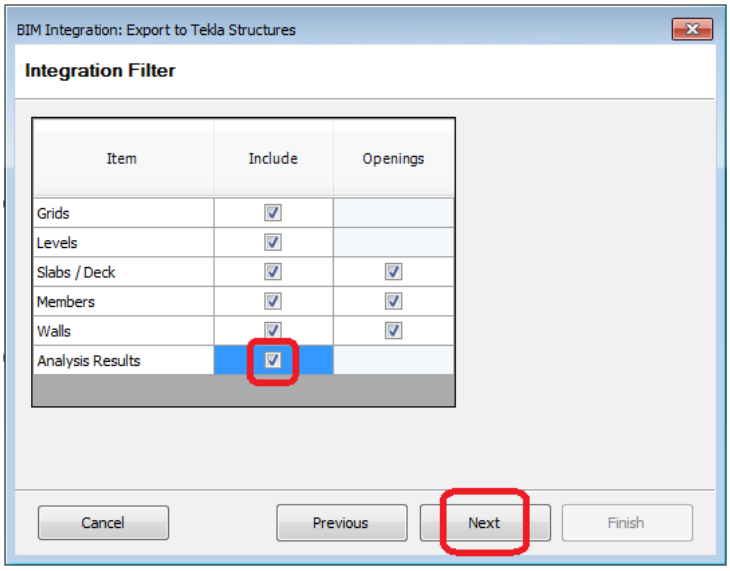
Once a model has been created in Tekla Structural Designer, you need to save the model with a recognisable name and then run the command **Tekla Structures Export**.



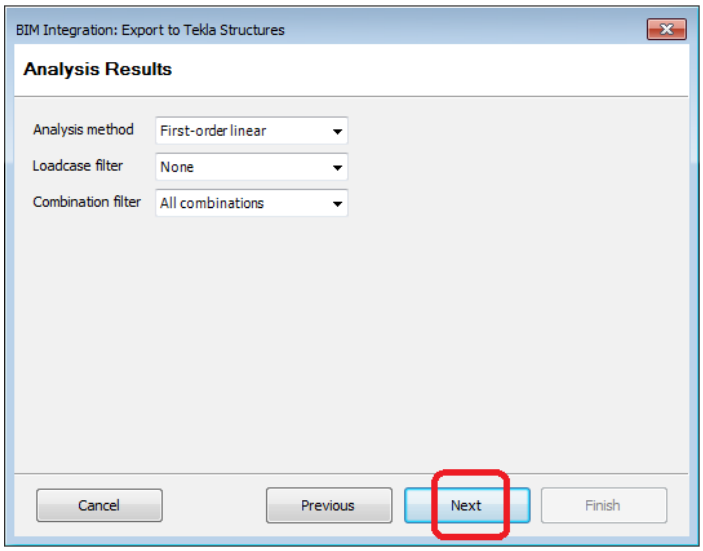
Running the command will start the export application with various dialogs displayed through a wizard process. The first screen encountered will allow you to move the model to a real world co-ordinate by entering suitable figures within the dialog. In our case, we will keep the values at the default and just choose **Next**.



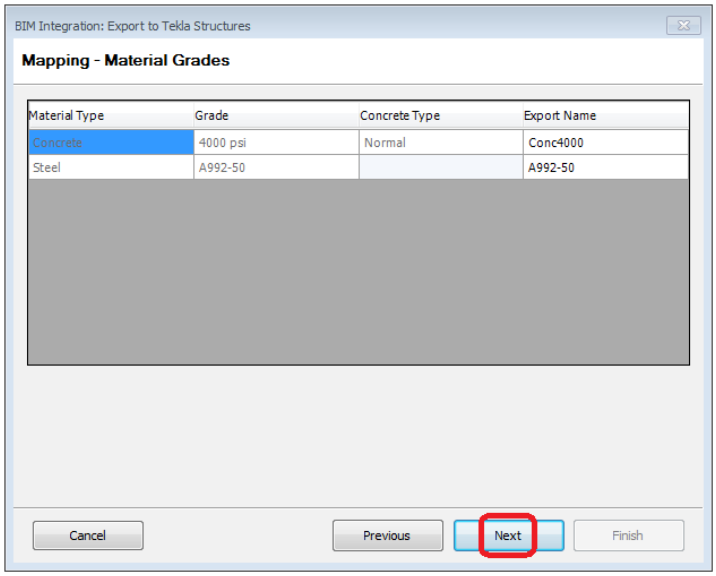

After the model location, you will be prompted to choose the element types to choose to export along with options for openings where applicable. The default settings are that all items should be exported and in this example, we will follow the same settings – clicking **Next** to continue.



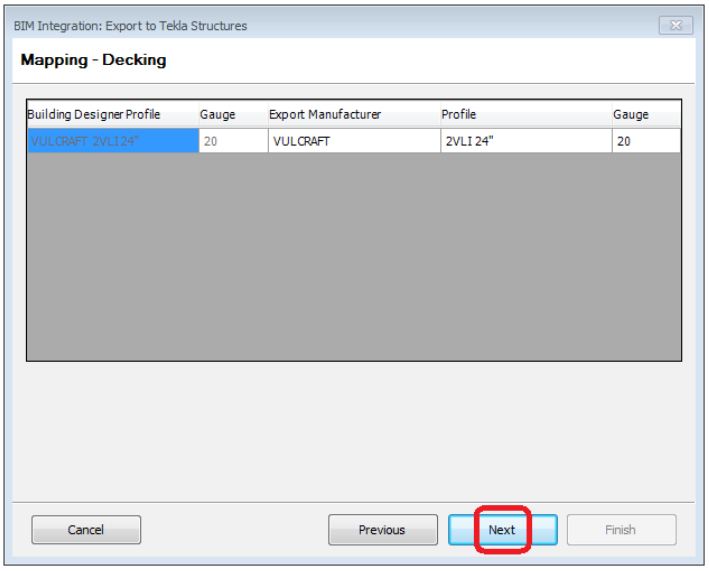
In this example, we have chosen to export Analysis Results as the model has been successfully analyzed and designed within Tekla Structural Designer. This option (deselected as default) directs us to a new dialog where we can choose which analysis methods, loadcase results and load combination results we can choose to export. We keep the default setting of first order linear analysis results for all combinations and simply click on the Next button to advance.



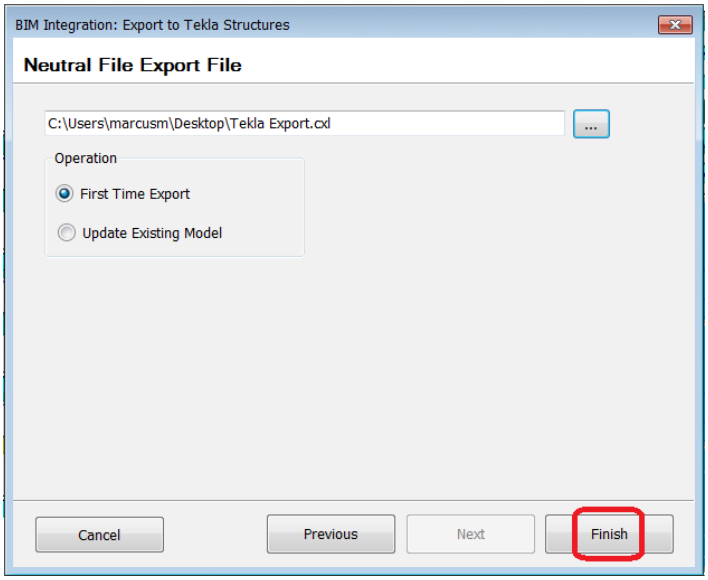

Mapping of materials to recognised grades will be then shown. Here you can view the different materials being used in the Tekla Structural Designer model and the option to overwrite the exported materials with a more preferred grade.



Following on from Material mapping, the dialog for Decking mapping will be shown (if applicable). Again, this allows users to view the decking types being used in the model and have the option of overwriting the exported details if required.



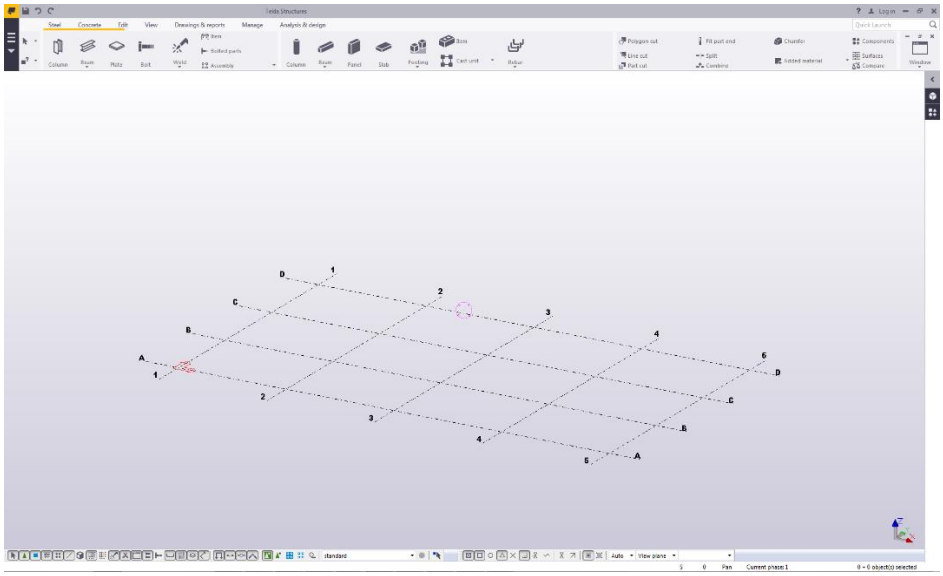

The final dialog screen of the export wizard will prompt for a filename and location of the CXL file to be created. Please note that there are two options relating to a first time export and an option to update and existing model. For the initial export, the option **First Time Export** should be chosen. (The option to **Update Existing Model** will be used to pass alterations in the event of a Tekla Structures model already in existence.)



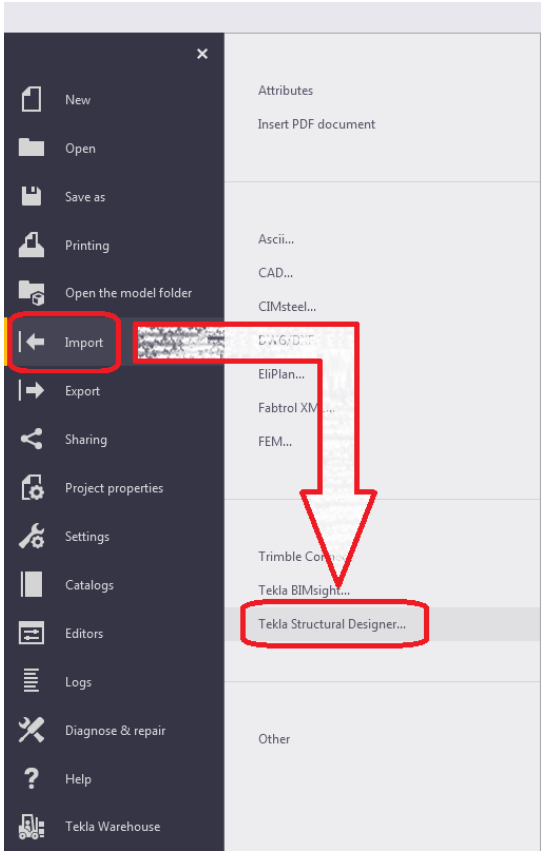
## 3.4 Importing a model from Tekla Structural Designer into Tekla Structures

This example covers the import of a model into Tekla Structures. The file that we are using contains no mapping problems (section sizes not being automatically recognised by the integration process) and reference should be made to section 6.1 if you find that your own files do contain problems regarding unrecognised sections.

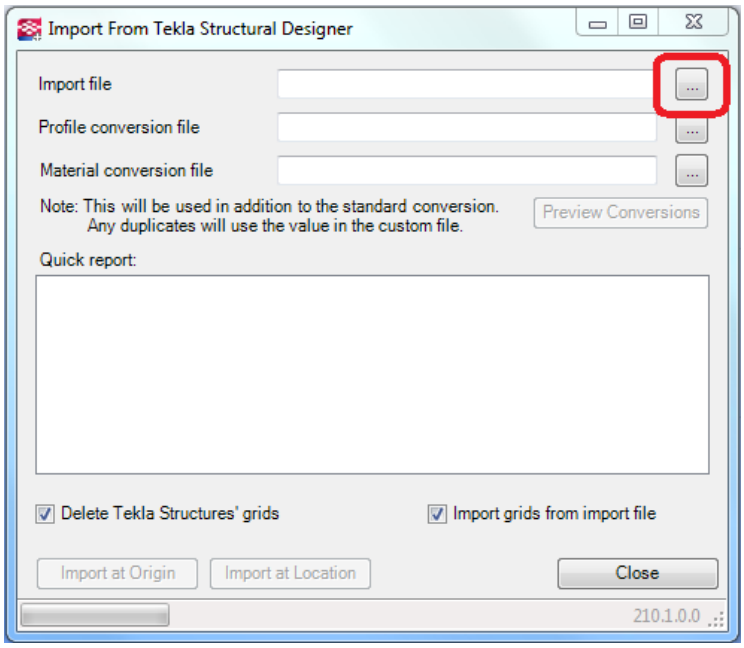
This example is going to follow a first time import into Tekla Structures from Tekla Structural Designer so initially we start with a new Tekla Structures model.



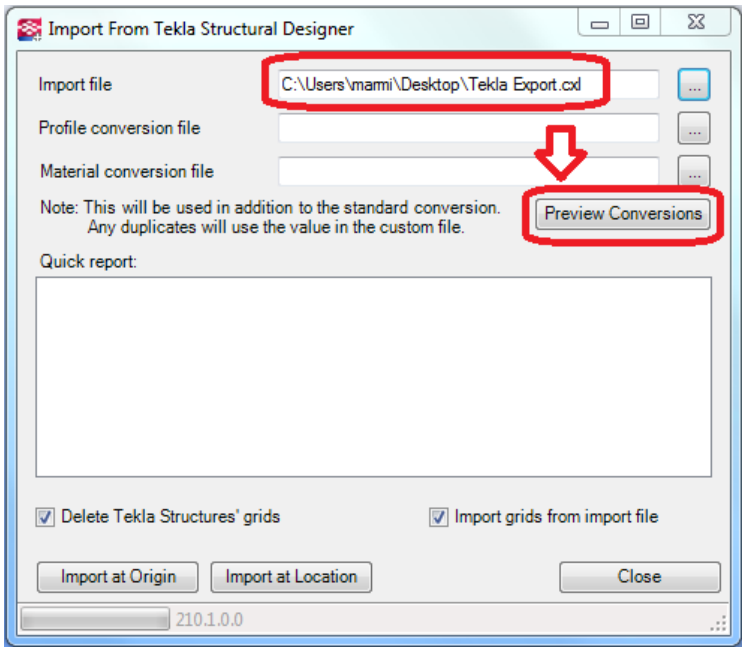
To import a model we need to use the command **Import - Tekla Structural Designer** which is available from the software **File** menu.



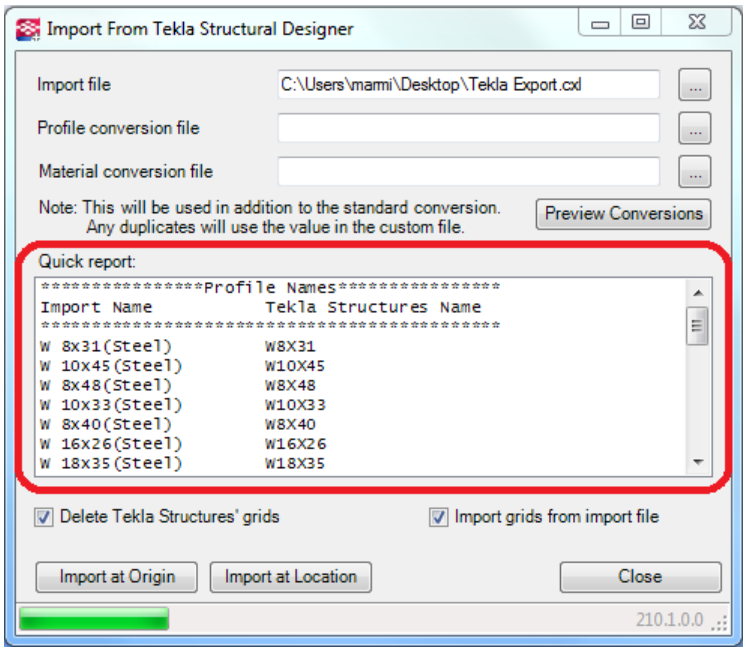
When the **Import From Tekla Structural Designer** command dialog appears, the first step should be to select the CXL file to be imported into the model. This can be done by clicking on the **…** button to the top right and browsing to the file with a simple windows dialog.



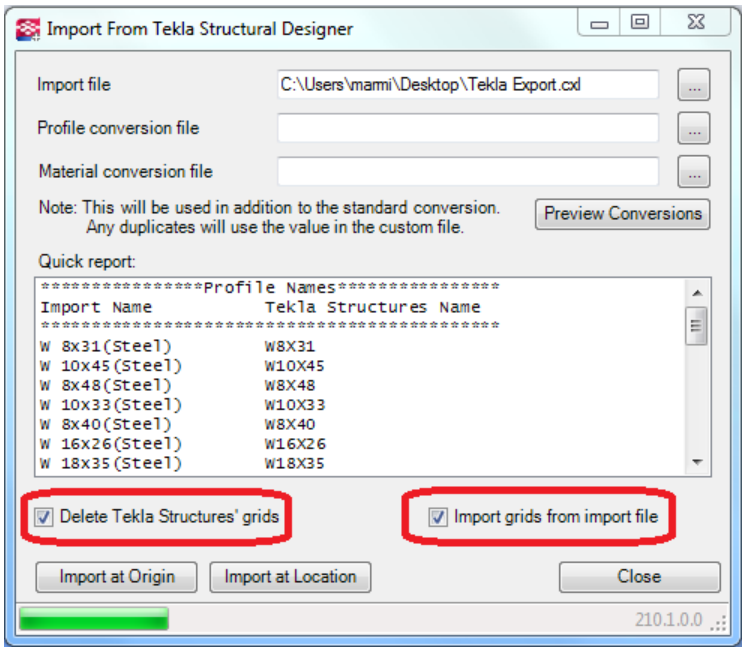

Once the file has been selected, the next stage should be to check the mapping of members between the software packages. This can be done by clicking on the **Preview Conversions** command.



The **Preview Conversions** button will allow you to check sections being imported from Tekla Structural Designer and flag any unrecognised profile names within the Tekla Structures software easily. Refer to the later section regarding conversion files for assistance if this is required.

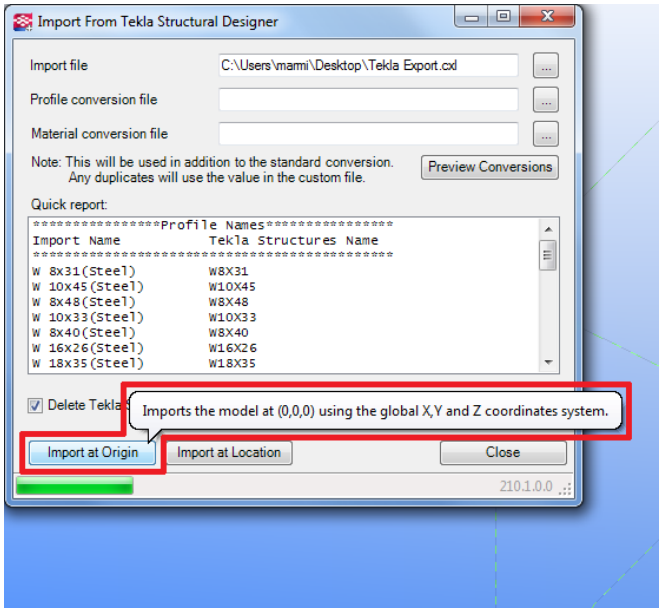



There are two options held towards the bottom of the dialog which are related to grid patterns. In this example we will keep both of the options enabled so that the existing grids are deleted from the Tekla Structures model and instead a grid pattern generated from the Tekla Structural Designer export is used instead.

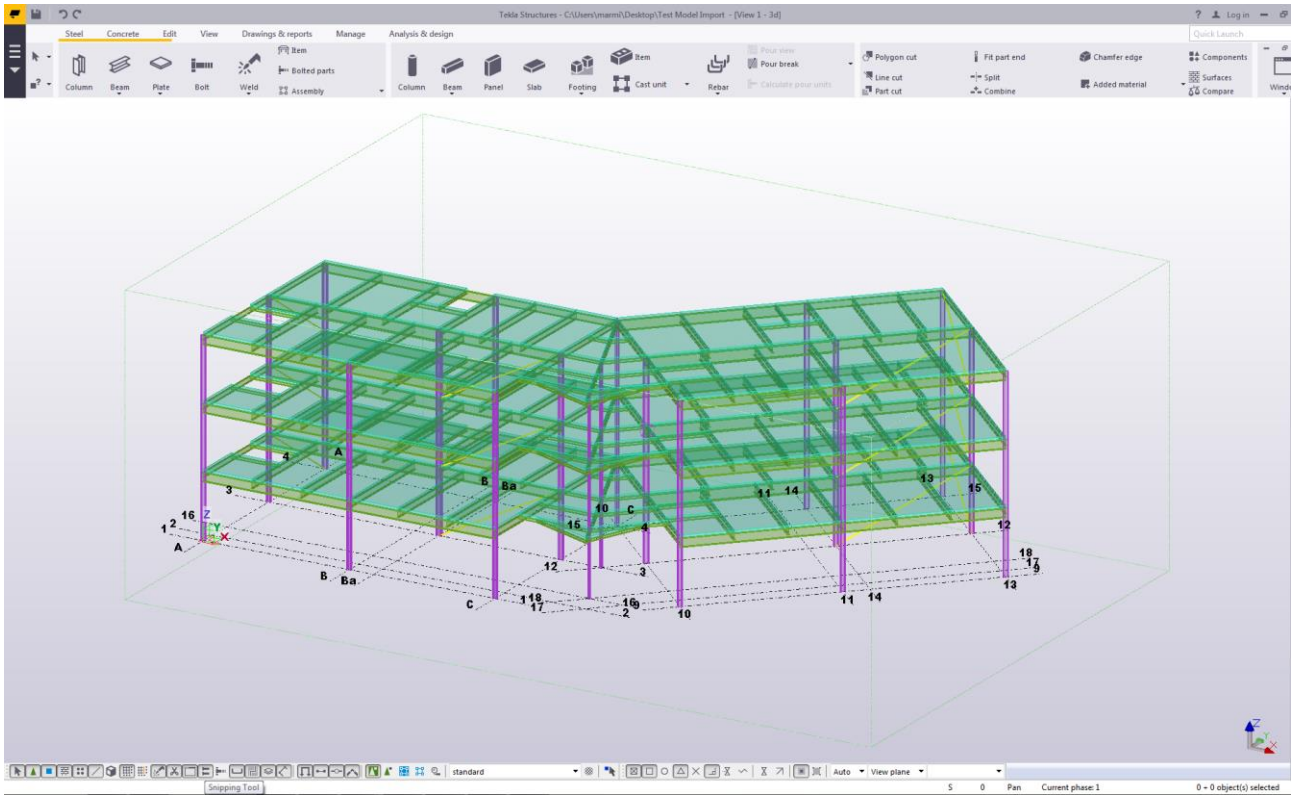


The final options relate to the import of the model itself. The **Import at Origin** option will create the model based on the **0,0,0** position within Tekla Structures whilst the **Import at Location** option will allow the user to specify a position to base the model upon.

In our example we will use the default datum position and so use the option **Import at Origin**.




The file will then process and quickly show the imported model. At this point, any open dialog windows can be closed down and the imported model inspected.



# 4 Tekla Structures into Tekla Structural Designer

## 4.1 The Tekla Structures Model

When the design process is started in Tekla Structures, there are a number of considerations to be made:-

A Tekla Structures model can be exported to Tekla Structural Designer in part or in full.
.

To export a part model, first select the members you wish to export, prior to creating the export file. The use of Tekla Structures view filters or selection filters can help with the selection of objects.

Only the main structural elements to be designed should be exported.

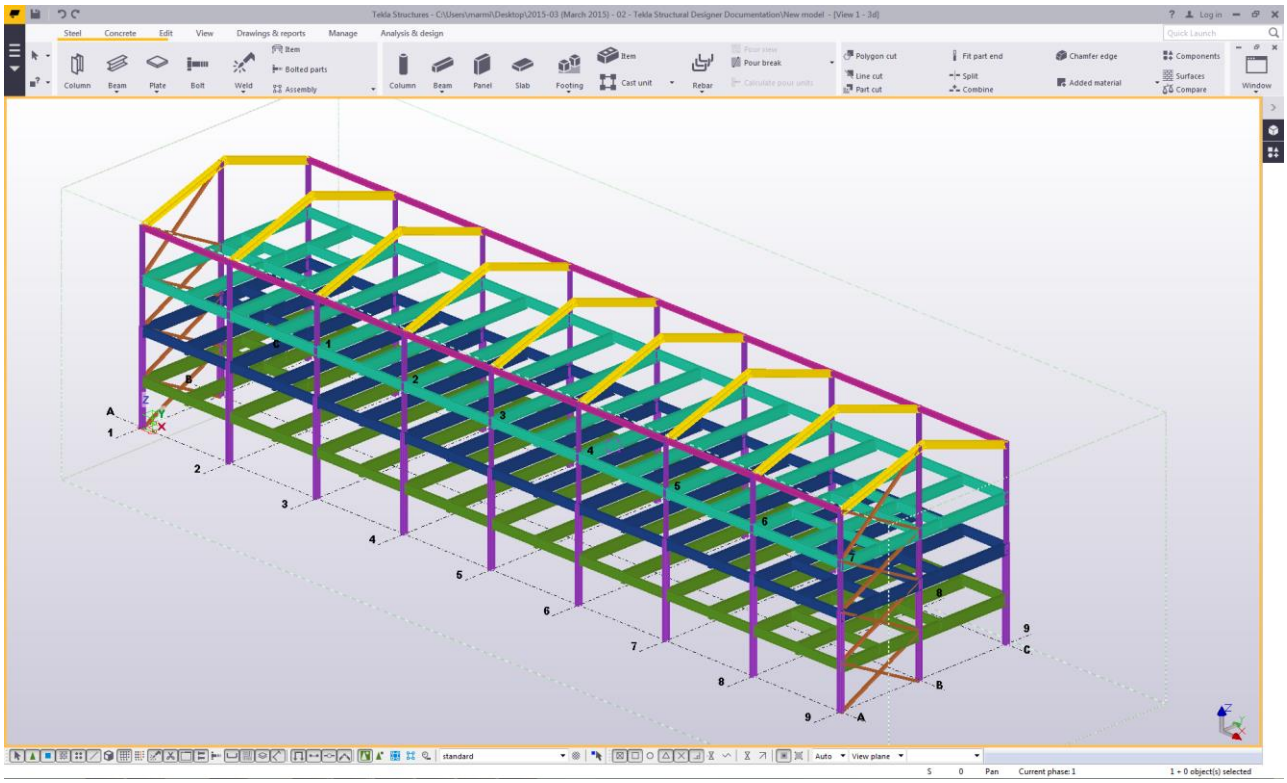
Part elements that are not structurally significant (such as endplates, cleats, gusset plates, handrails, ladders etc.) should not be exported. Remove these items from the view display (or from the selection criteria) and choose to export selected model parts only.

Tekla Structure part grip points should all intersect at the same location so that the resulting Tekla Structural Designer model is fully connected.

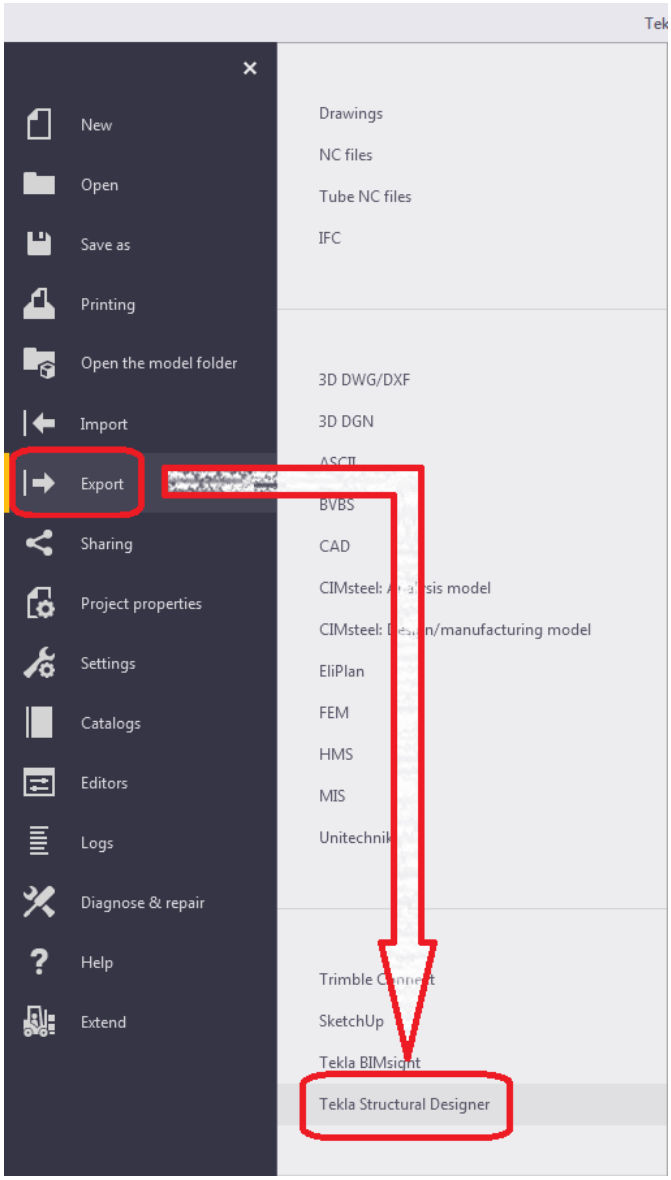
## 4.2 Exporting a model from Tekla Structures to Tekla Structural Designer

This example covers the export of a completed Tekla Structures model into CXL format. The CXL file can then be imported into Tekla Structural Designer.

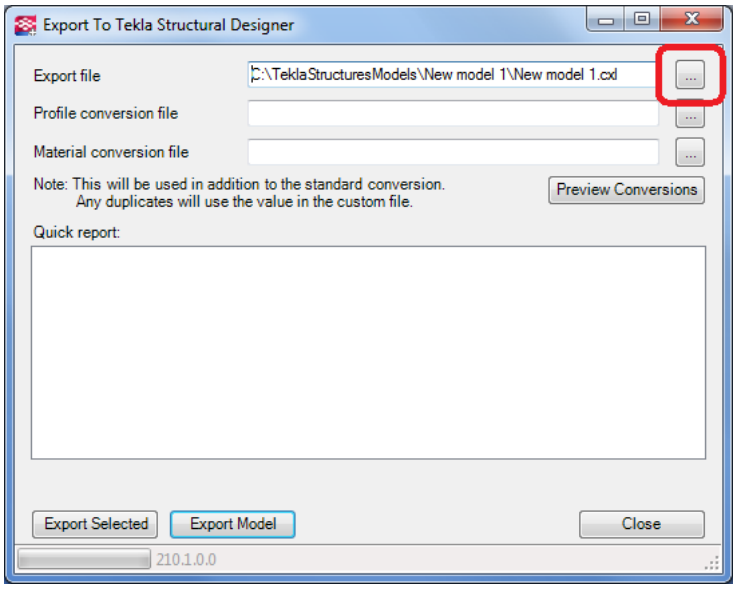
The file that we are using contains no mapping problems and reference should be made to the relevant help documentation should you find that your own model does contain problems regarding mapping.



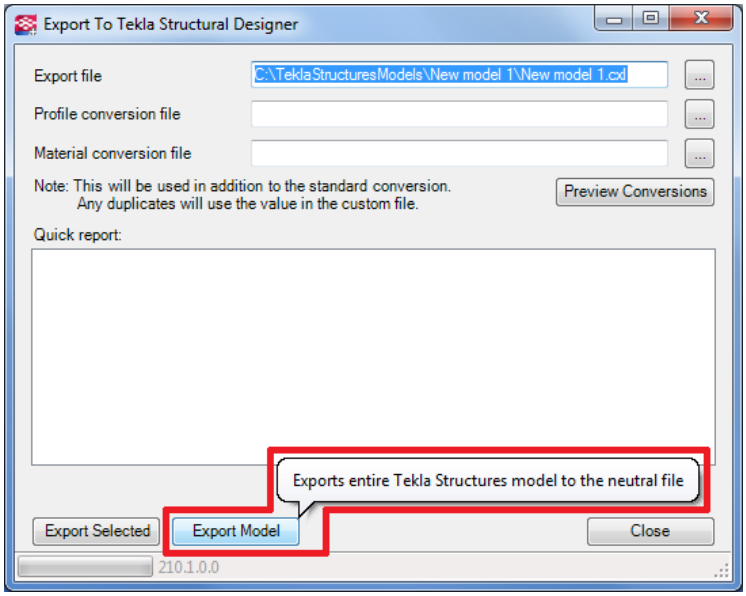
To export the model to Tekla Structural Designer, access the command **Export - Tekla Structural Designer** from the **File** menu dropdown.



The main **Export To Tekla Structural Designer** dialog should now appear. The first step that should be completed is to set the Export file name and location. Here we have chosen to call the exported file **New Model 1.cxl.**

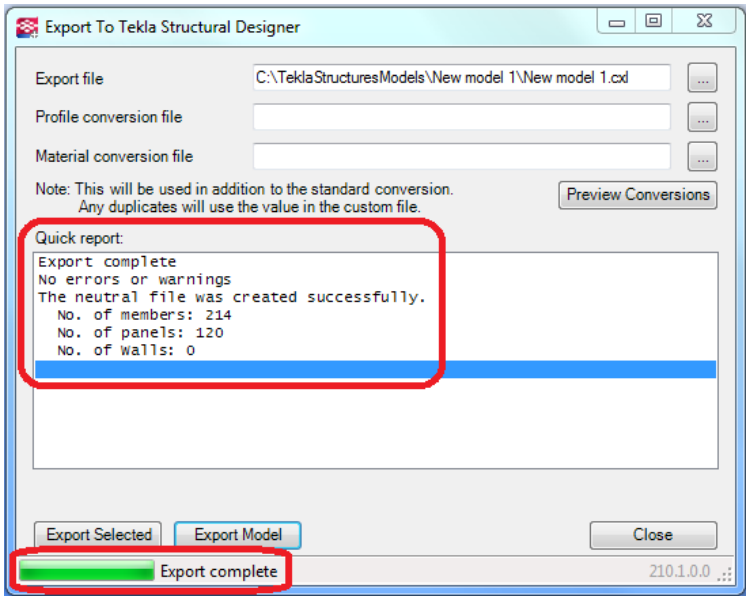



After setting the export filename, you can choose to preview the conversion process to check if there will be any mapping problems encountered. If members have been selected prior to running the export command, then the **Export Selected** option can be used. In our case though, we will use the **Export Model** command to transfer the entire model.



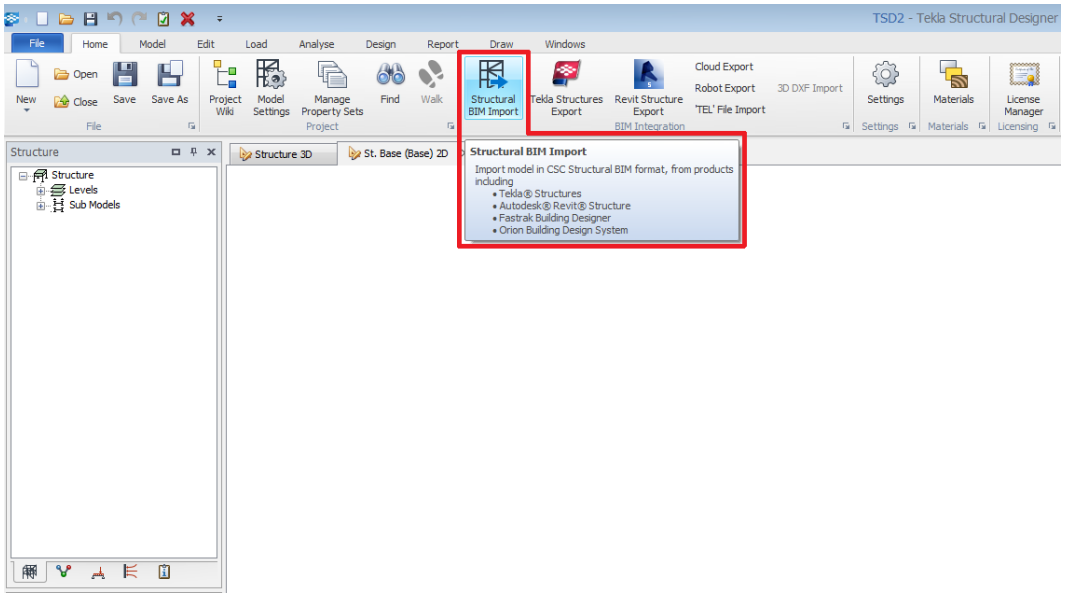
After the file has finished processing, a list of statistics should be displayed showing the amount of members, panels and walls which have been exported along with any warnings and errors which have been encountered.

The export dialog can then be closed along with the dialog and the resulting CXL file can be transferred to the Tekla Structural Designer user.

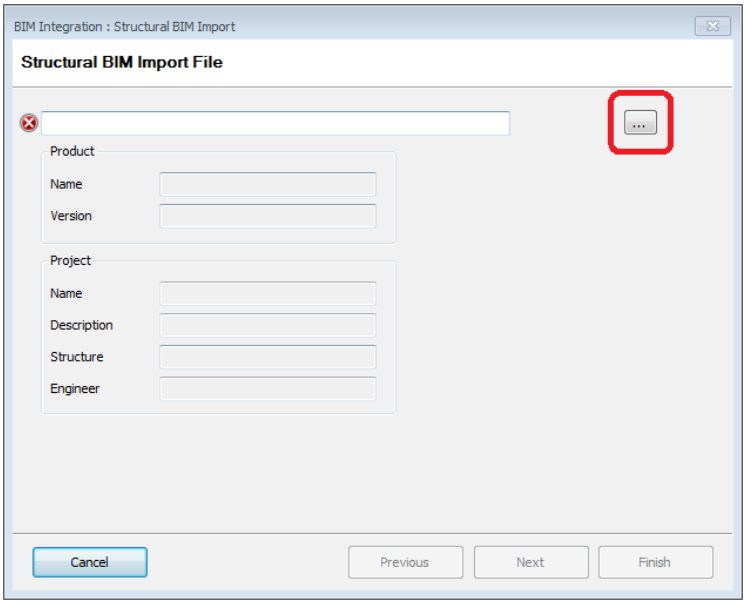


## 4.3 Initial Import into Tekla Structural Designer

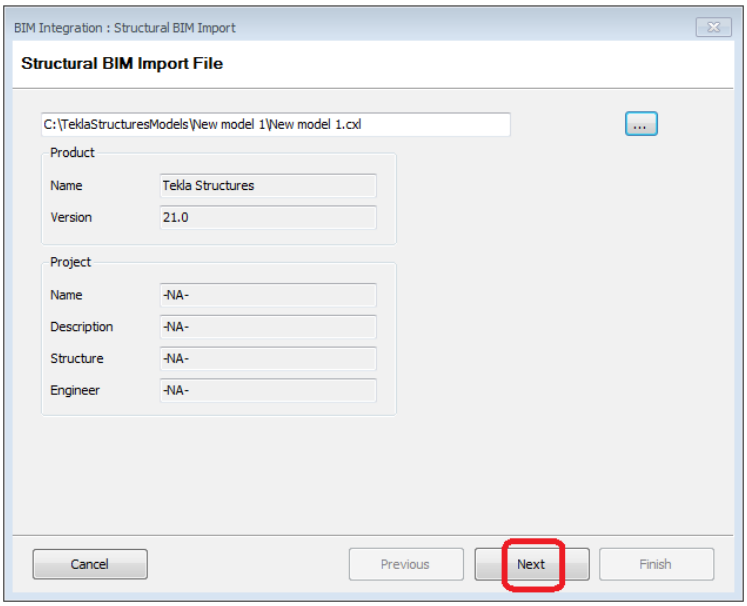
To import a model into Tekla Structural Designer from Tekla Structures, we need to use the command **Structural BIM Import** which is held on the **Home** tab.




Clicking on the command will launch the import application which shows several dialogs in a wizard process. The first one to be encountered will prompt for the CXL filename and location which is to be integrated. Use the **…** button to browse and select the appropriate CXL file.

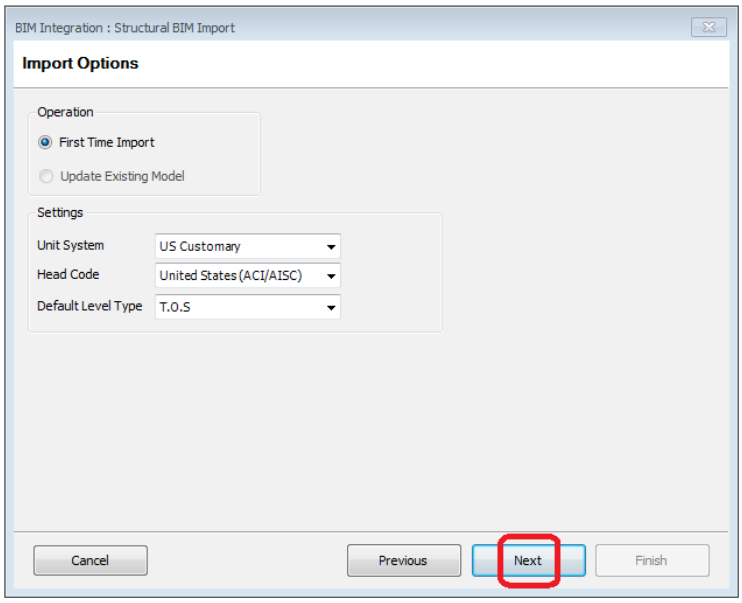


After selecting a CXL file for import, you should find that the remainder of the fields are populated with the settings read directly from the file. Click **Next** to continue after reading the information.

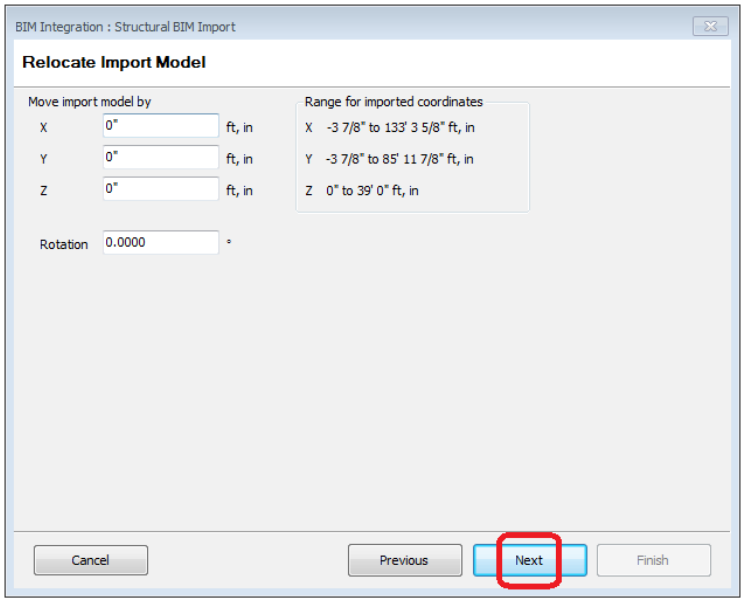



The next screen shows the settings related to the file allowing the user to choose **Metric** or **Imperial** for the units, a design code and the default level type. The level type can later be adjusted in the construction levels dialog if required.

Please note that the **Update Existing Model** option should not be used as this time. For changes to existing Tekla Structural Designer models, please refer to **Section 5**.

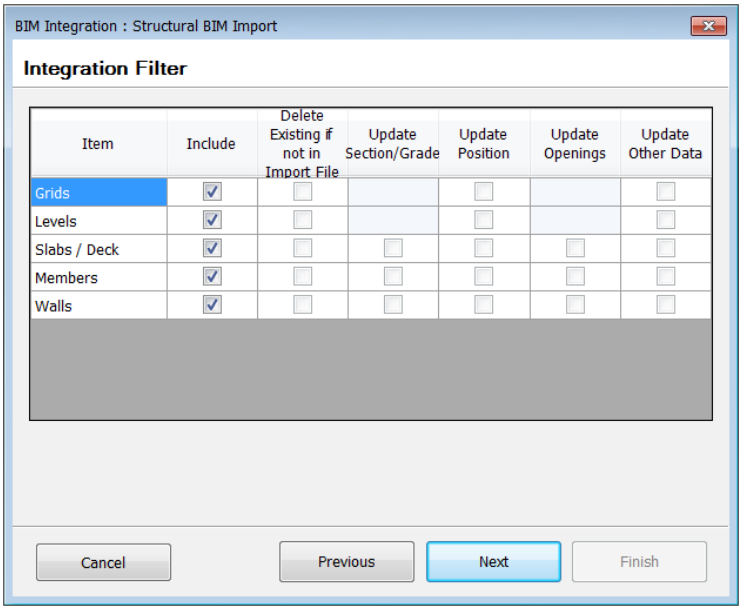


The **Relocate Import Model** dialog allows for models to be moved to around the datum position in Tekla Structural Designer from a real world co-ordinate. The extent of the model can be seen from the information displayed on the right hand side of the dialog. After entering suitable values, click **Next** to continue.

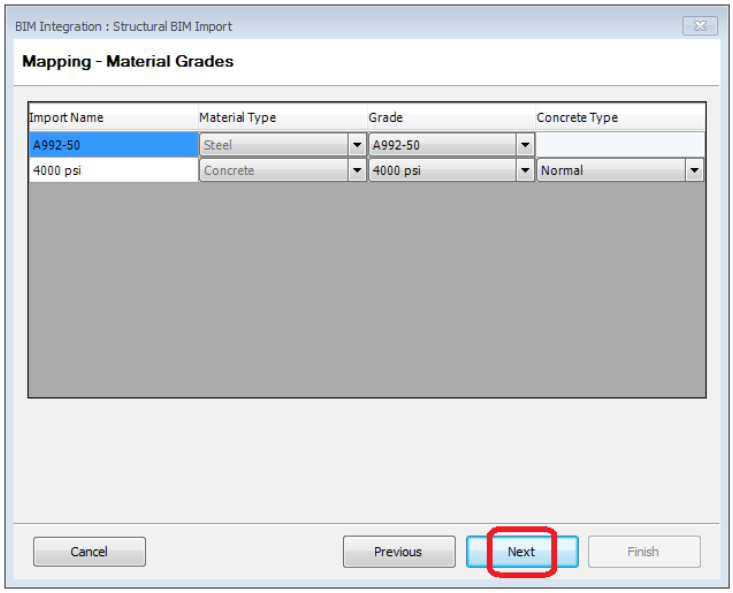



Following on from the position information, the integration filter will be displayed. The five options shown here allow you to verify if grids, levels etc. are to be imported.

Please note that the settings held in the **Delete Existing…** and four **Update…** columns should not be used when performing a **First Time Import** and are only used when synchronizing changes into an existing Tekla Structural Designer model.

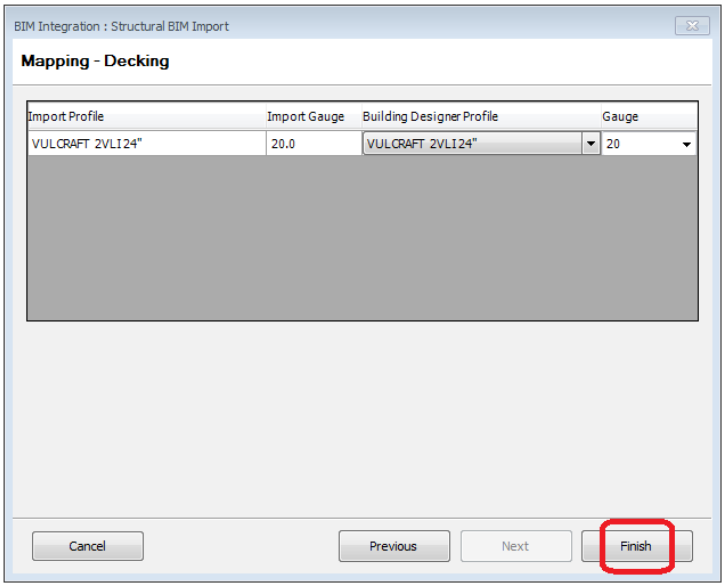


Mapping of materials to recognised grades will be shown now. Here you can view the different materials recognised in the incoming CXL file and the options to alter materials with a more preferred grade.

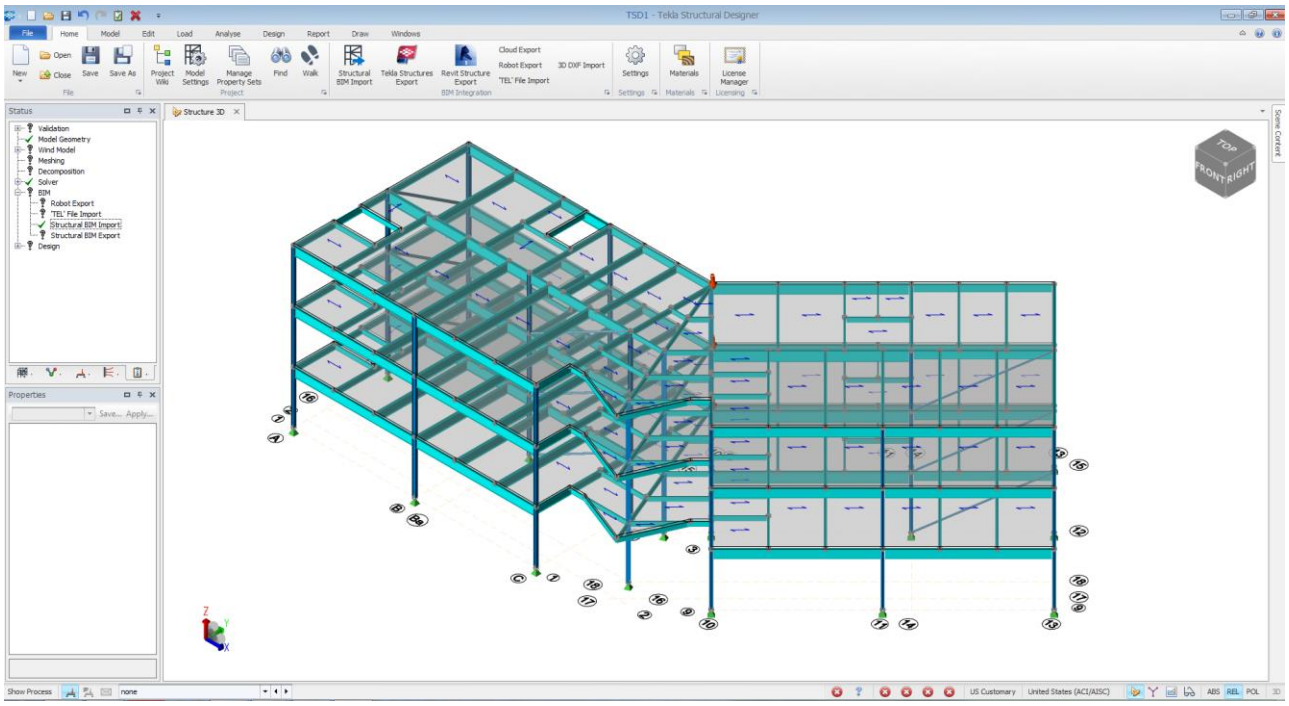



Following on from Material mapping, the dialog for Decking mapping will be shown (if applicable). Again this allows users to view the decking types being imported and have the option of overwriting the details if required.

After setting this information, click **Finish** to start the import into Tekla Structural Designer.



After the file has completed processing, the model will be displayed within the Structural 3D view and you can then proceed with validation of the structure before applying any analytical information.



# 5 Synchronizing Models

After an initial import has taken place it is typical for both the Tekla Structural Designer and Tekla Structures models to be developed independently.

However as the project and design of the structural frame is refined, it is appropriate to synchronize the models together to communicate any changes in geometry, section size, and design parameters. This is easily achieved by repeating the import procedures.

## 5.1 Synchronizing Tekla Structures to Tekla Structural Designer

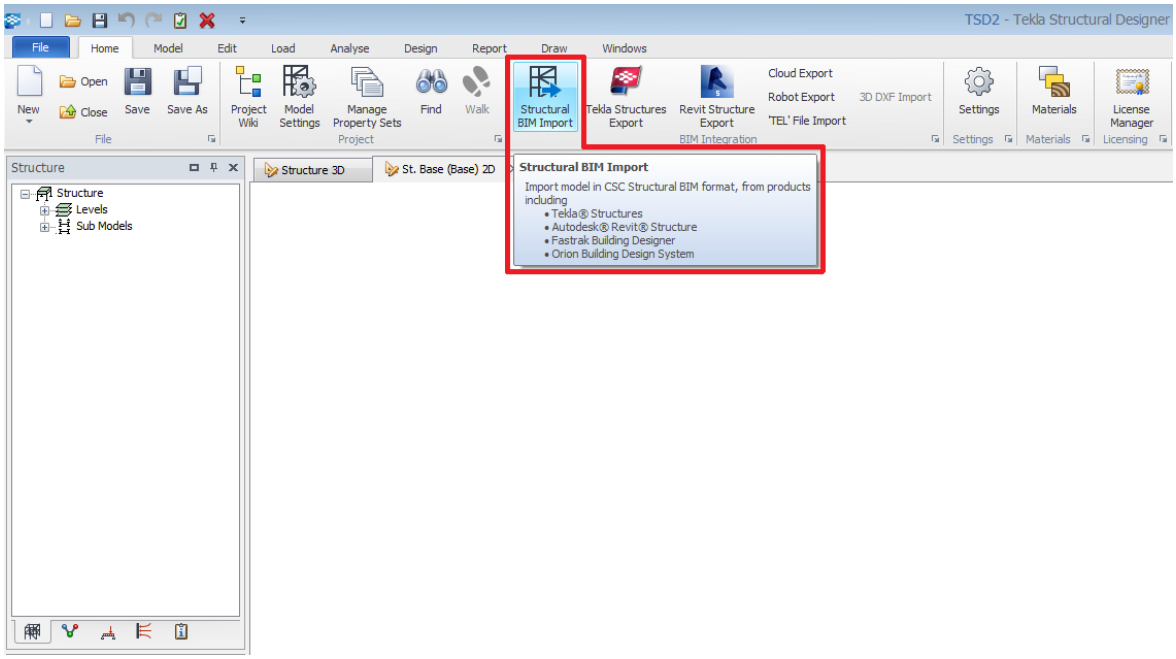
### 5.1.1 Export from Tekla Structures

In Tekla Structures save the model with a recognizable name and then use the command, **Export - Tekla Structural Designer - Export to…** to create a new .cxl file. It is recommended that you give this new .cxl file a name that indicates the integration sequence (i.e. Pass2.cxl). Note the details of the log file and check they match the user's expectations.

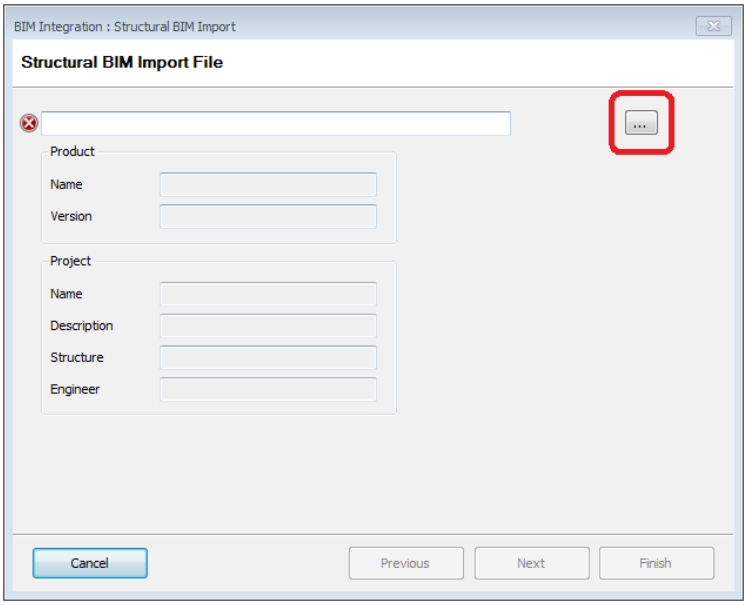
**Tip**: If objects are selected prior to initializing the export, use the option **Export Selected** rather than **Export Model.**

### 5.1.2 Import into Tekla Structural Designer

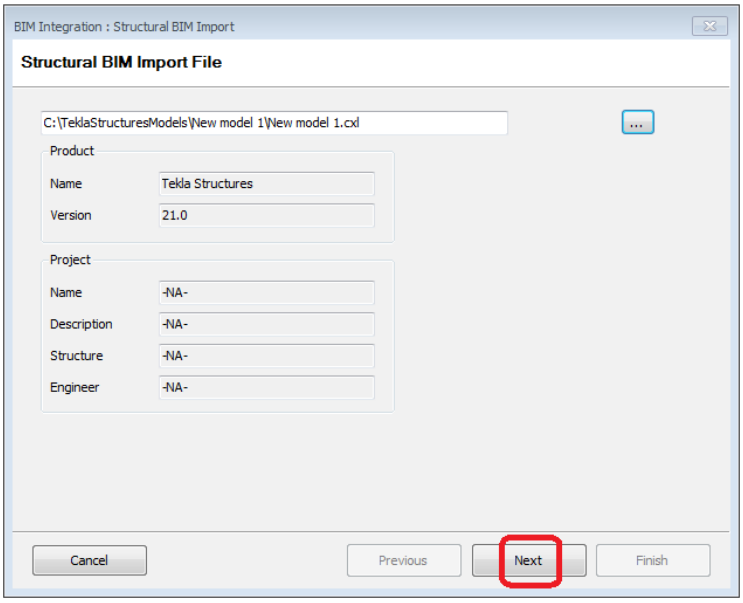
With your current Tekla Structural Designer model open, you should first save your model to retain a copy of the pre-import status, should it be needed in the future. Then repeat the command **Structural BIM Import** which is held on the **Home** tab.



Clicking on the command will launch the import application which shows several dialogs in a wizard process. The first one to be encountered will prompt for the CXL filename and location which is to be integrated. Use the **…** button to browse and select the appropriate CXL file.

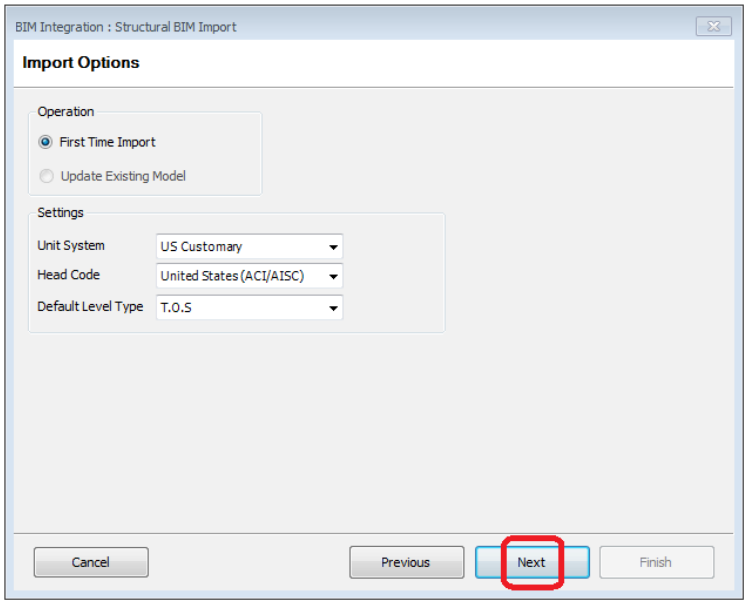



After selecting a CXL file for import, you should find that the remainder of the fields are populated with the settings read directly from the file. Click **Next** to continue after reading the information.

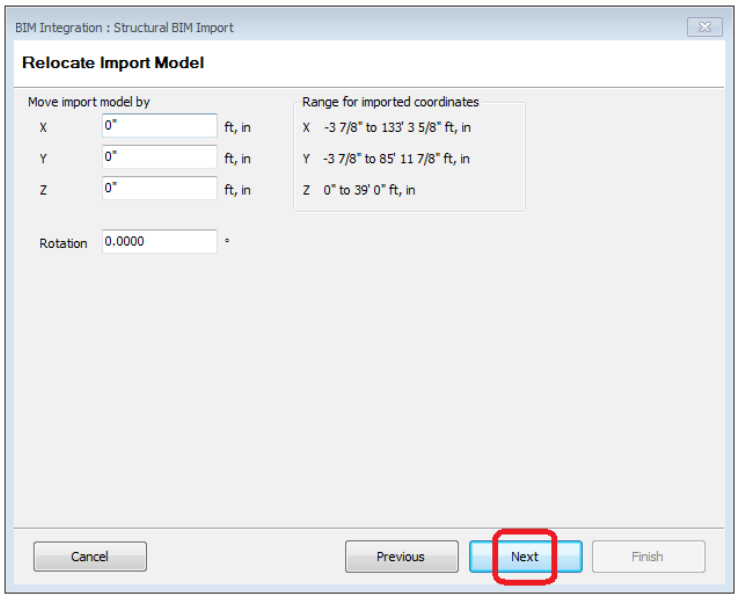


The next screen shows the settings related to the file allowing the user to choose **Metric** or **Imperial** for the units, a design code and the default level type. The level type can later be adjusted in the construction levels dialog if required.

The **Update Existing Model** option should now be used as we are importing changes to an existing Tekla Structural Designer model.




Use the exact same settings on the **Relocate Import Model** dialog as were used when previously importing the model into Tekla Structural Designer. If the model originated in Tekla Structural Designer, keep all values at **0** and click **Next** to continue.



Following on from the position information, the integration filter will be displayed. The five options shown here allow you to verify if grids, levels etc. are to be imported.

You should also determine whether the five additional options are appropriate to the synchronization that you are performing. All of the options in this dialog can be described as follows:

### 5.1.3 Include (enabled as default)

- Simply controls whether objects of this type are considered by the Import, (added, modified or deleted if checked) or left as currently defined in the existing model, (not checked).

### 5.1.4 Delete Existing if not in Import File (enabled as default)

- If enabled, then an object in the existing model that is not in the import file (most likely already deleted in Tekla Structures) will be deleted from the Tekla Structural Designer model.
- If you are unsure and wish to double check, uncheck the box and you will find the member retained for manual deletion at a later date.
- There are exceptions, depending on the object's BIM Status – see special Review mode. If the status is New or Excluded, then the object will not be deleted during the update process whether this option is checked or not.

### 5.1.5 Grids

- Update Position affects the start and / or end of a grid line. Note: Currently arc grids cannot be synchronised.
- Update Other Data affects changes made to the grid name only.

### 5.1.6 Levels (Construction Level)

- Update Position affects any changes made to the level height within Tekla Structures.
- Update Other Data changes the name of the level to suit the Tekla Structures model.

### 5.1.7 Slabs / Deck (Slab Items)

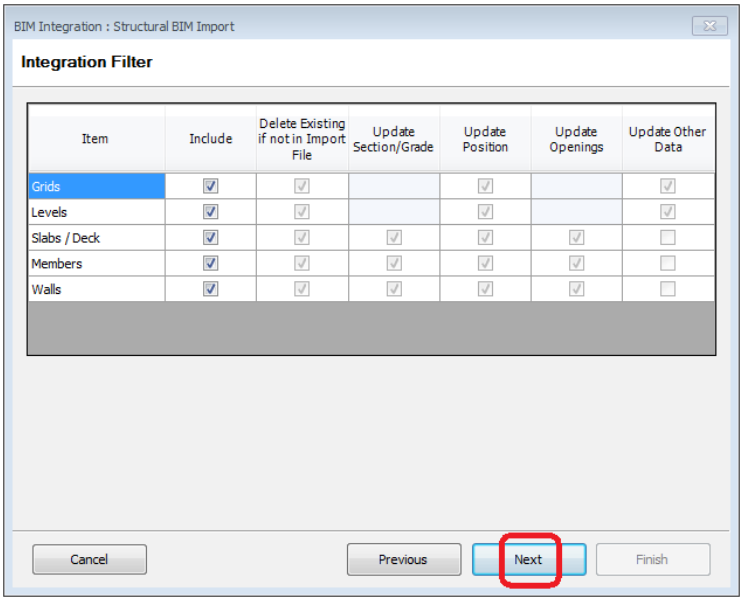
- Update Section / Grade updates any alterations made to Slab Depth, Concrete Grade or Decking Properties (if relevant).
- Update Position makes changes to the outline of the slab, alignment (vertical offset) and plan rotation.
- Update Openings adds, removes or modifies the outline for openings associated with the slab item.
- Update Other Data will alter the type of slab if amended in Tekla Structures.

### 5.1.8 Members (Columns, Beams, Braces etc.)

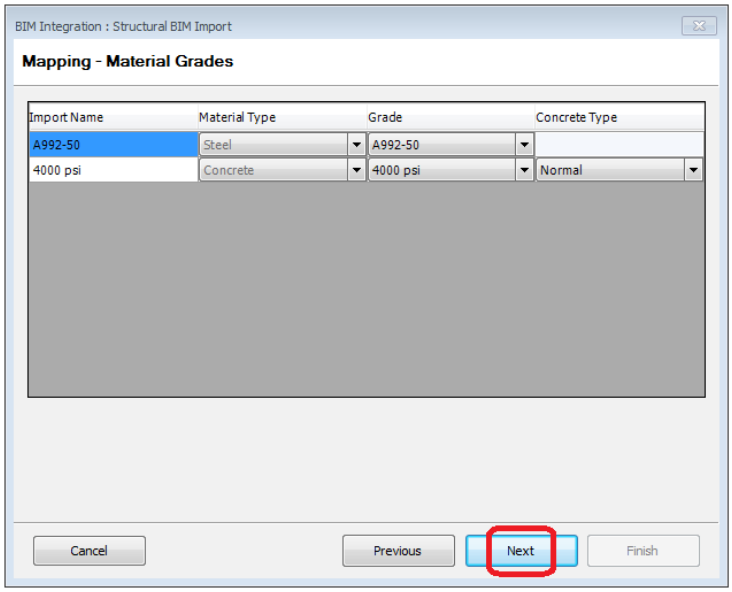
- Update Section / Grade will update and changes made to the section size or the material grade.
- Update Position changes the member to suit alterations made to the start and / or end of the physical member, alignment or rotation in section.
- Update Openings adds, removes or modifies the outline for openings associated with the member.
- Update Other Data will change any other characteristics such as the gravity only flag and end release conditions.

### 5.1.9 Walls (Concrete and Bearing)

- Update Section / Grade controls any updates to the wall thickness and material grade.
- Update Position changes the wall to suit amendments made to the start and / or end of the physical wall along with changes made to the alignment.
- Update Openings adds, removes or modifies the outline for openings associated with the wall.
- Update Other Data affects the 'Use mid pier' option (Note: for concrete walls only)

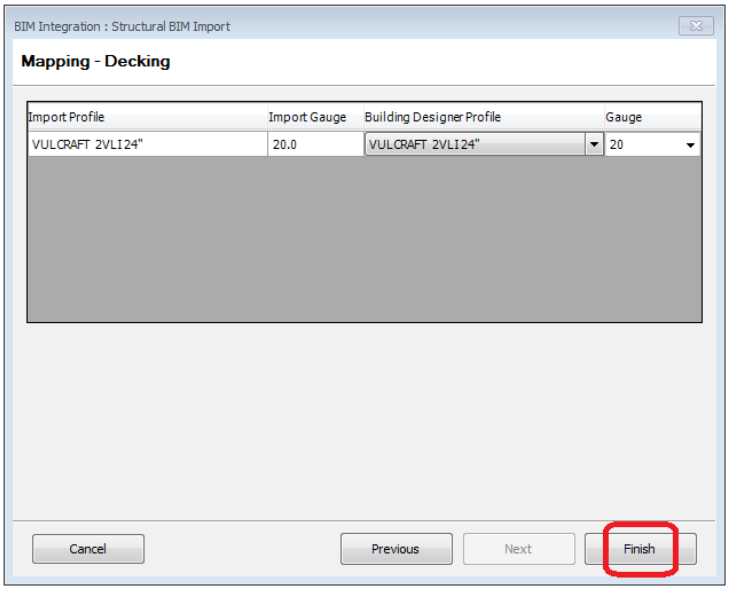


Mapping of materials to recognised grades will be shown now. Here you can view the different materials recognised in the incoming CXL file and the options to alter materials with a more preferred grade.



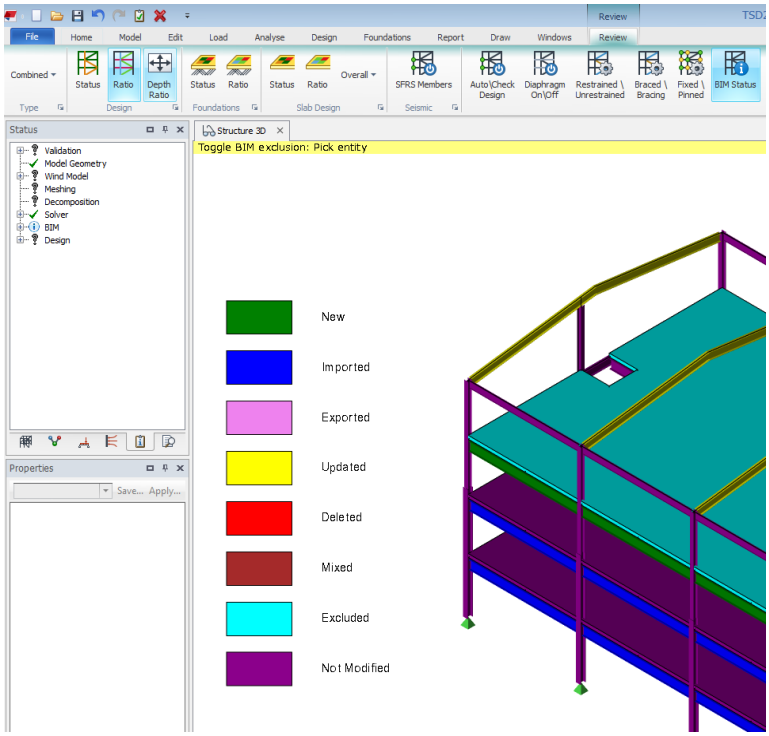

Following on from Material mapping, the dialog for Decking mapping will be shown (if applicable). Again this allows users to view the decking types being imported and have the option of overwriting the details if required.

After setting this information, click **Finish** to start the import into Tekla Structural Designer.



## 5.2 Integration management in Tekla Structural Designer

Once the synchronization process has been completed, the command **BIM Status** (held under the **Review** tab) can be used to provide a colour coded indication of how the model has been affected in the last import. This view identifies all the changes to Tekla Structural Designer members and slabs which have occurred as a result of merge process.




| Color coding | Description |
|---|---|
| **New** | Object has been created in Tekla Structural Designer and has not yet been exported to Tekla Structures. |
| **Imported** | Object has been created by the import from Tekla Structures. |
| **Exported** | Object has been previously exported to Tekla Structures (prior to any import processes). |
| **Updated** | Member has been modified as a result of the Structural BIM import. Check the BIM status tree for details. |
| **Deleted** | Object has been deleted in Tekla Structures but has been retained during the merge process due to the Integration Filter settings. |
| **Mixed** | Work in progress – Has no effect as yet. |
| **Excluded** | Item will not be communicated from Tekla Structural Designer to Tekla Structures. |
| **Not Modified** | Object has not been altered in any way by the Structural BIM Import process. |

**New** indicates members that have not been communicated to Tekla Structures yet. As Tekla Structures should hold the master physical model it is advisable to first export the Tekla Structural Designer to Tekla Structures and then perform the merge again with the updated Tekla Structures model.

## 5.3 Synchronizing Tekla Structural Designer to Tekla Structures

### 5.3.1 Export from Tekla Structural Designer

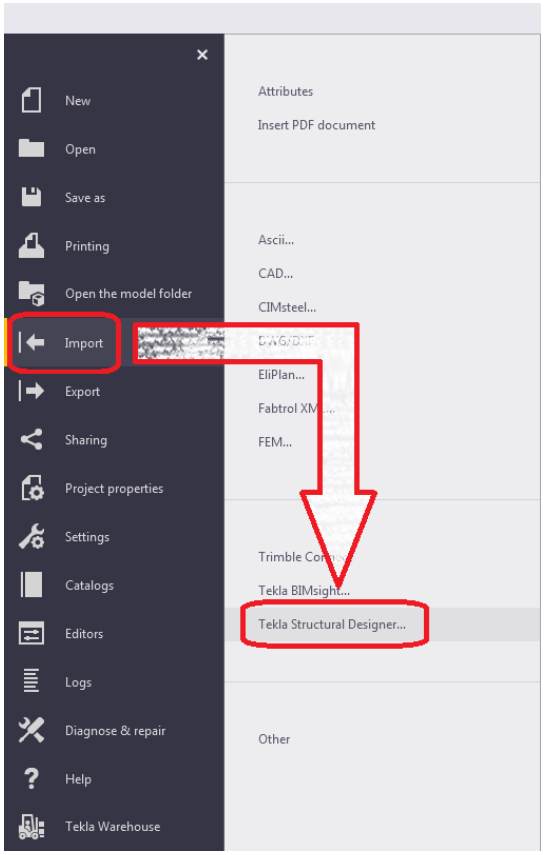
To send the changes made in the Tekla Structural Designer model to Tekla Structures, the export procedure is repeated using the command **Export to Tekla Structures** which is held on the **Home** tab.

During the export process it is recommended that you give this new .cxl file a name that indicates the integration sequence (i.e. Pass3.cxl).

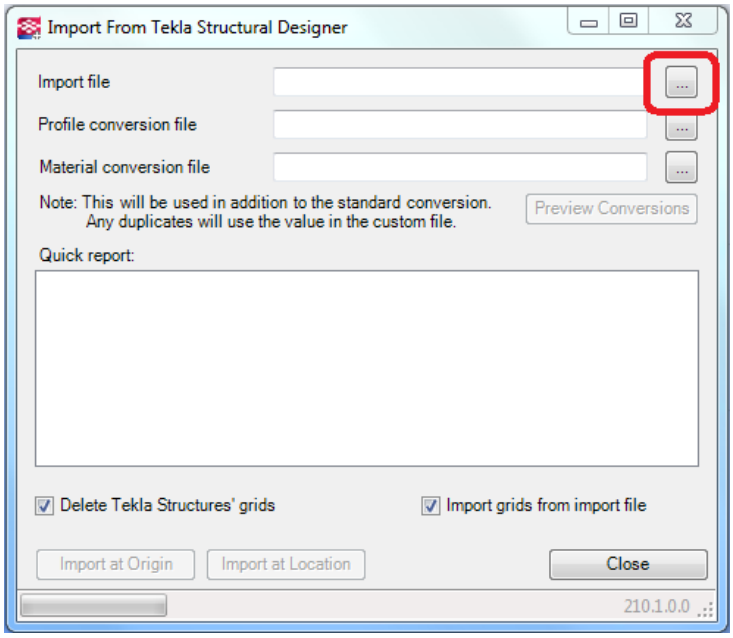
### 5.3.2 Synchronizing a model from Tekla Structural Designer to Tekla

This example covers the import of a second (updated) CXL file into Tekla Structures. The file that we are using contains no mapping problems and reference should be made to the relevant sections in this document should you find that your own file does have any problems regarding mapping.

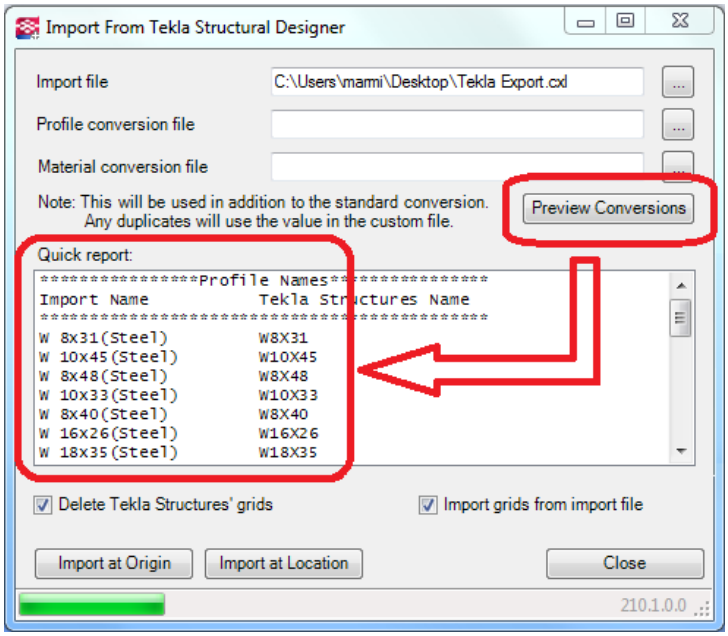
Firstly, with the current Tekla model open in the background, start the integration process by running the command **Import - Tekla Structural Designer**



When the **Import From Tekla Structural Designer** dialog appears the first step should be to select the CXL file to be imported into the model. This can be done by clicking on the **…** button to the top right of the dialog and then browsing to the file with a simple windows dialog operation.

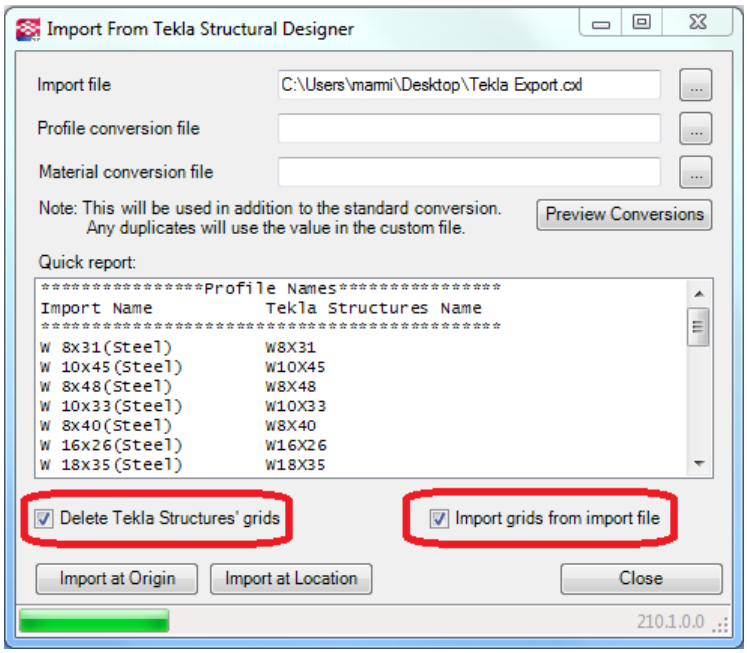



The **Preview Conversions** button will allow you to check section sizes being imported from Tekla Structural Designer and flag any unrecognised profile names within the Tekla Structures software easily. Unrecognised sections being listed in red type within the quick report window. Please refer to the later section in this manual for help with on creating conversion files and mapping part names if this is required.

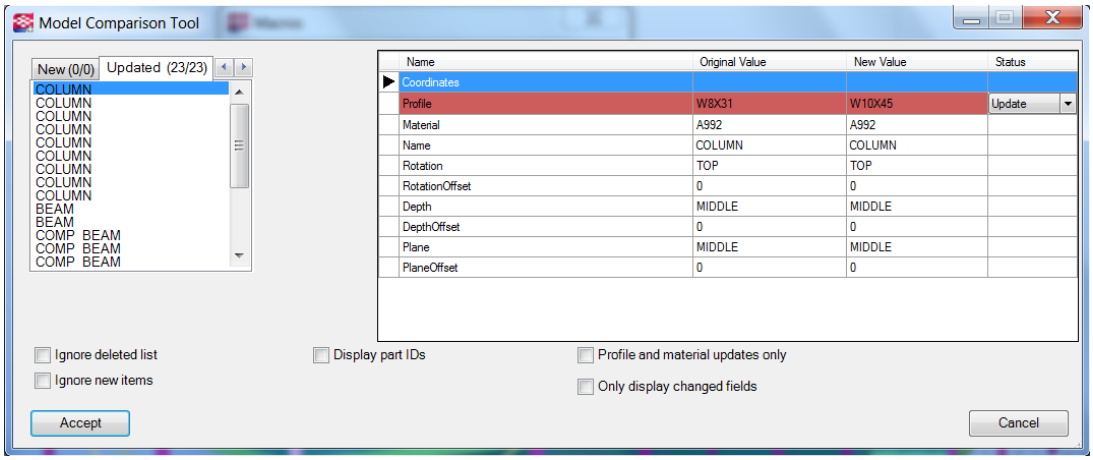


Two options are located at the bottom of the dialog relating to the position of the imported model. The **Import at Origin** option will create the model based on the **0,0,0** position within Tekla Structures whilst the **Import at Location** option will allow the user to specify a position to base the model upon.

As this example is an update to an existing model it is important to ensure that the same location is used to for the update as was used for the initial model import. The original model import was created using the **Import at Origin** option so we will use the exact same option for the update file.



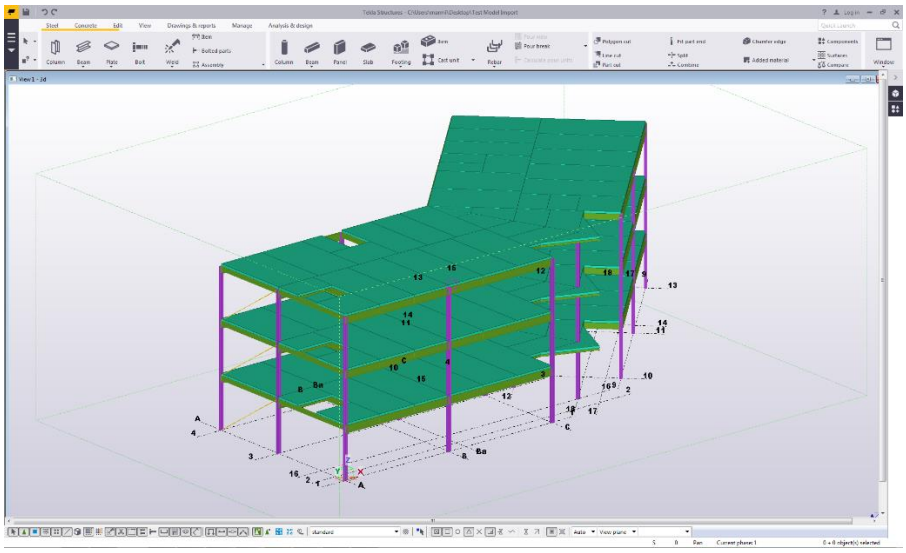

As items in the import file have previously been imported into Tekla Structures, the Model Comparison Tool dialog is shown. This dialog shows all parts which are flagged as **New**, **Updated**, **Deleted** or **Unchanged**. In our example, we see that we have **23** Updated Parts along with **317** Unchanged (**0** New and **0** Deleted).



Although there is no information which needs to be amended on the Unchanged tab, it is worth reviewing the information listed in the **Updated** tab. Each of the sections are listed along with a red highlight in the data window indicating the property field which has been amended, the original value and the new proposed value.

Each value can be either ignored or updated to suit.

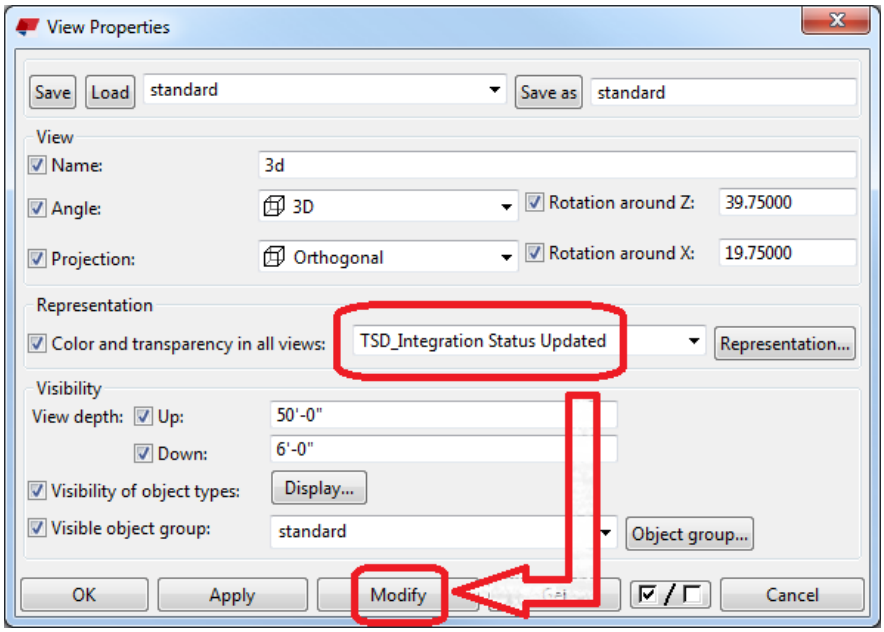
Click **Accept** to update all of the information alterations and exit the dialog. The model will then process the changes and show the updated model on the screen. At this stage, the **Import from Tekla Structural Designer** dialog window can be closed entirely.

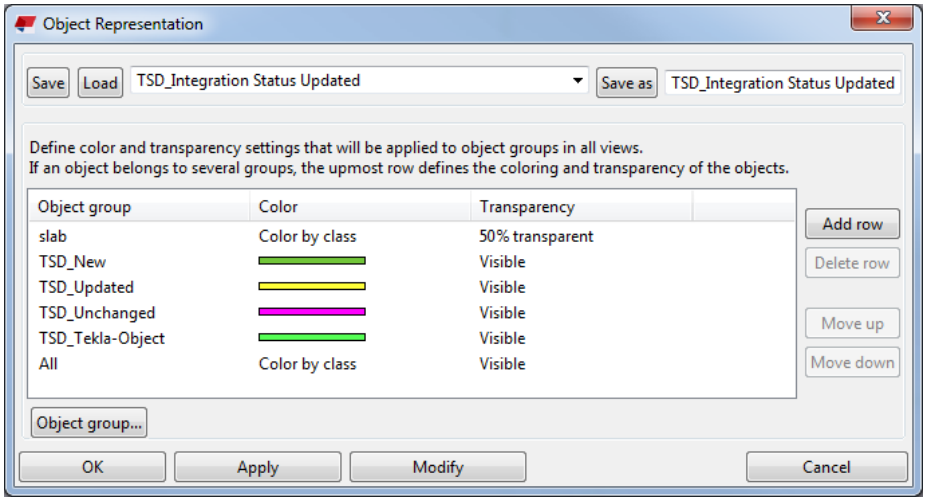


It is possible to view the changes in the model using the **TSD_Integration Status Updated** display representation.

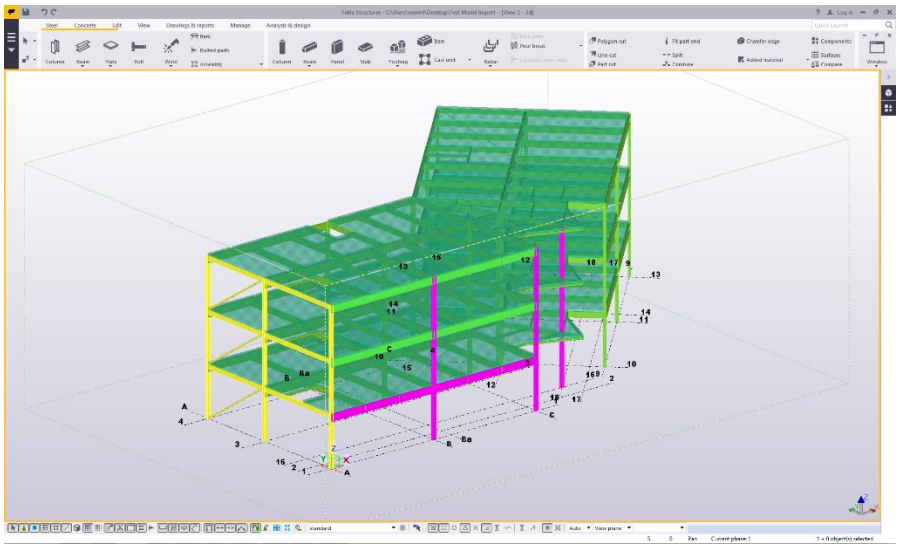
Views using this representation will indicate colored parts according to their integration status.

Double click on the view background to access the **View Properties** dialog, set the **TSD_Integration Status Updated** representation and then click on the **Modify** button.






The resulting view will then be coloured so the integration status is easily identifiable.



# 6 Key Rules

Some key rules to consider when integrating models :-

- Communication between both parties is crucial to ensure the sharing of data is as expected during model synchronization. It is particularly important that both parties are aware of significant changes and can verify them on completion of the integration process.

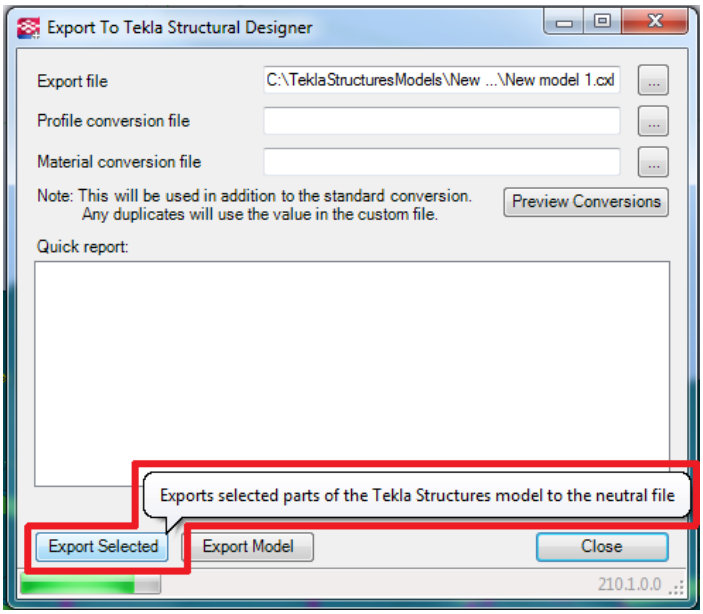
- Before exporting/importing models, always save the models with names that make it clear as to which step they represent. This permits the users of both Tekla Structural Designer and Tekla Structures to return to a given point should the need arise.

- If necessary, changes in the level of a floor are best made manually in Tekla Structural Designer before merging a model from Tekla Structures. The benefit of doing this is that only changes with the moved floor will be identified in the process. If the floor was not moved in Tekla Structural Designer, then the merge process would move the floor and identify all members in the floor and columns supporting the floor as having changed. This is far less informative than the alternative.

- Items are linked between the two products by using identification tags. Obviously if something is deleted and replaced, the new member cannot retain the tag and hence any relationship with what was there previously is lost.

- Should the same members be added to both the Tekla Structural Designer and Tekla models independently and then models merged, these members will be duplicated as the new member from one will be added on top of the new member in the other.

- Items which are not usually required in Tekla Structural Designer (such as concrete works or ancillary items like ladders, handrails, rails etc.) should not be exported to Tekla Structural Designer. This can be performed by hiding the unrequired items in the Tekla view or by the use of selection filters. Select the remaining model and then run the export command using the option **Export Selected**.

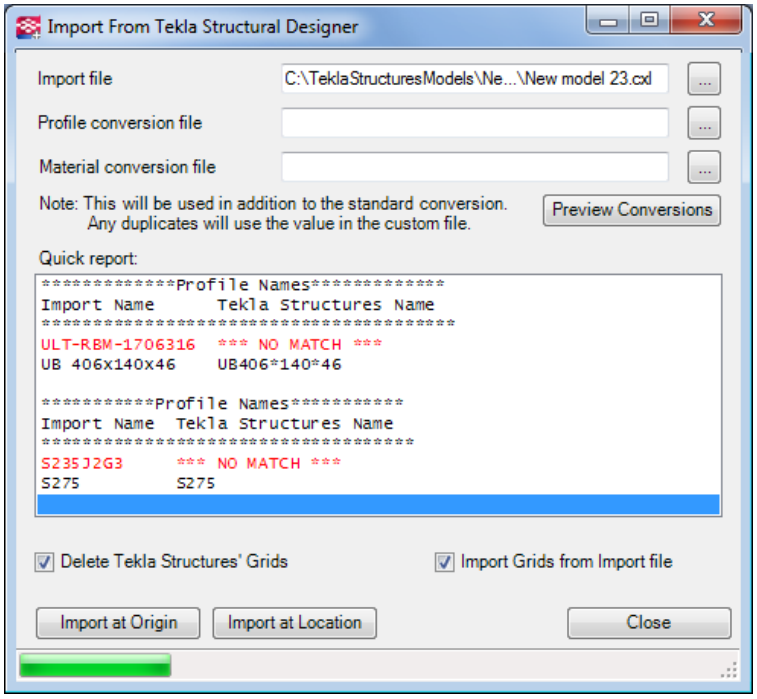


## 6.1 Mapping Sections between Tekla Structural Designer and Tekla Structures

After clicking on the Preview Conversions button, it may be found that one or more profile names or material grades cannot be mapped to an equivalent reference in either Tekla Structural Designer or Tekla Structures.

The link uses an internal conversion list contains the standard profiles and grades. Any item that cannot be translated using this internal conversion will be flagged in red and listed as having no available match.

E.g. **ULT-RBM-1706316 *** NO MATCH *****




In the example above as we have both profiles and materials being listed, we would need to create two conversion files. The files themselves are simply text files which can be created with any text editor such as **Notepad** or **WordPad**. The files do not need any information to be entered apart from the actual conversion itself.

The conversion format **MUST** be written in the format **Tekla Structural Designer profile name=Tekla profile name**. eg:

**STB 229x305x70=TEE229*305*70**
Or in our case
**ULT-BEAM-1705016=ULT-RBM-1706316**

It is possible to provide conversion for Tekla Structural Designer twin profile sections to and from Tekla Structures. The UK twin profiles in Tekla Structural Designer have a fixed gap and have been added to the automatic translations. For other countries, it is necessary to use the conversion file. The line is slightly different in that you need to include the gap in the line.

The number after the **#** symbol is the profiles code in the cxl file format. The code is different depending on the profile type, whether it is metric or imperial and what country is it from. Below are 3 different double angle profiles from Tekla Structural Designer. The first number represents whether the profile is metric or imperial: 0 for metric, 1 for imperial. The next 2 digits represent the country in this case 06 for UK. The last 2 digits are for the profile type, 15 for long leg to long leg, 16 for short leg to short leg and 14 for equal angles.

The TS profile is the L shape to use for each of the two members Tekla Structures will create to represent the single item in Tekla Structural Designer. The number after the **:** is the gap to use between the profiles in Tekla Structures and the (LL) and (SL) convey the required orientation of the members.

**2xUEA(LL) 100x75x8#00615=RSA100*75*8:10(LL)**
**2xUEA(SL) 75x100x8#00616=RSA100*75*8:12(SL)**
**2xEA 120x120x10#00614=RSA120*120*10:12**

On export, using the same conversion file, the two members in Tekla Structures will be written to the cxl file as one twin profile member assuming it is still logical and possible to do so.

The material conversion file would be similarly formatted with the **Tekla Structural Designer profile name=Tekla profile name** format. For example:

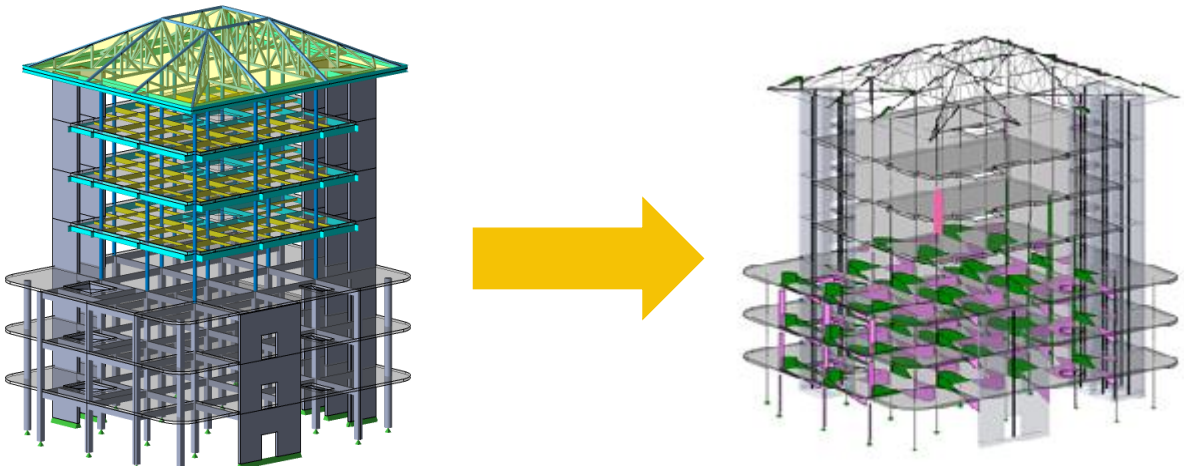
**S275=S235J2G3**

If the conversion files are not used, those members with profiles/materials that cannot be converted will still be created albeit with unrecognized section names. These members will be shown in Tekla Structures as a single line representation and within Tekla Structural Designer as a blank section size which will cause a validation error.

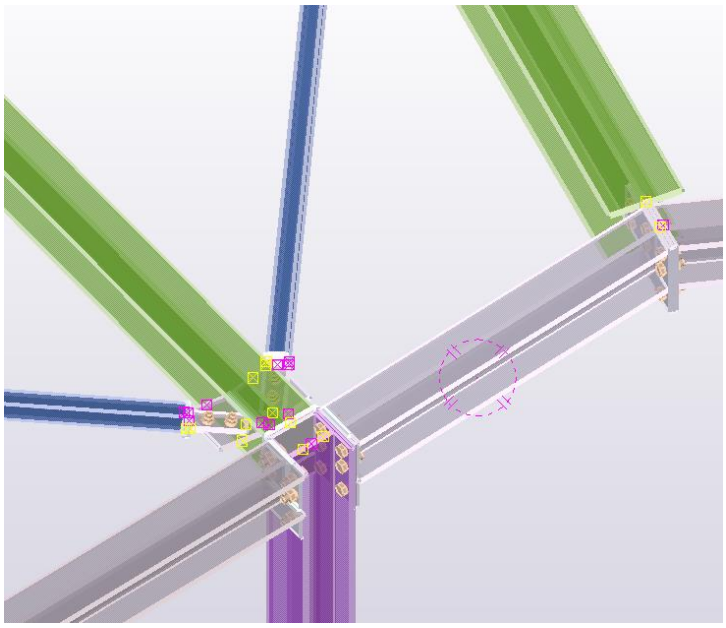
# 7 Generating efficient integration models

## 7.1 Principals of integrating with Tekla Structures

It is a requirement of Tekla Structural Designer to have a fully connected model so that analysis can be completed without any stability or validation issues. Engineers use an analytical wire model to mathematically predict how a building will behave under applied loads. The analytical wire model is derived automatically from the transferred physical model.



In order to communicate a viable model for analysis, it is important to ensure that Tekla Structures part objects are modelled to correct positions. The position of any structural item in Tekla Structural Designer is based on the grip point location of the element in Tekla Structures.
Therefore it is vital to ensure that parts are generated from common intersection positions when considering integration with Tekla Structural Designer. If parts are generated from physical locations then the resulting analysis and design model will not be analytically correct.



Please note that connection macros can still be applied to parts defined to common grid or part locations.
NB: Ensure that the connections themselves are not transferred (see later section).

## 7.2 Offset members and moved members

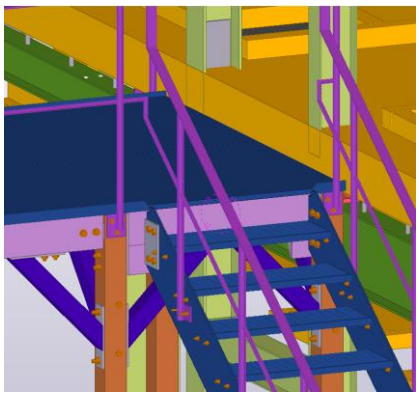
Where members are to be located away from member intersection points or grid positions, please note that there is a significant difference between moving parts and assigning offset values onto parts.

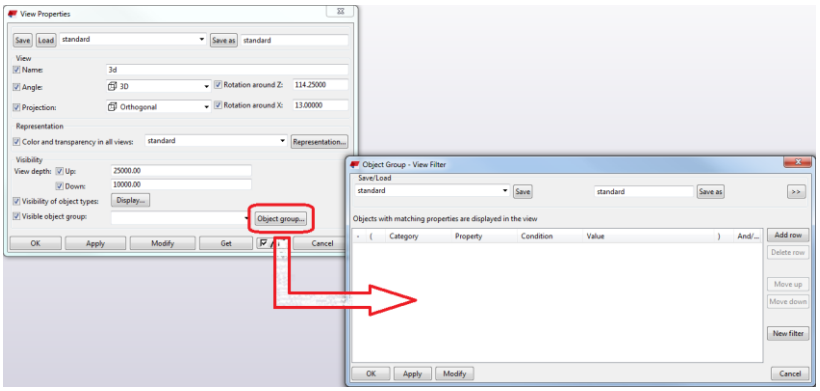
- Physically moving Tekla Structure parts also moves the grip points (which will potentially affecting frame connectivity when transferred into Tekla Structural Designer).
- Applying offsets to parts properties will move the physical representation but keep the grip points in the original location.

For integration with Tekla Structural Designer, we would recommend the preference of offsetting parts to ensure that model connectivity is maintained.

## 7.3 What items are transferred?

The default is that the export from Tekla Structures will export ALL parts, including connections and other ancillary items which cannot be designed in Tekla Structural Designer and are beyond the scope of the software. To ensure that these items are not transferred, use Object Group filters to disable the visibility of these items and then only export the remaining visible items.





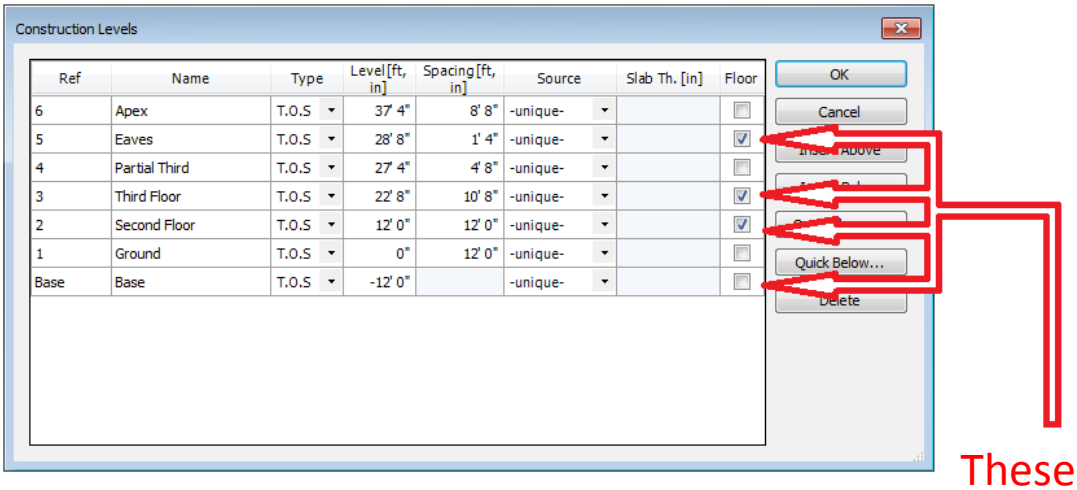

## 7.4 Construction levels

### 7.4.1 Levels exported from Tekla Structural Designer

When generating levels within Tekla Structural Designer, it is important to understand that not all levels will be transferred using the Integrator.

For levels generated in Tekla Structural Designer, only levels which have been flagged as **Floor** items will be exported. The exception to this rule is the lowest most entry in the dialog which is always exported regardless of the **Floor** flag setting.

E.g. When looking at the example below, we find that four levels would be exported. Three of the levels are flagged as **Floor** whilst the lowest most level is always exported.



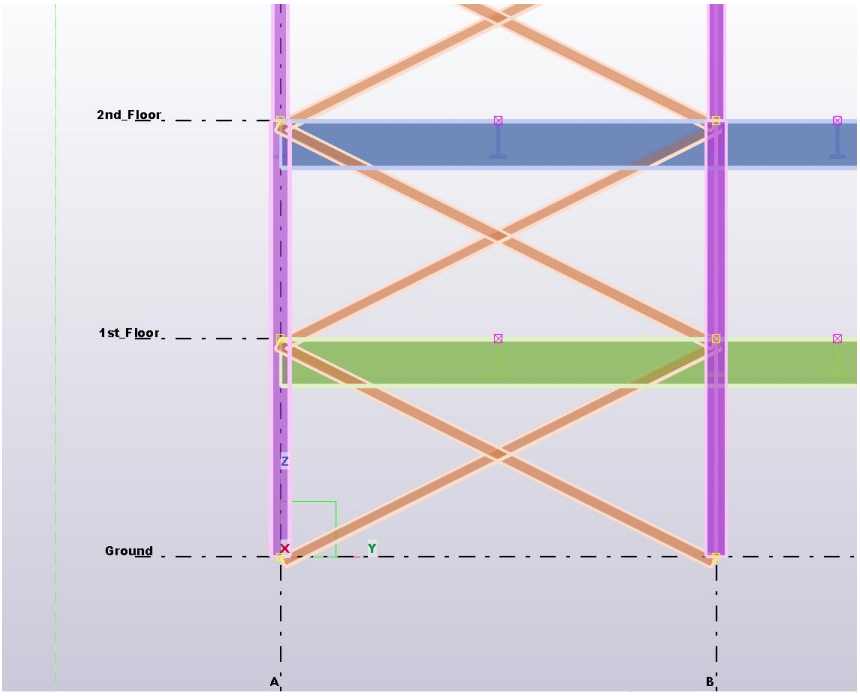

These levels exported

For levels created on import into Tekla Structural Designer from Tekla Structures, levels will be generated where either:

- A level has been exported from Tekla Structures (see below).
- Three or more beam or joist members are on the same horizontal plane.

### 7.4.2 Levels exported from Tekla Structures

For Tekla Structures, only levels containing a part grip point node will be exported. Where level entities have been generated but do not relate to any structural element they will be ignored for the purposes of integration.
Please note that there are no realistic limits on either datum level names or grid references which can be assigned although we do recommend the use of clear and concise references. The integration process will allow the use of both alphanumeric Latin characters along with alternative symbols if these are required.



## 7.5 Specifying objects within Tekla Structures.

When objects are imported from Tekla Structures into Tekla Structural Designer, the style of the object is set to be a copy of the item in the BIM software (e.g. Beam instances will be created as beam objects, bracing instances as Brace items etc.).

It is possible to override this though and stipulate the object style on import by setting text in the type field. The following text can be set within the parameters **MEMBER_TYPE**, **SLAB_TYPE** and **WALL_TYPE** which are available in the Tekla Structural Designer UDA sections for all members, slab and panel elements respectively.
Setting this information forces the element to be imported as that style of object within Tekla Structural Designer.

Some of the entries relating to Portal Frames cannot be imported into Tekla Structural Designer at present and are only included for list completion.

| **MEMBER_TYPE** parameter codes | Description |
|---|---|
| **Columns** | |
| **SIMPLE_COLUMN** | Column with the simple design option checked |
| **GENERAL_COLUMN** | Column with the simple design option unchecked |
| **Beams and Braces** | |
| **COMP_BEAM** | Composite beam – No edge conditions set |
| **EDGE_COMPOSITE_BEAM** | Edge condition composite beam |
| **INT_COMPOSITE_BEAM** | Internal condition composite beam |
| **GENERAL_BEAM** | Beam member |
| **BRACE** | Bracing member |
| **JOIST** | USA joist member |
| **SB_CANTILEVER_A** | Cantilevered beam; free at start end |
| **SB_CANTILEVER_B** | Cantilevered beam; free at finish end |
| **GB_FREE_END_A** | General beam; free at start end |
| **GB_FREE_END_B** | General beam; free at finish end |
| **GB_FREE_BOTH_ENDS** | Multi-span general beam member |
| **WSTK_WESTOK** | Ribbon cut Westok beam |
| **WSTK_CANTILEVER_A** | Cantilevered Westok member; free at start end |
| **WSTK_CANTILEVER_B** | Cantilevered Westok member; free at finish end |
| **ANALYSIS** | Analysis element |
| | |

| **Truss Members** | |
|---|---|
| **INT_TRUSS** | Internal truss member |
| **SIDE_TRUSS** | Side truss member |
| **TOP_TRUSS** | Top chord of truss |
| **BOT_TRUSS** | Bottom chord of truss |
| **Portal Sections** | |
| **PORTAL_COLUMN** | Portal frame stanchion (export from Tekla Structural Designer only) |
| **PORTAL_RAFTER** | Portal frame rafter (export from Tekla Structural Designer only) |
| **PORTAL_TIE** | Portal frame tie member (export from Tekla Structural Designer only) |
| **GABLE_POST** | Gable post member |
| **EAVES_BEAM** | Eaves beam member |
| **RAIL** | Sheeting rail member |
| **PURLIN** | Purlin member |
| **PARAPET_POST** | Portal frame parapet post (export from Tekla Structural Designer only) |

| **WALL_TYPE** parameter codes | Description |
|---|---|
| **Shear Walls** | |
| **MESHED** | Shear wall using mesh analysis method |
| **MID_PIER** | Shear wall under mid-pier theory |

| **SLAB_TYPE** parameter codes | Description |
|---|---|
| **Slabs** | |
| **RC_SLAB** | Two way spanning slab on beams |
| **RC_SLAB_1WAY** | One way spanning slab on beams |
| **COMP_SLAB** | Composite slab |
| **FLAT_SLAB** | Flat slab |
| **CAST_SLAB** | Precast slab |
| **STEEL_DECK** | Two way spanning steel deck slab |
| **STEEL_DECK_1WAY** | One way spanning steel deck slab |
| **TIMBER_DECK** | Timber deck slab |

## 7.6 Beam End Forces

Tekla Structures will import end forces for steel beam and bracing members. The forces imported will depend on the end condition applied to the element within Tekla Structural Designer. Where the force is not applicable (e.g. Moment forces on pinned member ends) the parameter will not be populated.
For parameters to be populated, an analysis of the frame must have been performed within Tekla Structural Designer, the End forces option must have been enabled during the export process and the End forces option must have been enabled during the import process.
Please note that forces are populated from the largest results across the full range of different combinations or loadcases and may not strictly act in unison. Please refer to detailed results from the Tekla Structural Designer software for values per combination or per loadcase.

| Parameter Name | Description of force on member end | Populated By |
|---|---|---|
| **Result_StartVShearMax** | Maximum positive vertical shear on end 1 | All steel beam members |
| **Result_EndVShearMax** | Maximum positive vertical shear on end 2 | All steel beam members |
| **Result_StartVShearMaxNeg** | Maximum negative vertical shear on end 1 | All beams where applicable |
| **Result_EndVShearMaxNeg** | Maximum negative vertical shear on end 2 | All beams where applicable |
| **Result_AxialMax** | Maximum positive or negative force carried | Bracing members only |
| **Result_StartAxialMax** | Maximum positive axial force on end 1 | Moment or fixed ends |
| **Result_EndAxialMax** | Maximum positive axial force on end 2 | Moment or fixed ends |
| **Result_StartAxialMaxNeg** | Maximum negative axial force on end 1 | Moment or fixed ends |
| **Result_EndAxialMaxNeg** | Maximum negative axial force on end 2 | Moment or fixed ends |
| **Result_StartMomentMax** | Maximum positive moment on end 1 | Moment or fixed ends |
| **Result_EndMomentMax** | Maximum positive moment on end 2 | Moment or fixed ends |
| **Result_StartMomentMaxNeg** | Maximum negative moment on end 1 | Moment or fixed ends |
| **Result_EndMomentMaxNeg** | Maximum negative moment on end 2 | Moment or fixed ends |

# 8 Information Transferred

## 8.1 From Tekla Structures to Tekla Structural Designer

### 8.1.1 Information Transferred

The following information is transferred from Tekla Structures to Tekla Structural Designer :

- All grid lines in Tekla Structures are imported.
- All levels in Tekla Structures are imported as levels with floor and diaphragm flags not set.
- By default supports are created at the bottom of every column unless another supporting element can be detected.
- All selected Tekla Structures beams, columns and braces are imported, including curved beams. Their snap alignment position, orientation, material type, grade and section size will be maintained. In addition:-
- Member releases at the ends of the physical members will be maintained.
- US Bar Joists are handled.
- Slanted columns are handled.
- All selected Tekla Structures Slab members will be imported:-
- Horizontal and sloping slabs will be imported as slabs covering the same area. If holes exist in the Tekla Structures panel, they will be ignored.
- Slabs in Tekla Structures without concrete plank or decking information will be transferred but with generic information.
- Slab with a metal deck layer or the appropriate shared parameter will be defined as composite slabs with the relevant decking.
- Slabs with concrete plank shared parameters will be defined as composite slabs with the relevant pre-cast concrete plank.
- All selected Tekla Structures panels will be transferred if they are linear:
- If holes exist in a Tekla Structures panel, they will be ignored for the purposes of integration.

### 8.1.2 Limitations

The following limitations exist in the current release :

- No Westok members are exported – however existing Tekla Structural Designer information will be retained on synchronising models.
- No Rebar objects will be transferred.
- No pre-cast concrete beams or columns will be transferred.
- No web openings and stiffeners will be transferred.
- Portal Frame members will not be exported to Tekla Structural Designer.

## 8.2 From Tekla Structural Designer to Tekla Structures

### 8.2.1 Information Transferred

The following information is transferred from Tekla Structural Designer to Tekla Structures :

- All grid lines in Tekla Structural Designer are exported.
- All construction levels are exported if flagged as Floor.
- All columns of all materials are exported along with all rotations. For concrete filled columns, an user attribute of concrete grade is set up.
- All beams are exported along with all rotation and end release information.
- For Composite Beams, the standard Tekla parameters “Camber Size” and “Number of Studs” are set up and an additional parameter for the Transverse Reinforcement.
- If a beam changes size along its length in Tekla Structural Designer, it will be split into separate physical members.
- US Steel Joists are exported along with all rotation and end release information.
- All Truss Members are exported along with all rotation and end release information.
- Braces are exported.
- Portal Frames are exported as separate members but due to limitations, haunches are not exported and the physical positions of various members will need to be adjusted. As a result, it is not possible to export such members back to Tekla Structural Designer.
- Slabs are exported with metal deck or concrete plank information as appropriate – where possible, metal decks will be represented physically, where not possible they will be represented by shared parameters.
- Shear Walls are exported.
- It is worth noting that members which are set to Auto-design and thus have no size are sent to Tekla Structures as a special UB.

### 8.2.2 Limitations

The following limitations exist in the current release :

- No curved walls or warped structural concrete slabs will be transferred.
- No walls which incline in elevation will be transferred.
- No wind walls are exported.
- No roofs are exported.
- No connection information is exported.
- No curved gridlines are imported. A straight grid is introduced instead.
- No cold formed sections are created.
- Bison Planks cannot be modelled physically in Tekla Structures, but information is available through shared parameters.

## 8.3 Tekla Structural Designer information retained during Round Tripping

The following information is not transferred but once created in Tekla Structural Designer maintained during Round Tripping :-

- Floor settings for diaphragms, imposed load reduction settings.
- Column information including :-
  - design criteria.
  - releases.
  - restraints and effective lengths.
  - notional eccentricities.
- Beam information including :-
  - design criteria.
  - support types.
  - restraints and effective lengths.
  - floor construction.
  - effective widths.
  - stud layout.
- Westok data not modelled in Tekla Structures.
- Brace information including:-
  - connection type.
  - analysis attributes.
  - tension/compression design attributes.
- Support data at the base of columns only.
- Loading and combinations including all Wind Data.
- Roof and Wall positions and attributes.
- Analysis and design options.
- List of Frames.
- Selection Groups.

Please note that on a model merge in Tekla Structural Designer currently :-

- All design results are lost and design will need to be repeated.
- All previous connection design is lost and needs to be repeated.