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REVIT BEST PRACTICE MANUAL:

Structural

Revit Best-Practices Manual: Structural

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1. Introduction

The objective of this Revit Best-Practices Manual is not to replace basic Revit training but rather supplement it and provide users of Revit within the Northrop Structural Group with guidance, best-practices and workflows to ensure consistency and compliance in the production of deliverables. Whether that be purely documentation or documentation with an accompanying model which will become an important piece in a BIM project based on client's needs.

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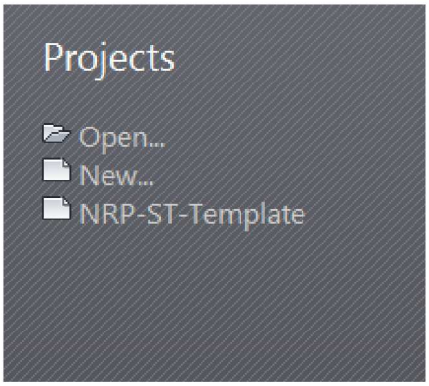
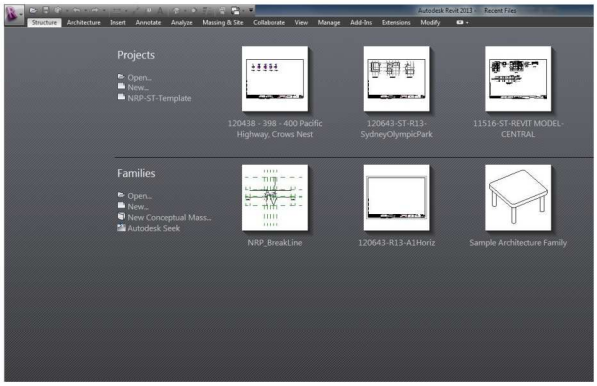
3. Management

3.1 Project Creation and Template Selection:

To begin a new Revit project file, select the Northrop Structural Template file '*NRP-ST-Template'* from the Revit '*Recent Files'* Screen, as seen below;





3.2 Naming Convention for Revit Project Files:

3.2.1 Revit Project Files;

The newly created Central model file is to be saved in the project-specific model folder, located here;

O:\20xx jobs\ProjectName\C-Drawings\D-Northrop\G-STRUCTURAL\6-REVIT MODELS\A-MODEL

And is to be named as follows; JOBNO-ST-R14-JobName. Where;

JOBNO denotes the Project Number
ST denotes Structural model
R14 denotes Revit version number
Job Name denotes Project Name

An example of which would be; 120412-ST-R14-OverlandGardens.rvt.

For more information on creating Central model files, Worksharing etc. refer to section 3.11.

3.2.2 Project Specific Revit Files;

Project specific Revit family files which may need to be created during the course of a project are to be saved in the project specific Revit Library folder, located here;

O:\20xx jobs\ProjectName\C-Drawings\D-Northrop\G-STRUCTURAL\6-REVIT MODELS\B-LIBRARY

And are to be named as follows; JOBNO-ST-FamilyName.rfa

Project sheets (title blocks) and project shared parameter files are to be saved in the project-specific Revit Standards folder, located here;

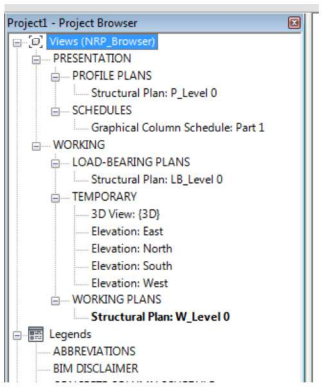
O:\20xx jobs\ProjectName\C-Drawings\D-Northrop\G-STRUCTURAL\6-REVIT MODELS\C-STANDARDS

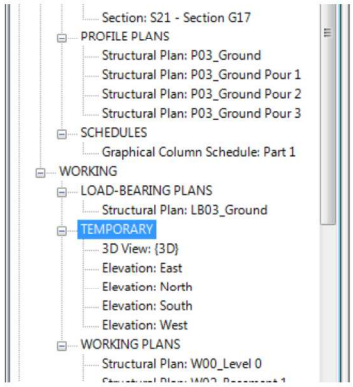
And are to be named as follows; JOBNO-R14-A1Horiz.rfa or JOBNO-ST-SharedParameters.txt

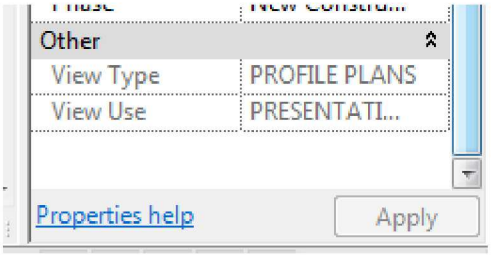
3.3 Project Browser Organisation:

The management of views within a Revit project is controlled by the '*NRP_Browser'* type and sorts views by the '*View Use'* and '*View Type'* parameters (see below screenshots). Generally, these will be automatically applied to views when View Templates are assigned. However, on occasion these will need to be applied manually when an appropriate View Template does not exist in the template.

Also see Section 3.9 of this document for information on View Naming Conventions to be used. If unsure of what values to assign, consult the BIM Manager.



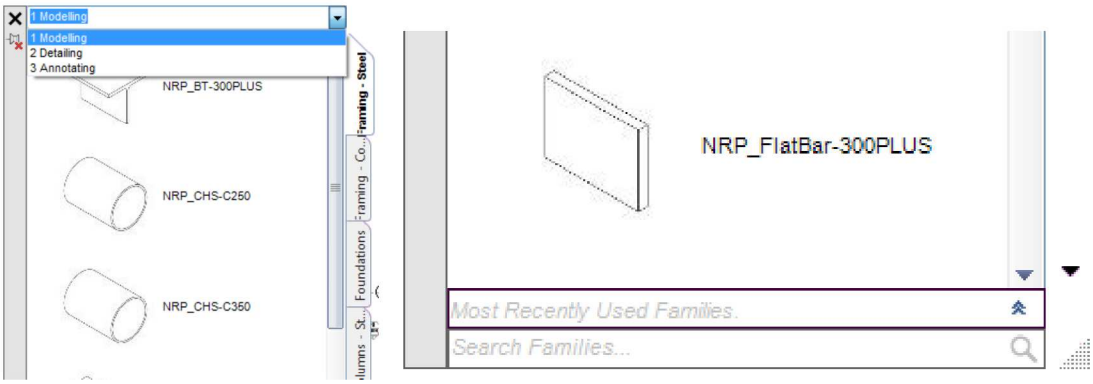




3.4 Family Browser:

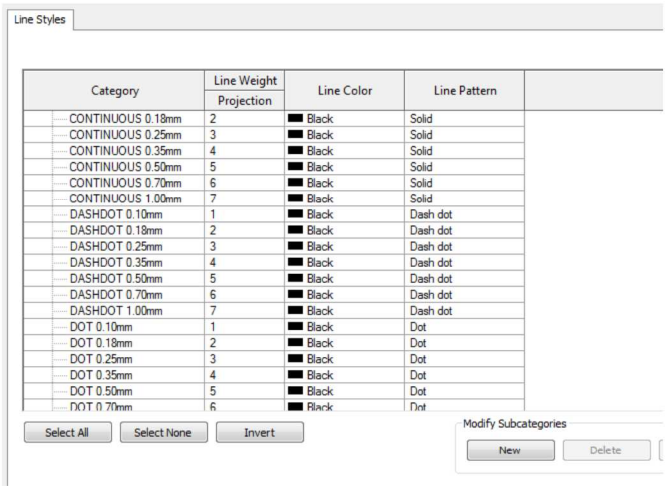
Northrop has implemented the third-party Revit application, Family Browser, as an easy way to distribute office standard families, detail components, typical details etc. and ensure consistency. Family Browser is available from the 'Add-Ins' Ribbon within Revit;

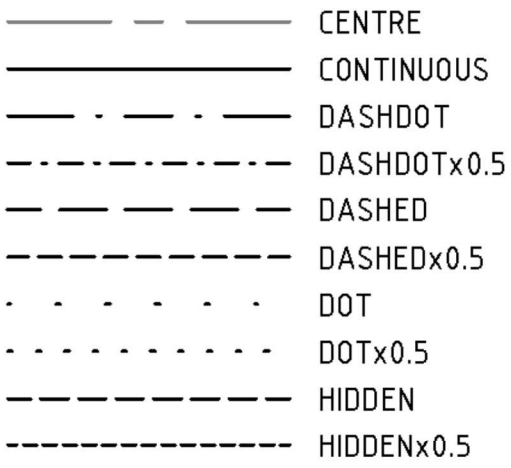
Upon loading Family Browser, you'll be presented with a floating palette containing the main Groups at the very top, then sub-categorized by Tabs on the right-hand side of the palette. From there it's just a matter of drag-and-dropping your desired family, detail, tag etc. into the view window to load it into your project. A search facility is also available at the bottom of the palette for quickly finding families of your choice.



3.5 Line Styles:

As a part of the overhaul of the Northrop Structural template in 2013, the line styles were revised. Please note this when detailing, especially if importing details from previous projects, the newly imported line styles will need to be changed to the new styles and then removed.





3.6 Filters:

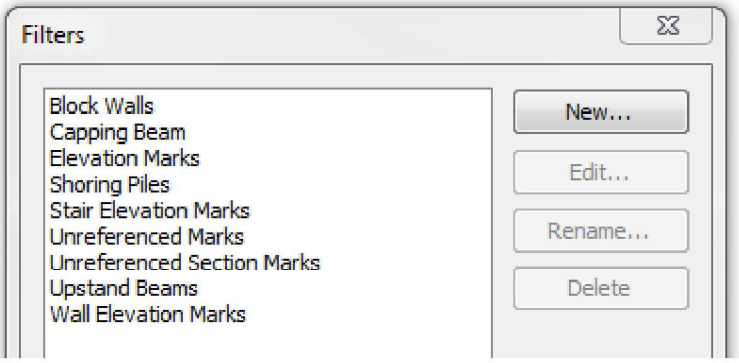
A number of commonly used Filters reside in the Northrop Structural Template and should be applied to views and/or view templates as required. If unsure, consult the project's Model Manager.

As part of the Structural Template, various filters have been applied to a number of the View Templates, ie the *'…PLAN-Profile'* view template includes filters for the hiding of unreferenced sections and callouts,

representation of brick and block walls etc.

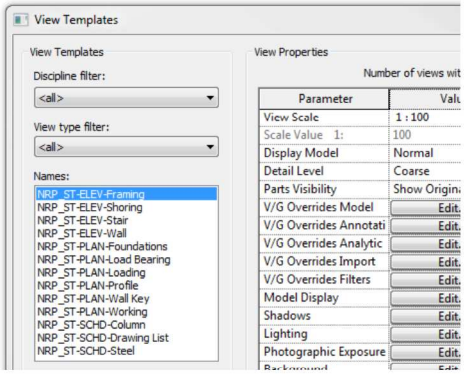
Name	Visibility	Projection/Surface			Cut		Halftone
		Lines	Patterns	Transparen...	Lines	Patterns	
Unreferenced Marks	☐						☐
Block Walls	☑	———		100%	———		☐
Brick Walls	☑	———			———		☐
Shoring Sections	☐						☐
Wall Elevation Marks	☐						☐
Stair Elevation Marks	☐						☐
Elevation Marks	☐						☐

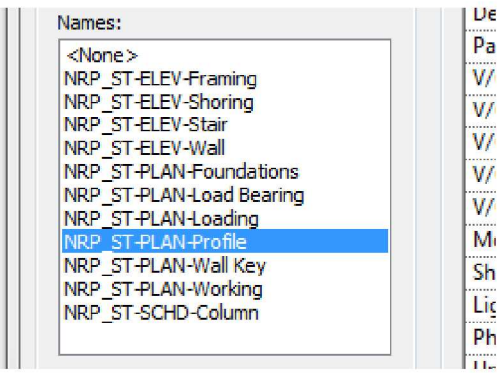
If new Filters are required in a project, then the naming convention should be by the element or category it controls, i.e. if you need to override the line style of a Structural Column in a view, then the Filter should be named '*Structural Column'*. This filter can then be applied to the view template in question. This naming convention enables the 'Structural Column' filter to be used in other views with different VG overrides as required.



3.7 View Templates:

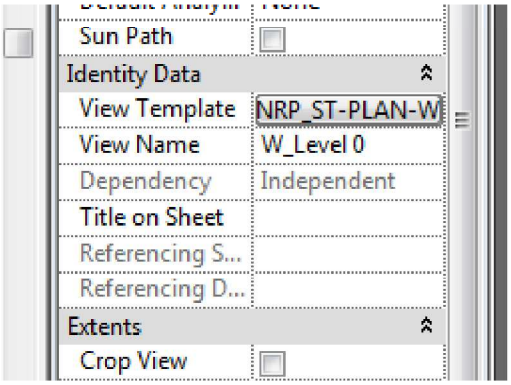
When creating new views in a Revit project, View Templates should immediately be assigned to the view in order to maintain consistency throughout the project. A number of which you'll find pre-loaded in the template for use.





It should be noted that the way these are now applied has changed slightly. View Templates are now 'assigned' as opposed to merely applied, this means that subsequent changes to a View Template are then

also made to the view which has that template assigned. View Templates are assigned via the '*View Template'* button under '*Identity Data'* in the views properties dialog.



Note that changes to View Templates should only be made by a projects Model Manager/Lead Draftsperson.

It is important to ensure every view has an appropriate View Template applied so as to ensure consistency in documentation.

3.8 View Naming Convention:

The naming and organisation of Views within a project is important as it aids in the management of a project and as such a naming convention for these is needed to be set and followed. A number of views have already been created in the template which follow the convention, however many more will need to be created depending on size and type of project. Naming convention is to be as follows;

3.8.1 Presentation Views;

View Type	**View Naming Convention**
Slab Profile/GA Plans	**P_*LevelName*** (or alternatively P01_*LevelName*, P02_*LevelName*)
Slab Reinforcement Plans	**RB_*LevelName*** for Bottom Reinf't Plan **RT_*LevelName*** for Top Reinf't Plan
Slab Post-Tensioning Plans	**PT_ *LevelName***
Details	**DT_S*XX* – Section *YY***, where *XX* denotes the sheet number the detail/section resides on and *YY* denotes the Section or Detail number
Details - Typical	**DT_S*XX* – *Typical Column Detail*** where *XX* denotes the sheet number the detail/section resides on and is then followed by the typical

	details description.
Stair Elevations	**EL_Stair S*XX***, where *XX* denotes the Stair number. Important to note that the View Name must contain 'Stair' for various filters to work correctly.
Wall Elevations	**EL_Wall W*XX***, where *XX* denotes the Wall number. Can be modified to suit projects with multiple cores etc, ie Wall W101 (for Core 1 Wall 01 etc.). Important to note that the View Name must contain 'Wall' for various filters to work correctly.
Building Elevations	**EL_Building *XX***, where *XX* denotes Building Elevation number/letter/direction.
Shoring Elevations	**EL_Shoring *XX***, where *XX* denotes Building Elevation number/letter.
Wall Key Plans	**KP_Wall *XX***, where *XX* denotes Wall number.
Stair Key Plans	**KP_Stair *XX***, where *XX* denotes Stair number.

3.8.2 Working Views;

View Type	**View Naming Convention**
Working Plans	**W_*LevelName***
Load-Bearing Under Plans	**LB_*LevelName***
Temporary User Views	***_BAH-ViewName***, where *_BAH* denotes users initials and *ViewName* denotes name of view. If user wants to create a view for temporary viewing, ie a section, then it should be prefixed with users initials so others users and/or model managers know not to delete when auditing/cleaning up the model.

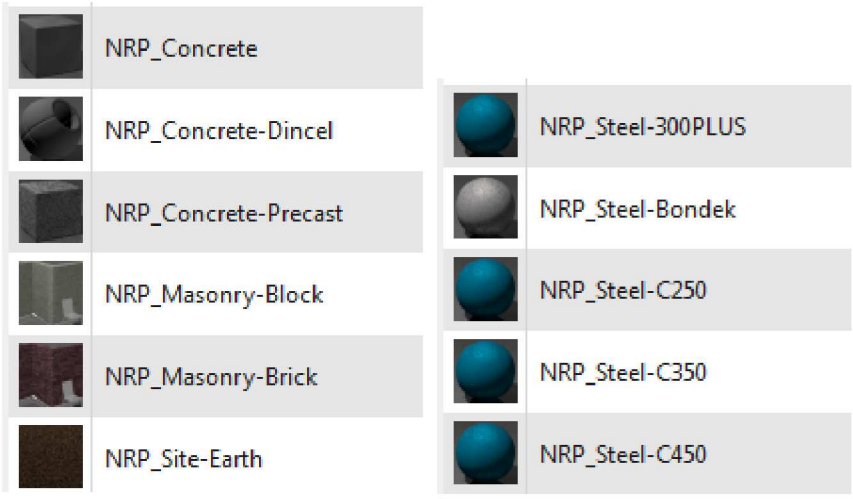
3.8.3 Reference Views;

View Type	View Naming Convention
Reference Plans	**_REF-*ViewName***, Reference Views are used to assist in the control and maintanence of tagging of building elements. An example of which would be '*_REF-Concrete Columns'*, a plan view created at the highest level of the building, having an unlimited view range, with VG set to only show concrete columns. This view then easily enables the control of 'mark' parameters of multiple columns and tags. For more information consult the BIM Manager.

If you require a view that does not fit the above listed types, please consult the BIM Manager for assistance in creating an appropriate view name.

3.9 Materials:

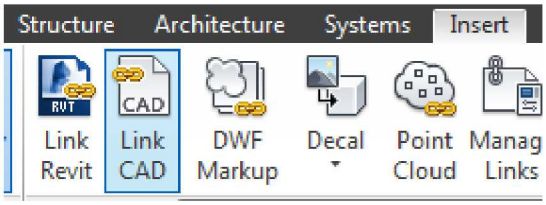
The Northrop Structural Template contains a set of materials which have been pre-assigned to all of the elements available in the Northrop Structural Library. These are;



As these have been pre-assigned, user interaction with these should be minimal. However, if an additional Material is required to be assigned to an element please consult the BIM Manager for it's creation/inclusion.

3.10 Linking and use of Revit/DWG files:

During a project's start-up meeting it will be determined what type of 'positioning' will be used in order to co-ordinate the various consultants CAD files, models etc. This will be determined by the project's Model Manager/Lead Draftsman and shared with the team.



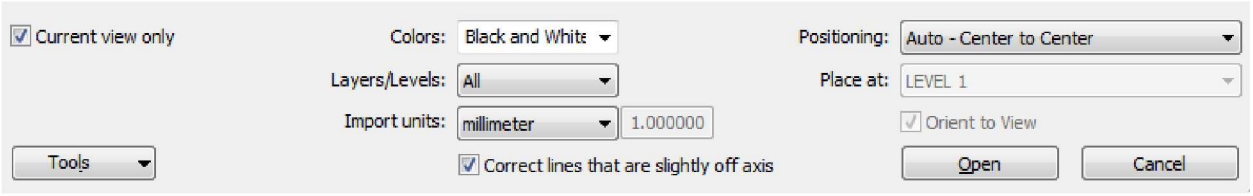
For some background information, Revit projects have a file (reference) origin that does not change, in a way it's like AutoCAD's World Coordinate System (WCS). The shared coordinate concept is similar to using the User Coordinate System (UCS) in AutoCAD to provide an alternate way of seeing the model.

A wealth of information on co-ordinating projects using shared co-ordinates is available here;

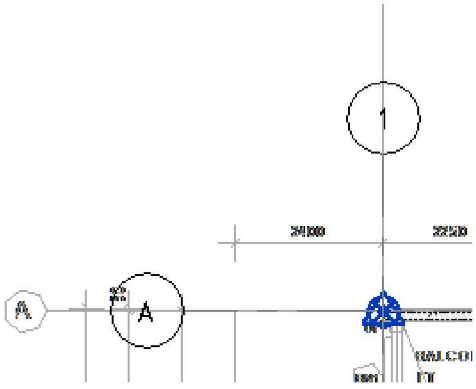
http://revitoped.blogspot.com.au/2013/06/coordinating-projects-using-shared.html

3.10.1 Linking DWG files:

DWG files should only be inserted into the '*Working*' views, so be sure to open a '*W_*' view prior to linking. If the external consultant issues their CAD files in DWG format, the majority of the time the positioning of the file should be set to '*Auto – Centre to Centre'*. Other settings should be as below;

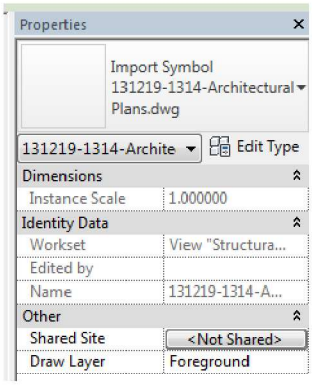


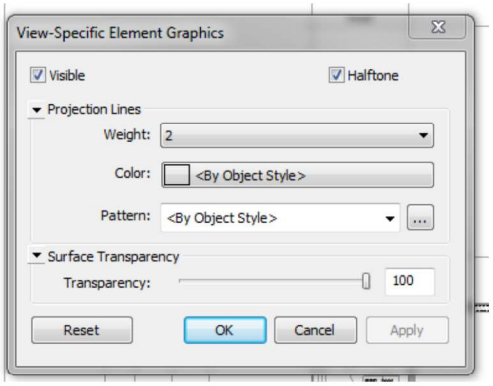
Once inserted, the CAD file should then be moved to a logical position, ie move the CAD files intersection of Grids A and 1 to the Revit project base point 0,0. See screenshot below;



If unsure, or if you suspect the project is using a form of shared co-ordinates, consult the project's Model Manager/Lead Draftsman.

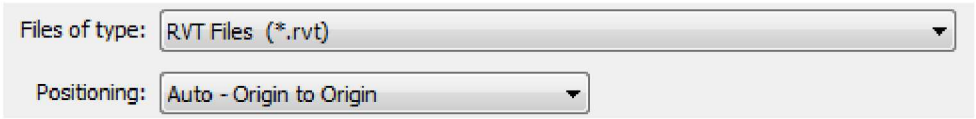
Once inserted the DWG can then be brought to the *'foreground'*, and have it's view graphics overridden. The below screenshot shows the preferred graphic overrides, however these can vary depending on user preference.





3.10.2 Linking Revit files:

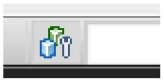
As mentioned above, a project's 'positioning' will be determined prior to the beginning of modelling on a project and this will determine how an external consultants Revit model will be inserted. For this information, consult your project Model Manager. However, the majority of the time the positioning of the file should be set to '*Auto – Origin to Origin'*.



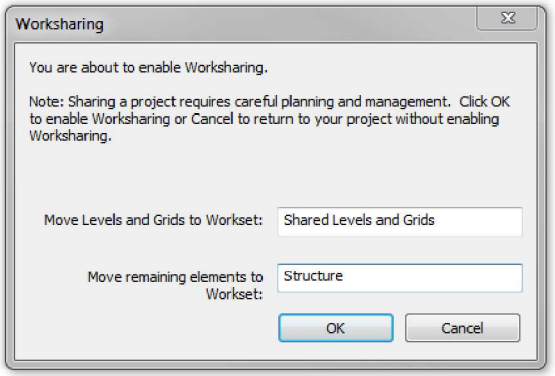
Obviously, in this case we're relying on the Architect (or other external consultant) to correctly position the project. If you suspect this isn't the case, or you receive an error/warning relating to the positioning upon insertion consult the project's Model Manager/Lead Draftsman or BIM Manager.

3.11 Worksets:

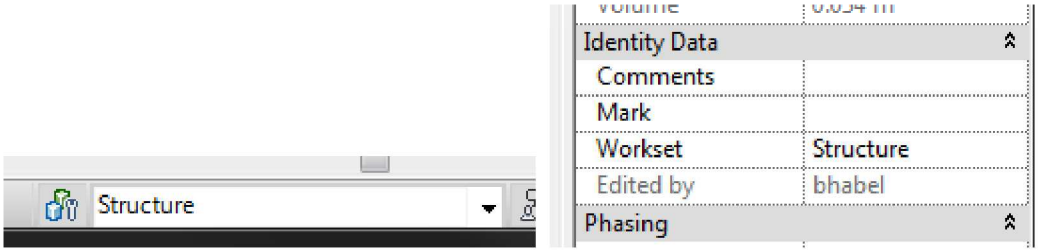
Worksets should be enabled on all projects, this allows multiple team members to work on different parts of a project simultanesouly. When beginning a new project, simply hit the 'Worksets' button;



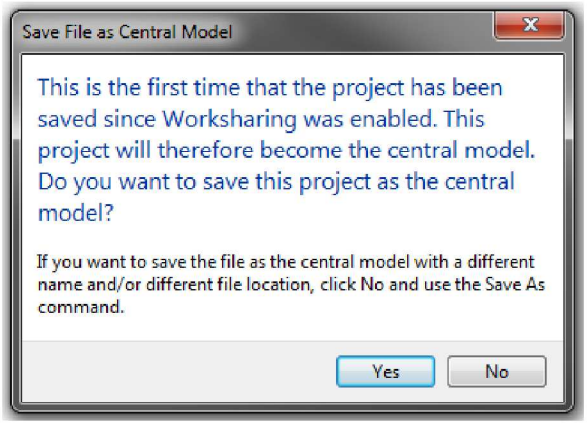
For our structural model(s), we'll place all of our elements on two Worksets, those being '*Shared Levels and Grids'* and '*Structure*'.



Ensure the '*Active Workset'* remains as '*Structure*' as all elements created will be placed on the '*Active Workset'.*



Following this, the first time you 'save' your project after introducing Worksets you'll be presented with the following dialog box, select '*Yes*';



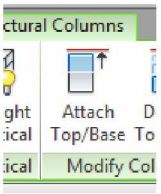
It should be noted that if you have not yet saved your project prior to creating the Worksets, you won't be presented with this dialog.

The central model should then be closed, and a local copy of the model created.

4. Creation and Manipulation of Modelled Elements

4.1 Columns:

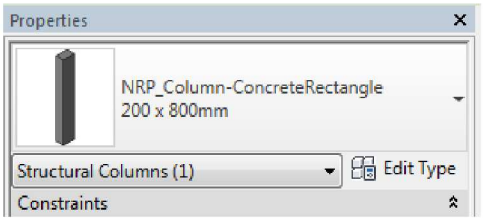
When modelling Structural Concrete Columns, they should be modelled level-to-level to ensure they are able to be tagged as being over, under or both on a profile plan and have it's design information appear in '*Graphical Column Schedules'*. This is done by attaching the column top to the structure above (whether it be a slab, band beam etc.) and base to the structure below, using the *'Attach Top/Base'* button;



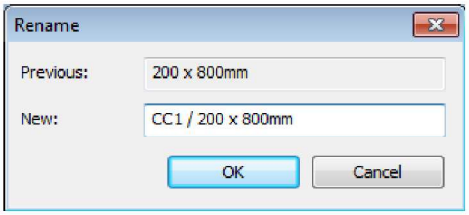
The way a concrete column is tagged/identified differs depending on the stage a project is in, that being either pre or post-tender. How these differ is detailed below;

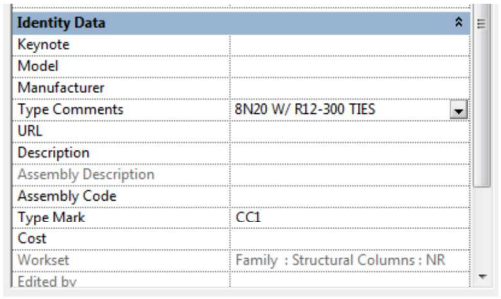
4.1.1 Concrete Columns Pre-Tender:

Load the required concrete column by using the Family Browser, then edit the columns '*Type Properties*'



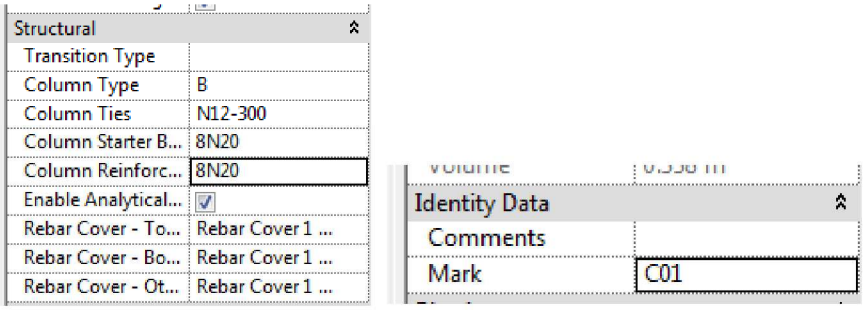
As the project is in a pre-tender stage, the columns will be identified by type. Therefore rename the columns '*Type Name'* and prefix with it's type, ie CC1, CC2 etc. Add the corresponding column Type Mark to the columns '*Type Mark*' parameter and any '*Type Comments*' you want to appear in the schedule.





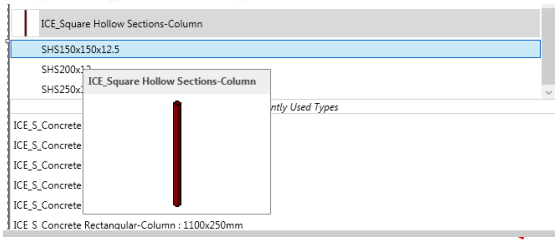
4.1.2 Concrete Columns Post-Tender:

In the Post-Tender stage concrete columns will be identified individually (ie, C01, C02) by 'Mark' rather than by type and 'Type Mark' as was the case during Pre-Tender stages and columns should be scheduled using a '*Graphical Column Schedule'*. The necessary instance parameters (vertical reinforcement, ties, type etc.) will now need to be populated with the required design information.

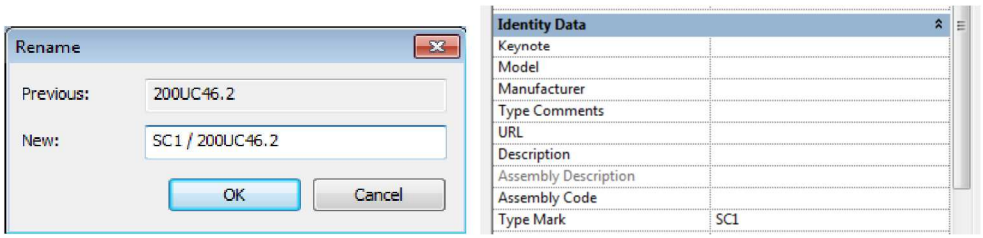


4.1.3 Steel Columns:

Load the required steel column by using the Family Browser, then edit the columns '*Type Properties*'

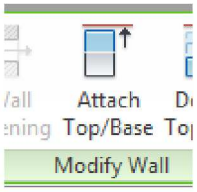


Rename the columns '*Type Name'* and prefix with it's type, ie SC1, SC2 etc. Add the corresponding column Type Mark to the columns '*Type Mark*' parameter and any '*Type Comments*' you want to appear in the schedule.

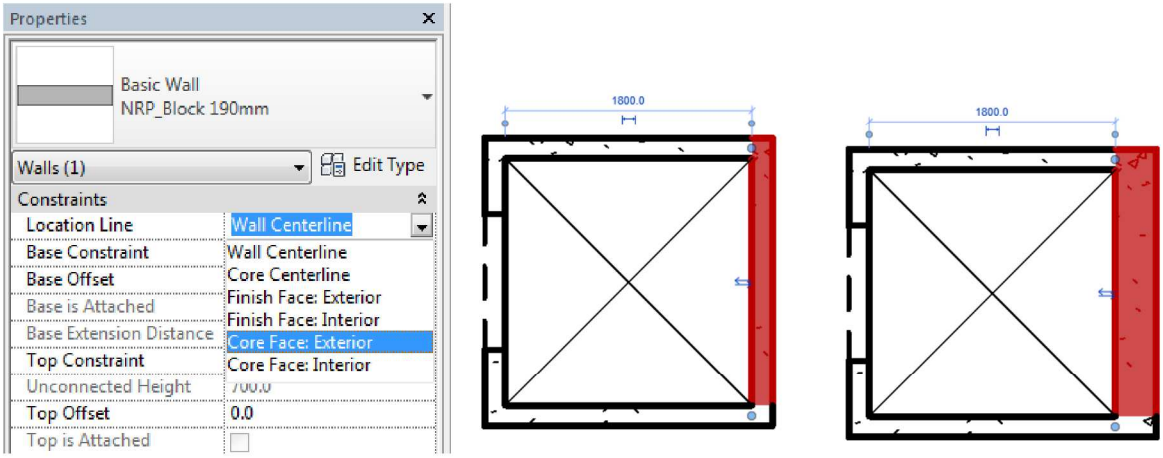


4.2 Walls:

When modelling Structural Walls, they should be modelled level-to-level to ensure they are able to be tagged as being over, under or both on a profile plan. This is done by attaching the top of the Wall to the structure above (whether it be a slab, band beam etc.) and the base to the structure below, using the *'Attach Top/Base'* button;



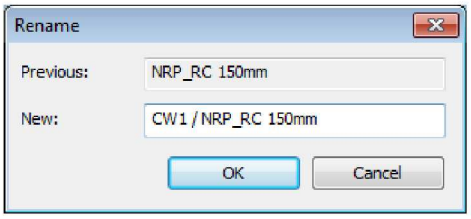
Core Walls should be modelled with the Location Line set to *'Core Face: Exterior'*. This future-proofs the model for if/when there is a change in the design and the wall thickness changes as you won't need to move the wall (as you would if the Location Line were set to '*Core Centreline'*) as it will simply increase/decrease in size from the Location Line, which will be set to the exterior of the wall (and hence the penetration edge).



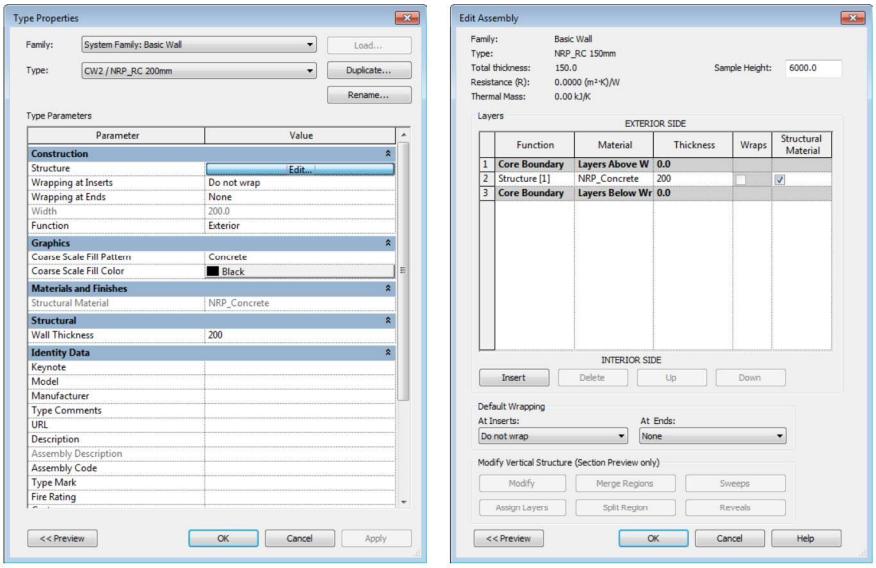
As Walls are a '*System Family'*, wall families cannot be inserted through the Family Browser and must be created inside of the project. A number of types have been created in the Structural Template and are available in your project.

4.2.1 Concrete Walls:

Another effect of walls being a system family is that in order to create new types, you'll need to duplicate and rename one of the walls that are already present in the project. Once duplicated, add the prefix for it's type, ie CW1, CW2 etc.

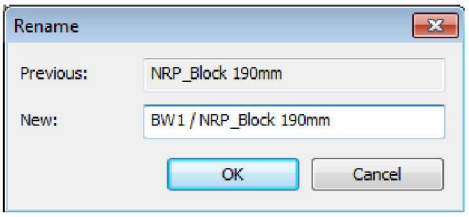


Once the new wall type is created, edit its parameters, thickness etc. to suit.



4.2.2 Masonry Walls:

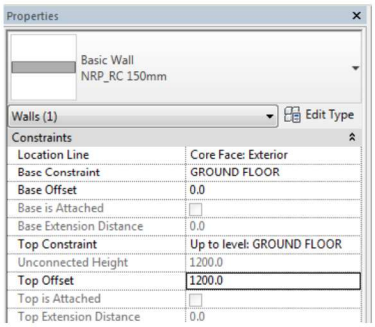
Similarly to Concrete Walls, duplicate and rename one of the masonry walls that are already present in the project. Once duplicated, add the prefix for it's type, ie BW1, BW2 etc.



Once the new wall type is created, edit its parameters, thickness etc. to suit.

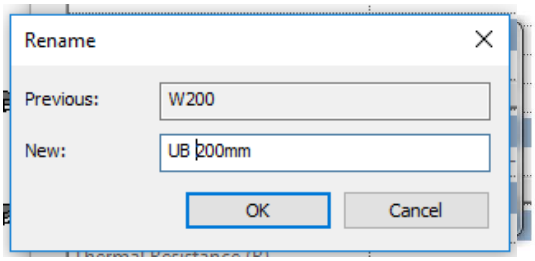
4.2.3 Upstands:

Upstands are to be modelled as a Wall. The main reason for this is so that with the *'Base Constraint'* and *'Top Constraint'* set to the same level. The *'Top Offset'* value is used to dictate the height of the upstand. Where possible the *'Location Line'* should be set to *'Core Face: Exterior'* and modelled along the slab edge to allow for easy changes in upstand thickness.



Similar to Walls, duplicate and rename an existing wall type (or upstand) that is already present in the project. Once duplicated, add the prefix for it's type, ie UB1, UB2 etc. To allow easy navigation through wall types in your project insert *'Upstand'* to the Wall Type Name prior to the thickness.

Once the new wall type is created, edit its parameters, thickness etc. to suit.

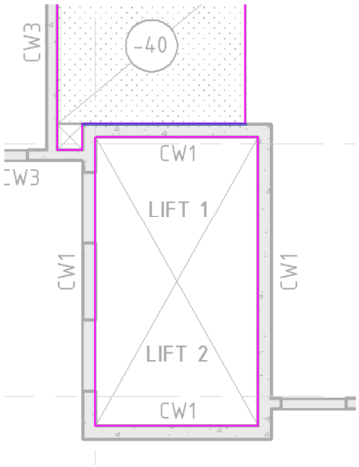


4.3 Slabs:

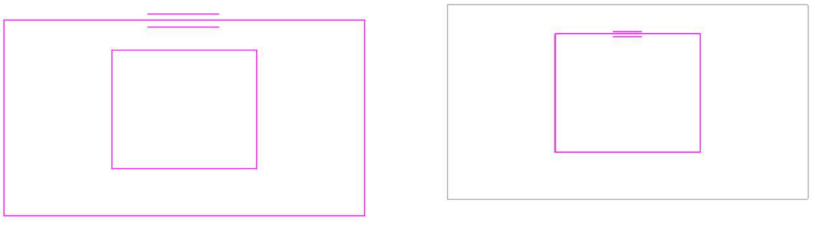
Slabs, like Walls, are a '*System Family'* and hence slab families cannot be inserted through the Family Browser and must be created inside of the project. A number of types (RC, Bondek etc.) have been created in the Structural Template and are available in your project.

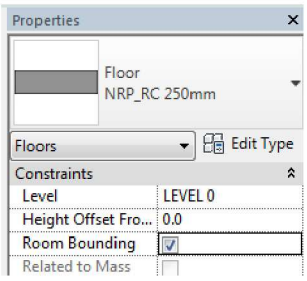
4.3.1 Concrete and Composite Slabs:

When sketching a slabs extents, it is important to note that the extent of the slab should extend to the exterior face of a core wall, as per below;

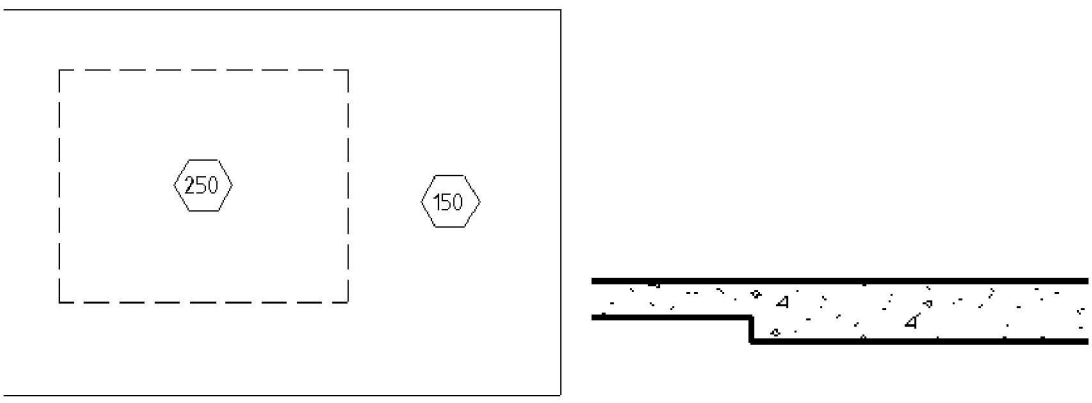


For changes in depth to a slab, simply edit the profile of the surrounding or adjacent slab and sketch the extent of the differing thickness slab. Then create a new slab matching that extent, ensuring the slabs properties match that desired.

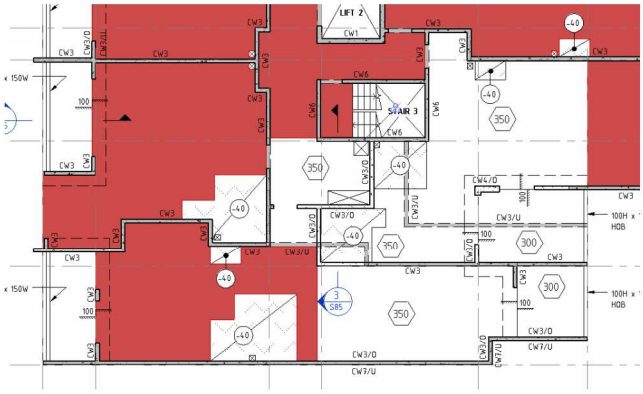
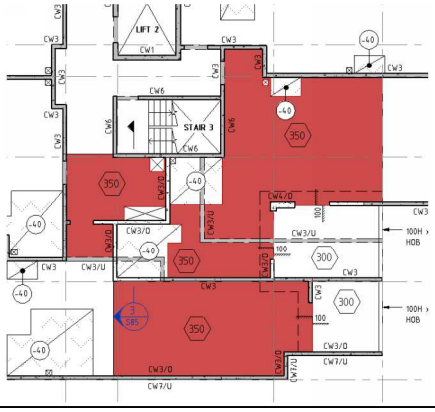




It is important to then ‘join’ the two slabs to ensure correct representation on plan and in section.

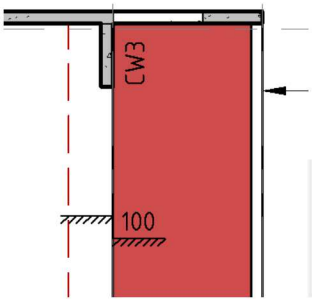


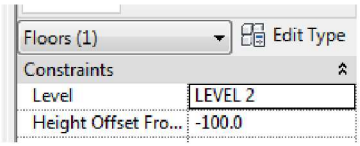
For context, a more complicated ‘real-world’ example is shown below;

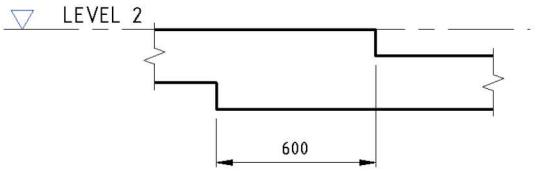
Extent of 200 Thick Slab	Extent of 350 Thick Slab
	

4.3.2 Steps in Slabs:

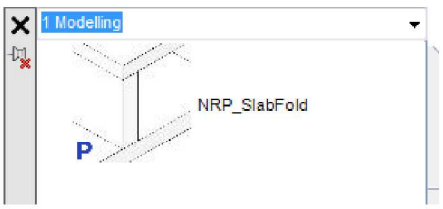
Where a step in a slab occurs and there is a step in the soffit a separate slab element should be modelled and it's '*Height Offset From Level'* value adjusted accordingly;



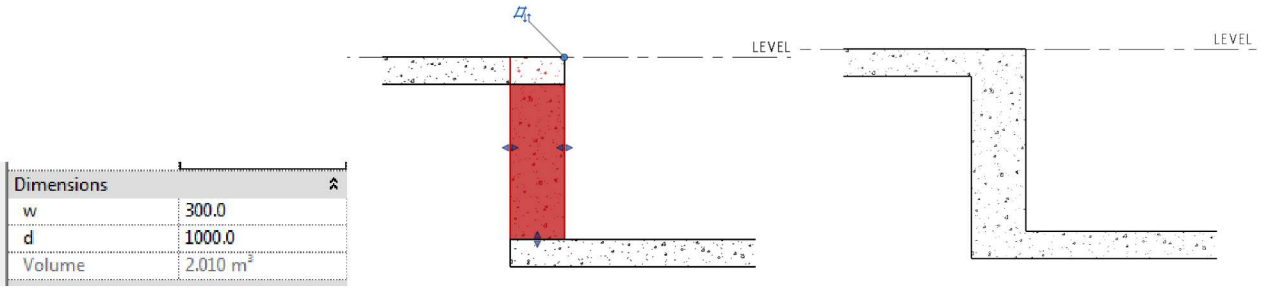




If the step is greater than the thickness of the higher slab, the '*Slab Fold'* family (found under Modelling>Slabs in the Family Browser) should be used;

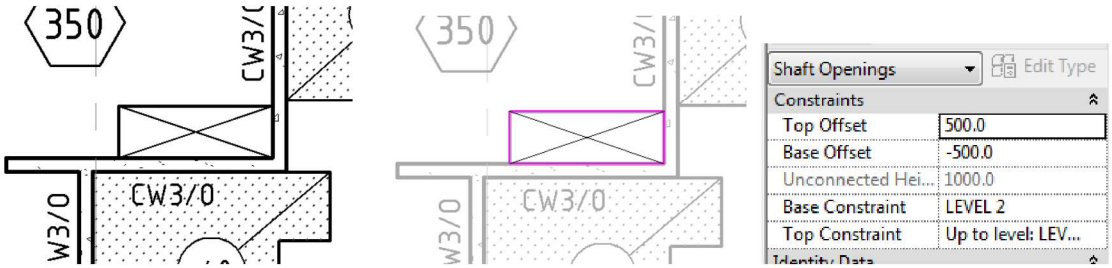


As the Slab Fold is a 'face-based' family, when inserted into the project it will ask for a slab face to be hosted on, the higher of the two slabs in question should be selected. The 'Slab Folds' dimensions should then be adjusted to suit (ie width and depth) and then be manually 'joined' to both the higher and lower slabs.

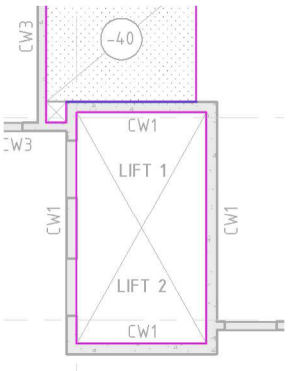


4.3.3 Slab Penetrations:

Where a penetration in a slab occurs, a *'Shaft Opening'* should be used to create the penetration. With the *'Base and Top Constraints'* being the level the penetration is at and the *'Top and Bottom Offsets'* generally being ±500mm (this may vary depending on the location of the slab).

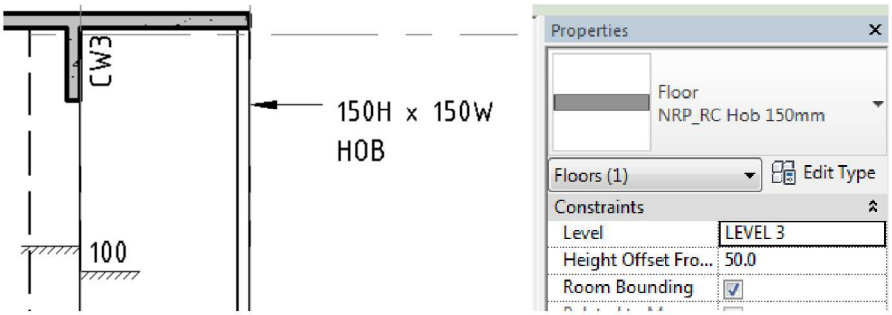


The exception to this is for core/stair walls where the slab sketch should be edited to provide the penetration *(See 4.3.1)*.



4.3.4 Hobs:

Hobs are to be created as 'Floors', simply duplicate an existing floor type, adjust thickness and rename it to include 'Hob' in the Type Name (see screenshot below). It's then just a matter of sketching the extent of the hob and adjusting the '*Height Offset From Level'* to suit the slab it sits atop.



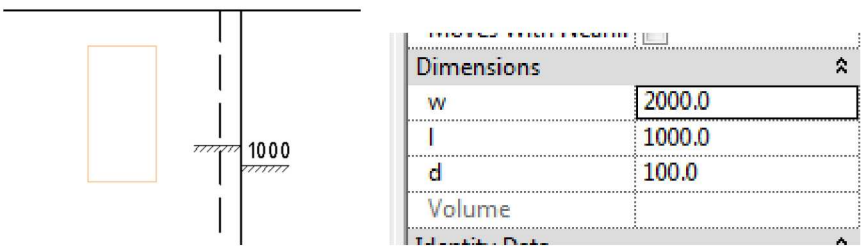
Note that if the newly created hob doesn't join with the slab automatically, a manual join will be required. It's always worthwhile to check with a temporary section.

4.3.5 Setdowns in Slabs:

4.3.5.1 No Step in Soffit:

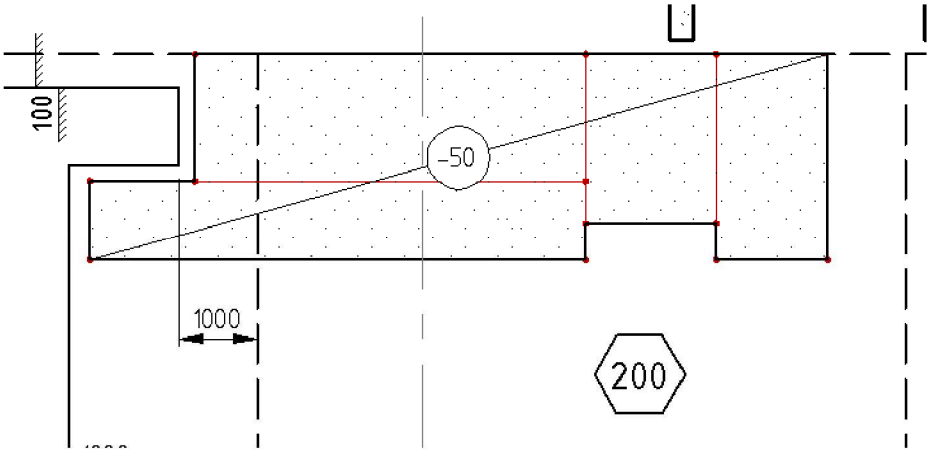
Where a step in a slab occurs and there is no step in the soffit of the surrounding slab and the shape and extent is a rather simple rectangular (or can me made up of a series of rectangles) setdown, the '*NRP_SetdownRect'* family (found under Modelling>Miscellaneous in the Family Browser) should be used.

Like the Slab Fold family, '*NRP_SetdownRec'* is a 'face-based' void family and hence when inserted into the project it will ask for a slab face to be hosted upon. Once inserted the 'Slab Folds' dimensions should then be adjusted to suit (ie width, length and depth).



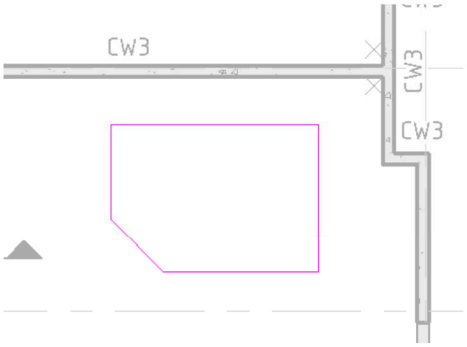
It's then a matter of using the 'cut' tool (found under the Modify ribbon>Geometry panel) to cut/create the setdown in the slab.

The example below shows how a series of '*NRP_SetdownRect'* families can be used together to create a more unusually shaped setdown extent;

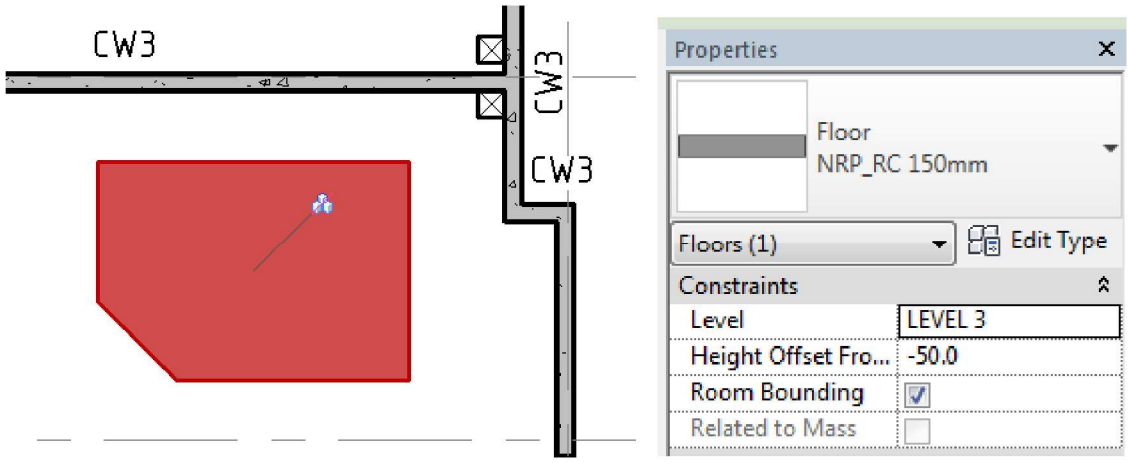


It should be noted this same method can also be used to 'cut' a framing member if the setdown crosses a band beam or the like.

If the desired setdown is not able to be generated using the above method, then the surrounding slab's profile should be edited to accomodate the shape of the setdown;

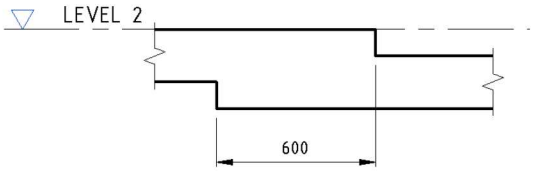


It's then a matter of infilling the resulting void in the slab with a slab which is setdown. Ensuring that the setdown's slab '*Height Offset from Level'* value is set appropriately, along with the slab depth, in this example we have a 50mm setdown in a 200mm slab with the soffit remaining flat.



4.3.5.2 Step in Soffit:

Where a step in a slab occurs and there is a step in the soffit of the surrounding slab, refer '*4.3.2 Steps in Slabs*' for the methodology for modelling the setdown in this case.



4.4 Foundations:

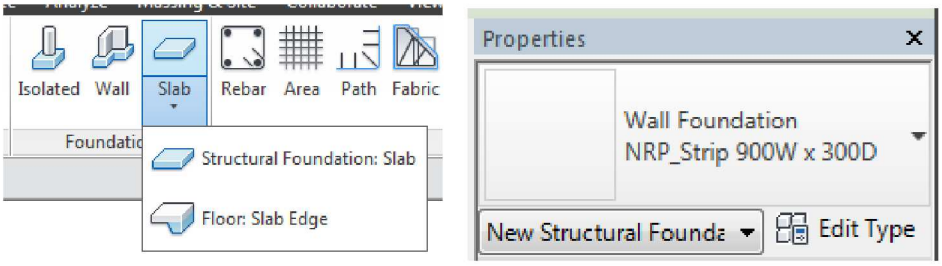
4.4.1 Isolated Foundations:

Isolated foundations, ie Pad Footings, Piles, Pile Caps etc. are available from the Family Browser under Modelling>Foundations.

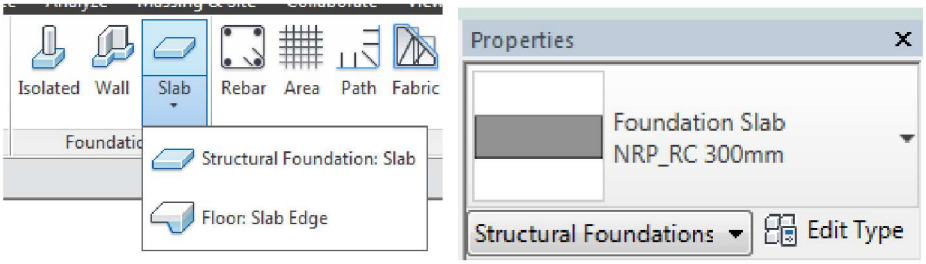
For foundation types not available in the Family Browser (ie, the 'System' Families) the following should be used;

- Foundation – Wall: Used for 'Strip Footings' under walls in a model. A type of which is included in the template (see screenshot below). New types 'Type Names' should adhere to the convention of those types included in the template.

  There will be occasions where the use of the 'Foundation – Wall' tool will not suit the type of strip footing required in a project (ie, one which steps), in these cases an in-place foundation family could be used. If unsure, consult the projects Model Manager/Lead Draftsman or BIM Manager for the best option.

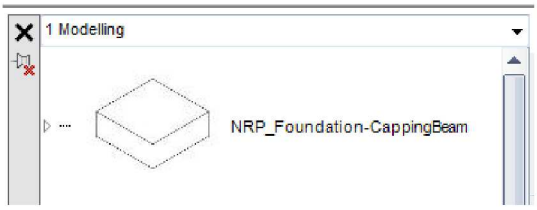


- Foundation - Slab: Used for Lift and Stair Core Wall bases. A type of which is included in the template (see screenshot below). New types 'Type Names' should adhere to the convention of those types included in the template.

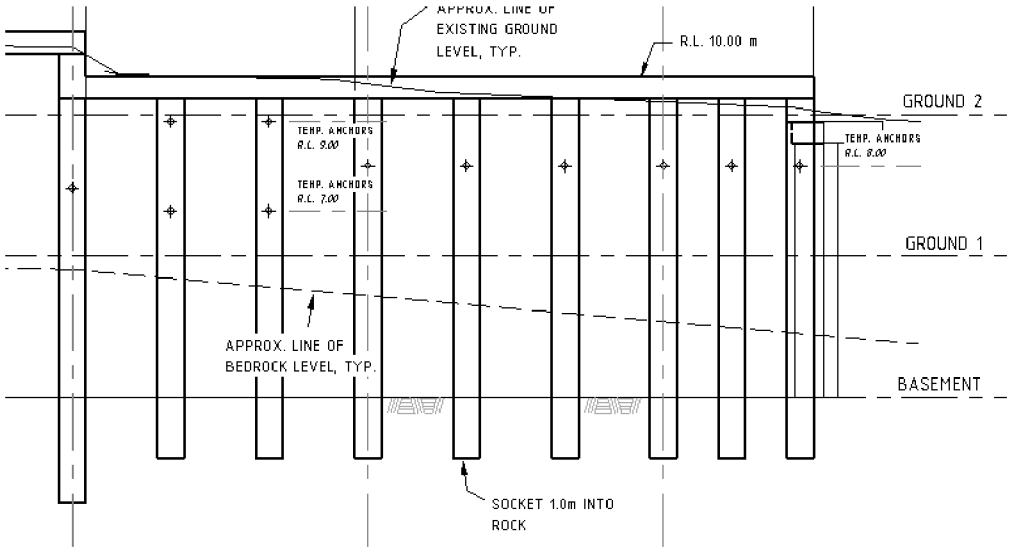


4.4.2 Shoring Walls:

In order to model shoring walls there are a series of families that should be used to create the walls, these being*; 'NRP_Foundation-ShoringPile'*, '*NRP_Foundation-CappingBeam'* and '*NRP_Foundation-ShoringWall'*. All of which are available from the Family Browser under Modelling>Foundations;



It's also adventageous to have the topography modelled, so when shoring elevations are cut and created a true representation of the cut topography is indicated.



There may be projects where using the above collection of families may not suit and in-place families, floors etc. may need to be used in their place. Please consult the BIM Manager in this situation.

4.5 Framing:

4.5.1 Concrete Beams:

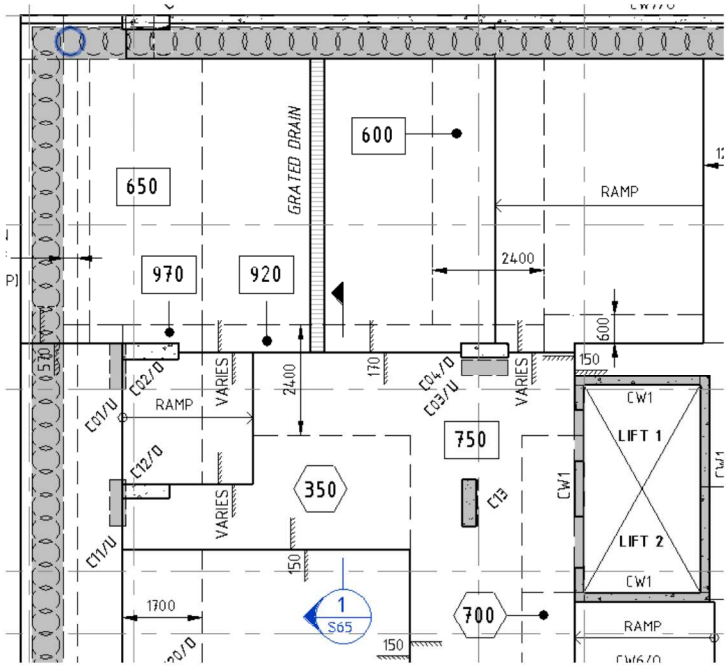
For the majority of concrete beams, the family available from the Family Browser will suit. However, there will be projects where the slab profile and concrete beams are designed in such a way that either in-place families or ‘slabs’ will be a more efficient way of modelling the concrete framing members.

4.5.1.1 In-place Families:

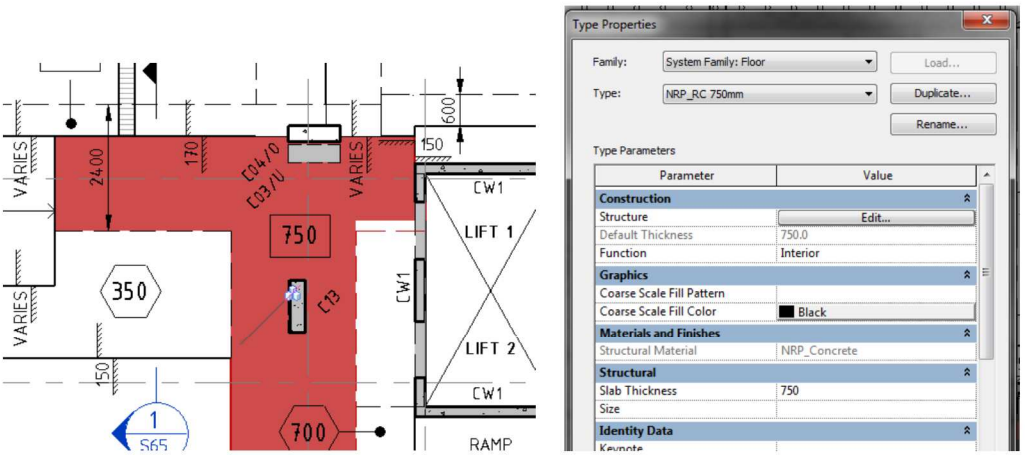
In-place concrete beams should be used in situations where the ‘occasional’ concrete beam that cannot be modelled using the family available from the Family Browser is required.

4.5.1.2 Slabs:

Slabs should be considered to be used in situations where the ‘entire’ slab profile is such that to model the design would require immense time and effort using a combination of the out-of-the-box concrete beam members and the ‘occasional’ in-place family. Example of such a slab profile is shown below;



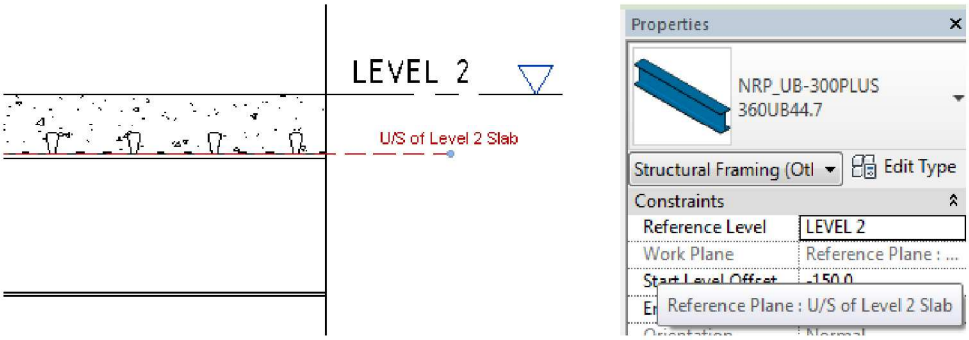
To use ‘Slabs’ as concrete beams, simply duplicate and existing slab type, rename and adjust ‘Type Properties’ to suit. Then model extent and ensure the resulting ‘beam’ is joined to adjacent elements.



Replace with ICE pic.

4.5.2 Steel Framing for Composite Slabs:

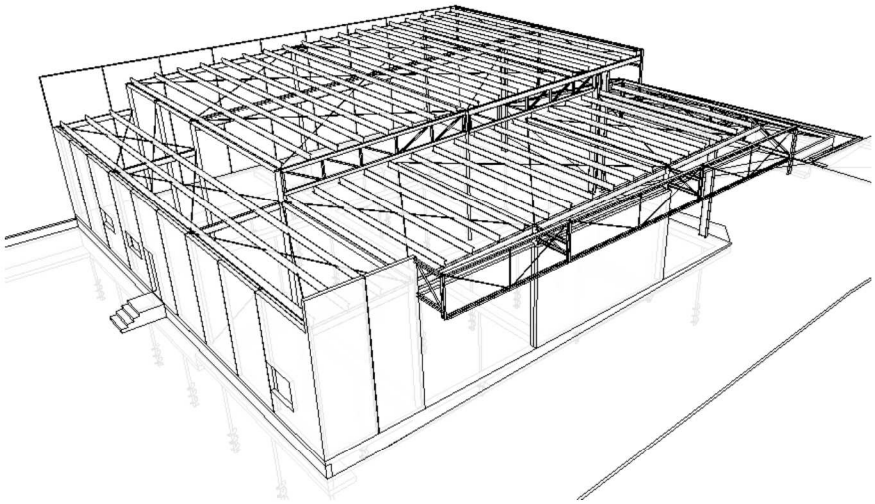
When modelling steel framing as a support for a composite slab it is important to ensure that a reference plane is place at the underside of the slab and the steel framing hosted on that plane.



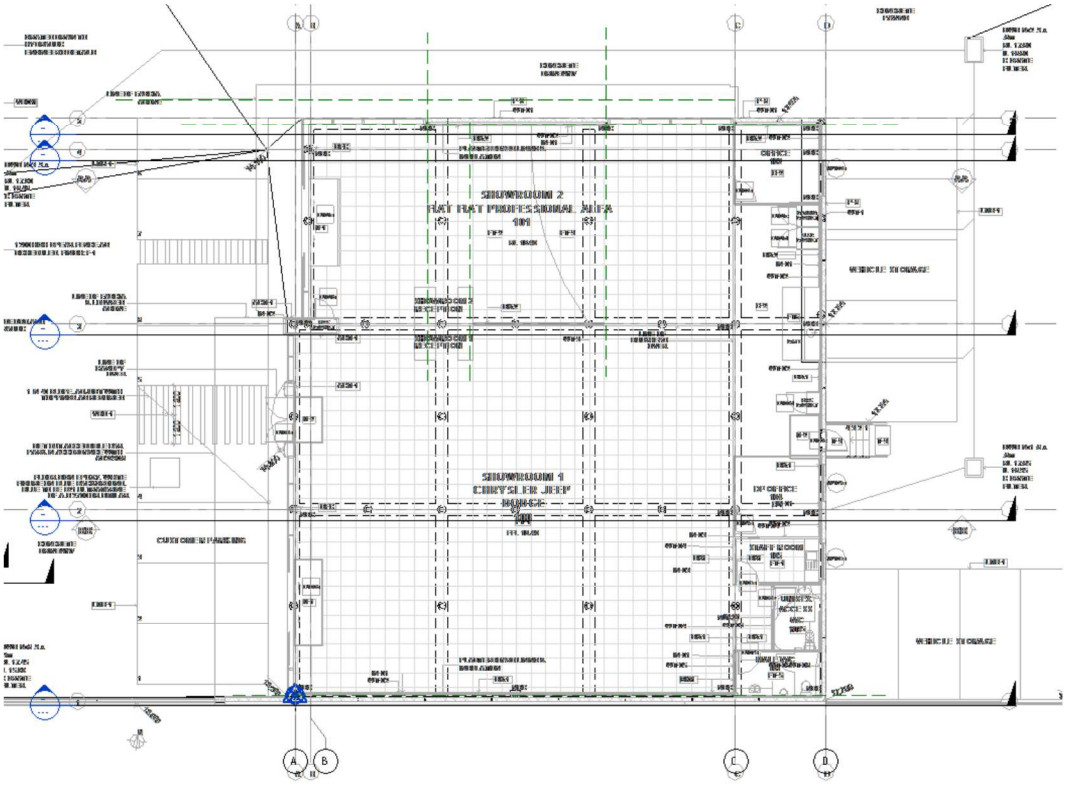
This allows the supporting framing to be moved easily if the depth of the supported slab changes during the design process as it's a simple matter of moving the one reference plan as opposed to having select members manually and then revising the offset.

4.5.3 Steel Framing for Roofs:

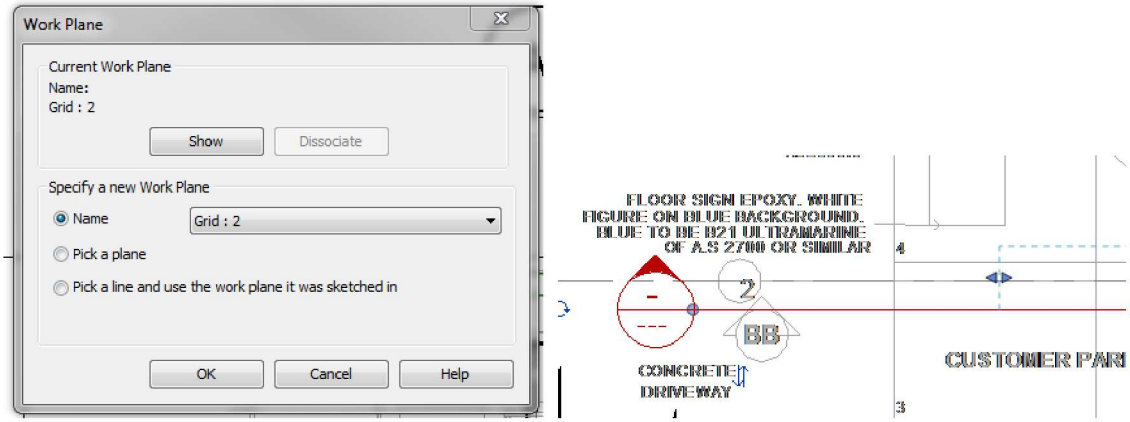
As has already been mentioned numerous times, setup is key in Revit and for the modelling steel framing it's especially so.



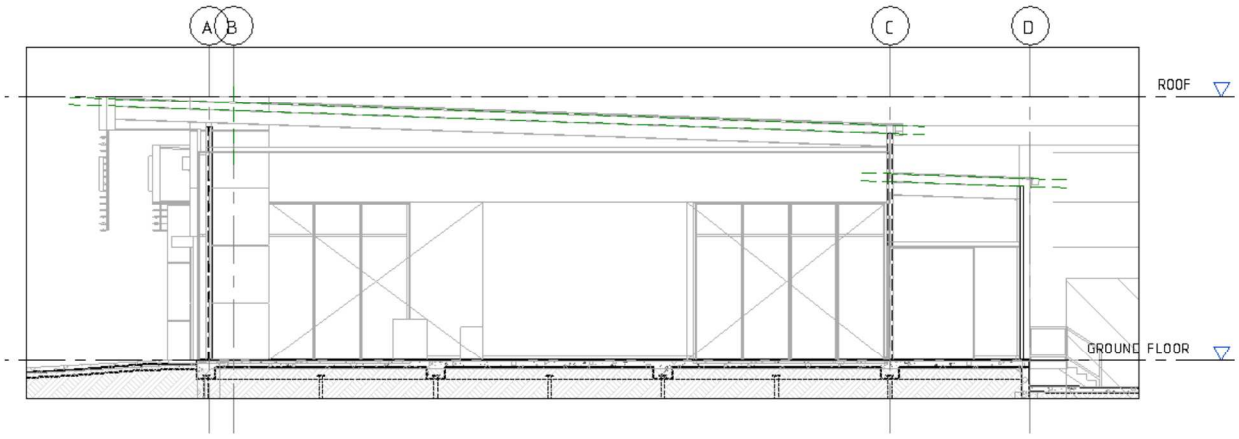
To begin modelling, a 'plan of attack' will need to be considered and this can vary depending on the type of structure. Ideally, the first step is to model each of the columns in plan view. Once the columns have been modelled, create a section (with a '*Far Clip Offset'* value of 1000 or so) along each 'portal frame'. In the majority of cases these 'frames' will sit on grid, although this is not always the case (approach for this will be detailed later).



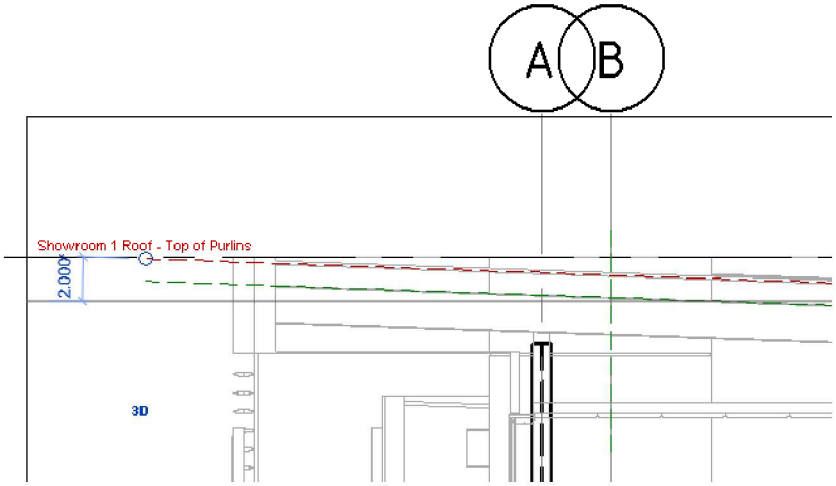
Open one of the section views created and ensure the work plane is correctly set.



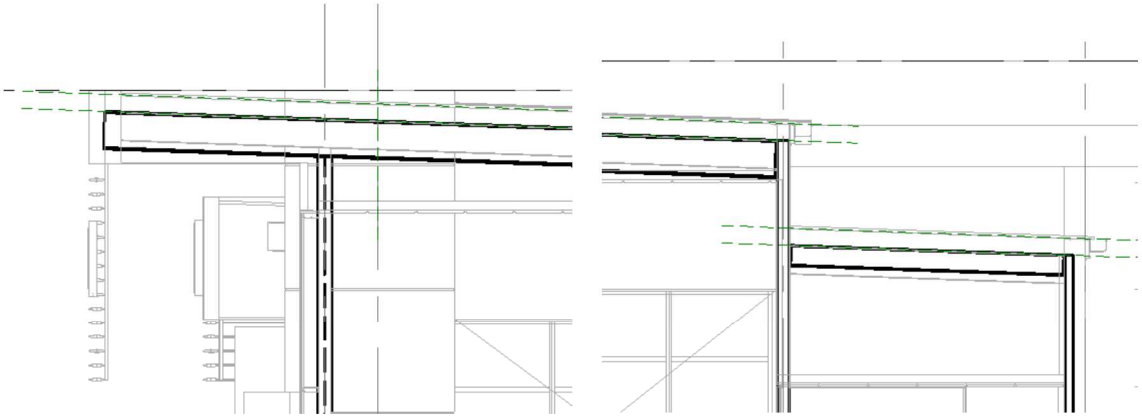
Now create a series of '*Reference Planes*', one in line with the top of the main rafters and one in line with the top of the purlins.



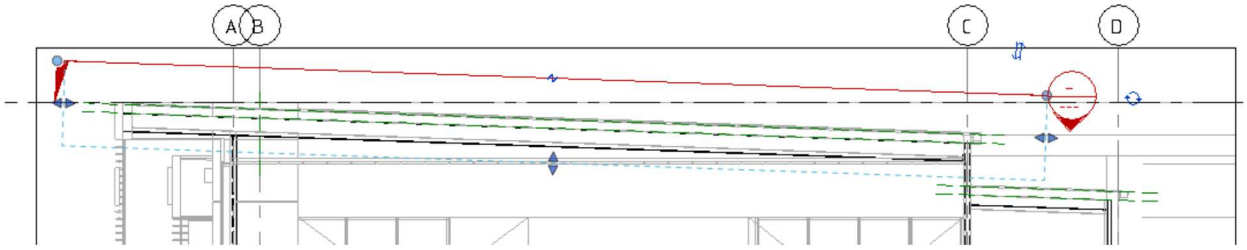
Ensure the newly created reference planes are named appropriately, ie '*Showroom 1 Roof – Top of Purlins'* or '*Showroom 1 Roof – Top of Rafter'* etc.



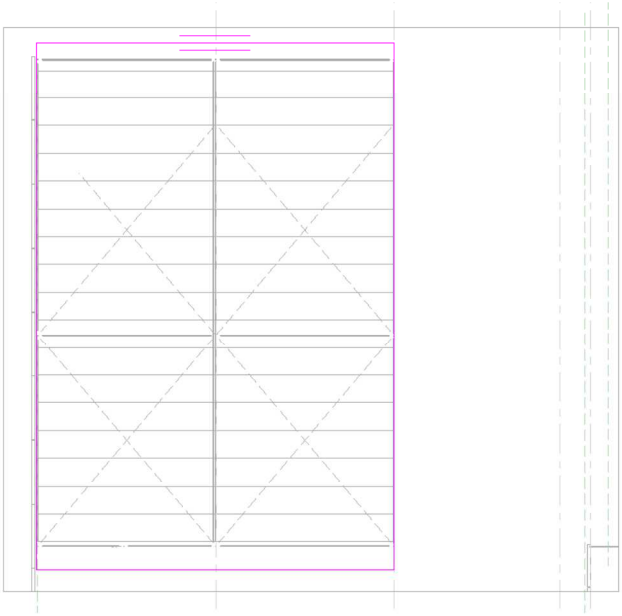
Next step is to model the main 'portal frame' members, ie rafters. As the work plane has been set to a grid/line of columns anything modelled in this view will be in the correct plane/alignment. Once the main rafters have been modelled, attached the tops of the columns to either the rafter or '*Reference Plane'*, depending on the connection condition.

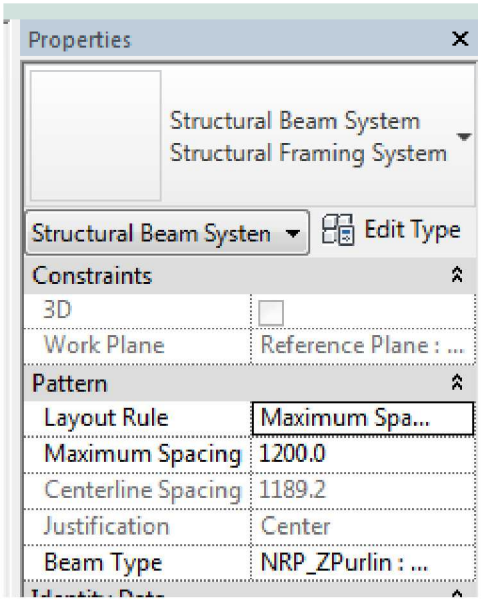


In order to model the purlins along the correct roof fall, create a section and ensure it is parallel to the '…– *Top of Purlins'* reference plane.



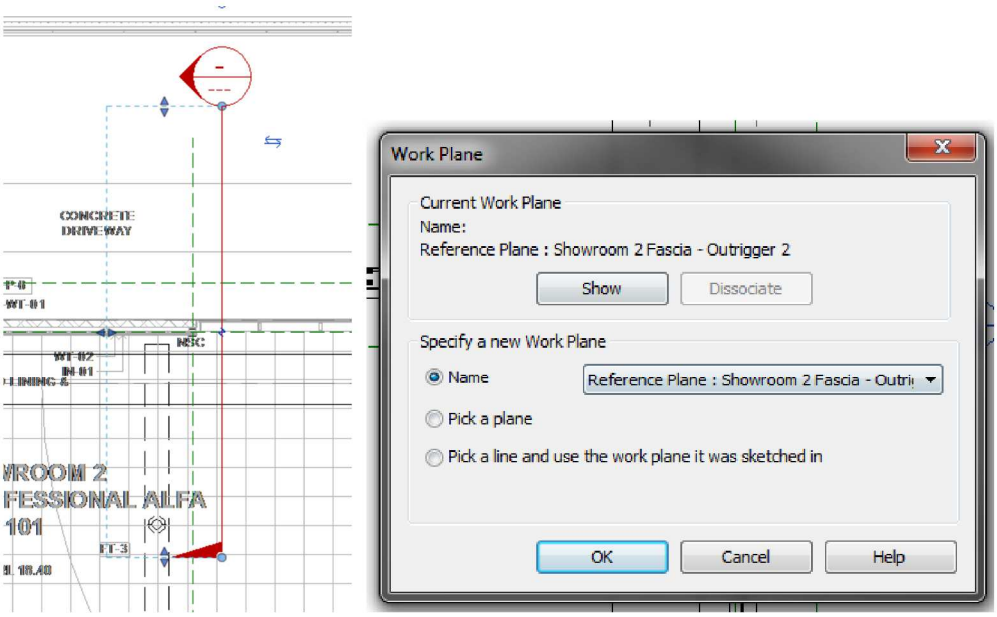
Open the section view and ensure the work plane is set to the '…– *Top of Purlins'* reference plane. Using a *'Structural Beam System'* model the purlins as required. Any necessary horizontal bracing can also be modelled in this view.





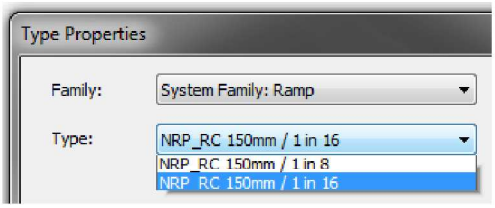
Changing the section views 'Work Plane' to '…– *Top of Rafters'* allows any struts between frames to then be modelled. However, keep in mind that whilst the struts modelled this way will be 'aligned' to this plane the resulting strut members rotation will need to be revised to suit. Alternatively, the struts can be modelled in plan view (ie, a roof plan) and then be lowered/risen to their correct levels in section views. This may depend on the requirements of the project, so consult the projects Model Manager/Lead Draftsperson if unsure.

In the case of a frame not falling on a grid line, a reference plane should be created and named appropriately (ie, '*Showroom 2 Fascia – Outrigger 2*'). Once done so, a section can be created parallel to the reference plane. Then model the framing members as previously mentioned.



4.6 Ramps:

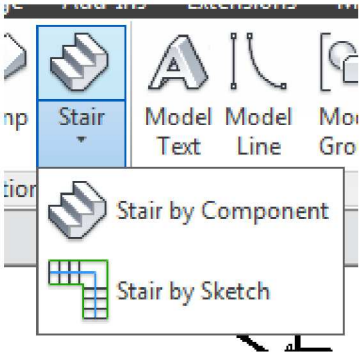
Ramps are a '*System Family'* and hence ramp families cannot be inserted through the Family Browser and must be created by duplicating and editing a type already available within the project. A number of types (RC 150mm / 1 in 8 etc.) have been created in the Structural Template and are available in your project.



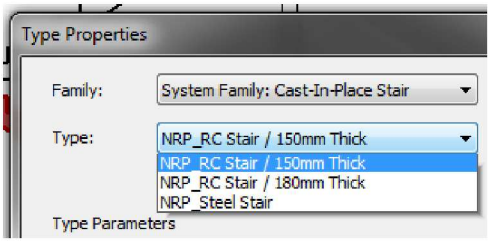
The type name convention for a Ramp is as follows; **'NRP_RC *XXX*mm / 1 in *XX*'**, where *XXX* denotes the thickness of the ramp and '*1 in XX*' denotes the ramps slope.

4.7 Stairs:

Like columns and walls, stairs should be modelled level-to-level. When modelling a new stair, 'Stair by Component' should be used in the majority of cases.

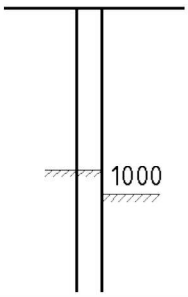
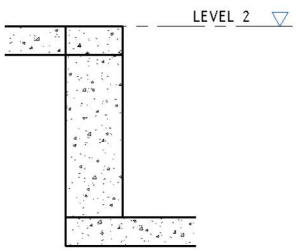
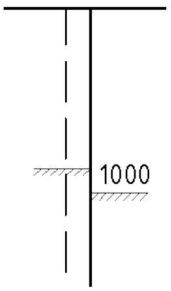
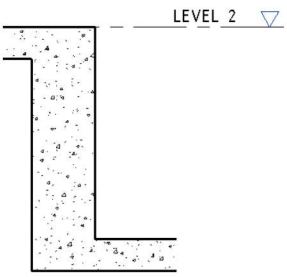


Stairs are a '*System Family'* and hence stair families cannot be inserted through the Family Browser and must be created inside of the project. A number of types (RC, Steel etc.) have been created in the Structural Template and are available in your project.



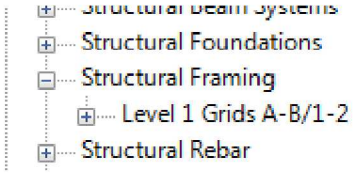
4.8 Joining of Elements:

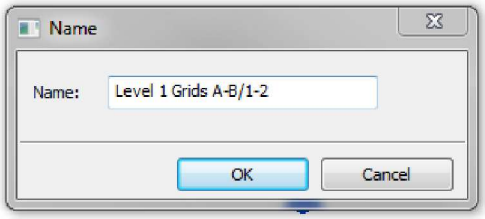
To ensure correct representation of all elements, whether that be in plan, section, elevation etc. it is important to join **all** concrete elements where necessary. Examples of representation issues that will arise if elements are not correctly joined can be seen below;

Representation of Elements when *NOT* Joined		**Representation of Elements when Joined**	
Plan	Section	Plan	Section
			

4.9 In-Place Components:

When creating an 'In-Place Component' it's important that the component name adheres to the following standard to allow for easy identification and model management. The naming convention is to be as follows; **'Level *XX* Grids *XX/XX*'**, where *'Level XX'* denotes the work plane (or reference level) of the component and '*Grids XX/XX'* denotes the grids the component resides between. Example of which is below;

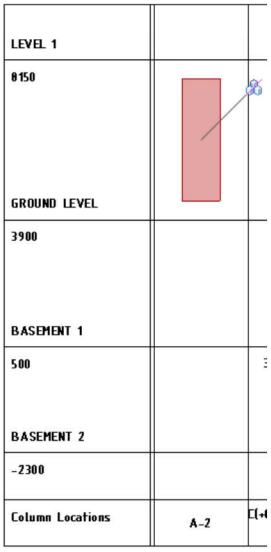




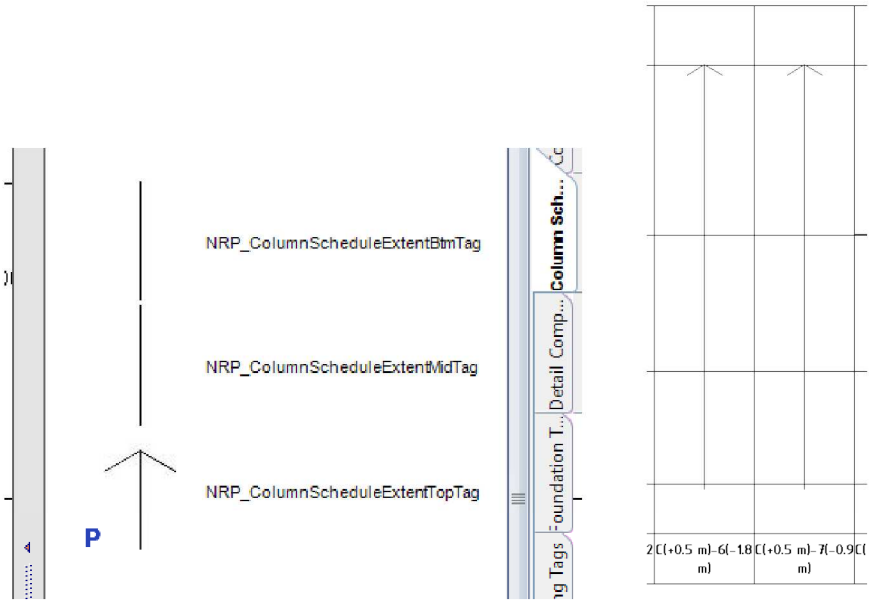
5. Creation and Manipulation of Detailing Elements

5.1 Concrete Column Schedule:

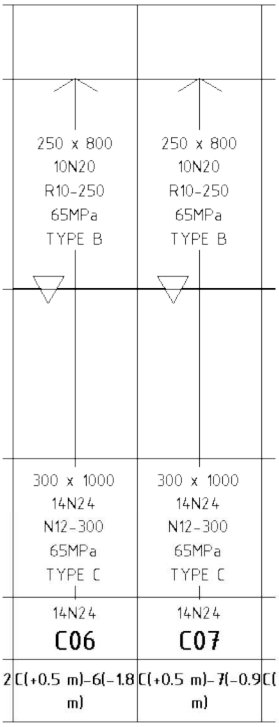
The Graphical Column Schedule should be used to represent the extent, size, concrete grade, type and reinforcement information of all concrete columns once the project enters the post-tender stage. A Graphical Column Schedule is included in the Structural Template by default and will start generating as soon as you model a concrete column.



As the schedule is a direct representation of the model we can tag each column in the schedule and each columns design information will be presented. The schedule tags are available from the Family Browser under Annotation > Column Schedule Tags. It's important to begin tagging with the '…Extent' series of tags, as per below;

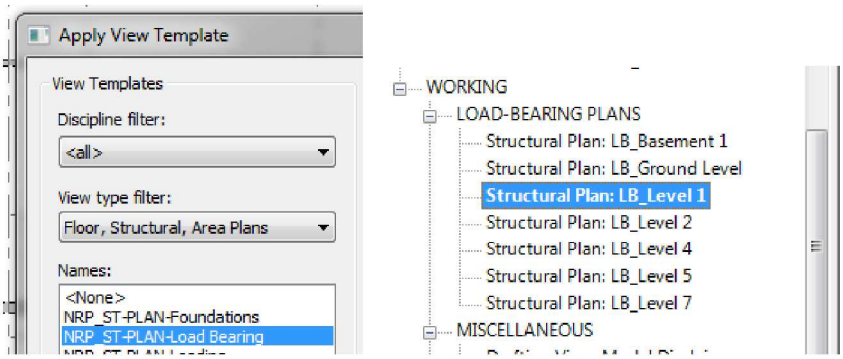


This is so that the ‘Extent’ tags remain ‘behind’ the other schedule tags. Then continue tagging the columns with the remaining tags as required until result is achieved as per below;

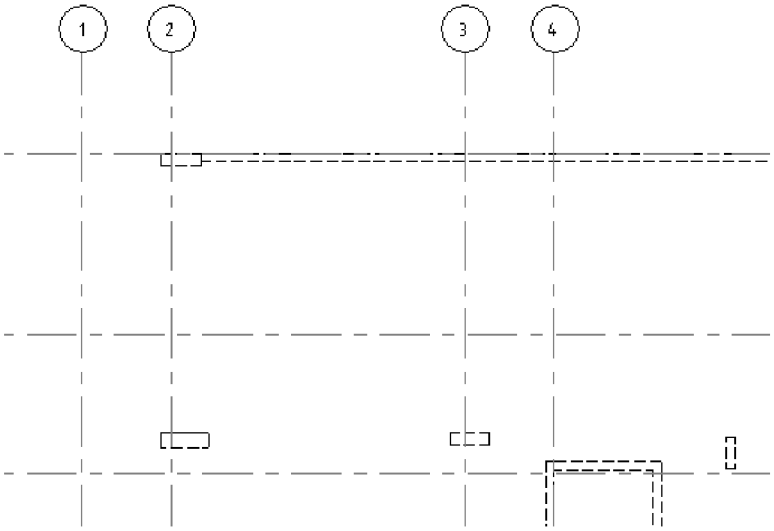


5.2 Representation of Load-Bearing Elements Under:

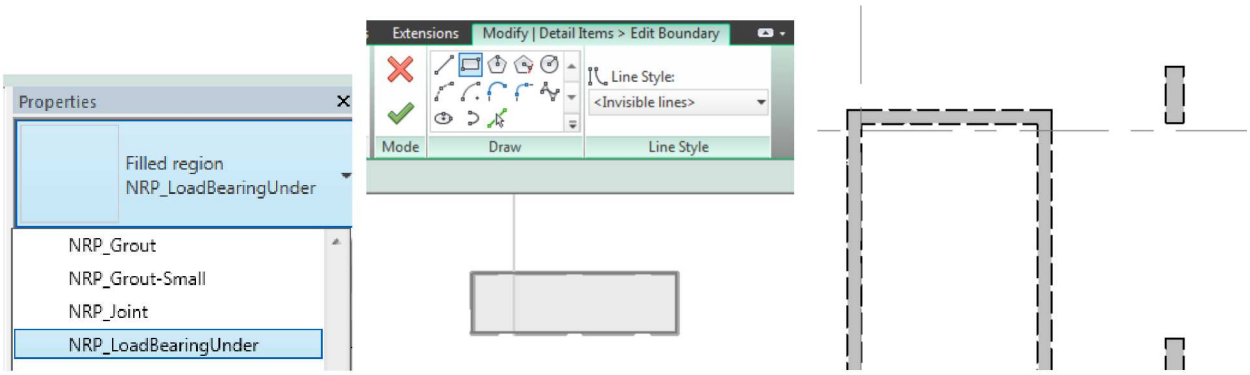
In order the identify and represent load-bearing elements under a particular level on plan, the creation of a detail group containing a filled region is required to achieve this. The first step is to duplicate a ‘Working’ view of a level, then rename this to *‘LB_Level XX’*. Then apply the ‘*NRP_ST-PLAN-LoadBearing’* view template.



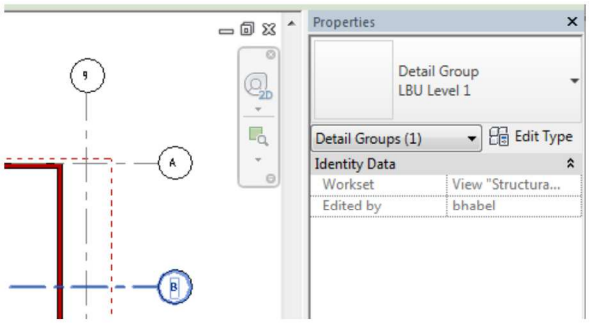
You’ll then have a plan which shows only columns and walls (ie, the load-bearing elements) under the level your view is associated to. ie, ‘*LB_Level 1’* will show the columns and walls from the Ground to the underside of Level 1.



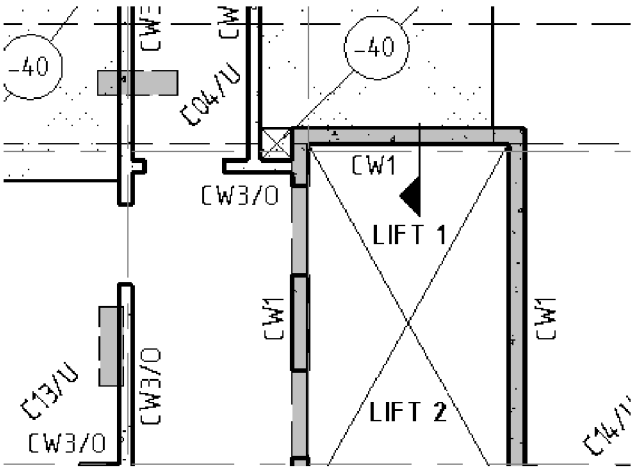
Then create a '*Filled Region'* of type *'NRP_LoadBearingUnder'* which has line style of 'invisible' and create regions which match the extents of the load-bearing columns and walls.



Once finished, select all instances of the LBU filled regions and create a 'Detail Group'. Call the resulting group 'LBU Level XX'.



From here you can simply copy the 'Detail Group' to other plan views as required, whether that be a GA, post-tensioning or reinforcement plan. As changes occurs to size, location etc. ensure the load-bearing Detail Group is updated to suit. This is easily done in the *'LB_Level XX'* plan and changes made to the model are easily visible. Changes will automatically be reflected in all views that Detail Group is contained in.



5.3 Element Type Naming Convention:

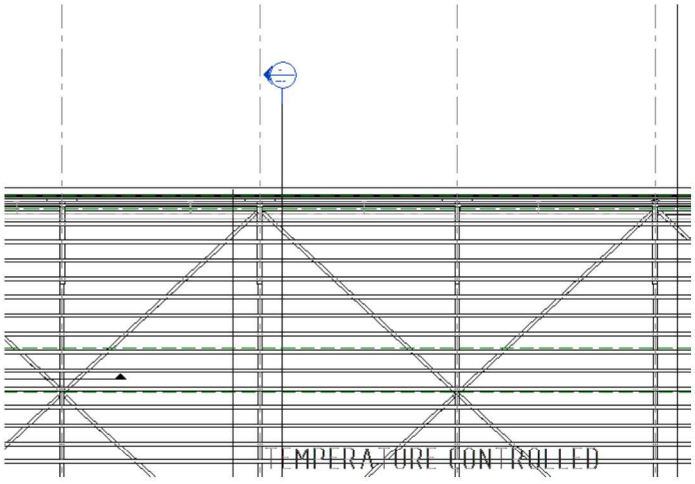
As previously touched on in *Section 4.3*, it is important an elements *'Type Name'* is to a standard convention not only for model management but also scheduling, tagging etc. and as such a naming convention for these is required to be set and followed. Generally, all elements which are required to be scheduled will need their *'Type Name'* revised and prefixed with a *'Type Mark'*.

Element	**Type Name Convention**
Columns - Concrete	**CC*XX* / 300 x 1000mm**, where *XX* denotes column type number. This number is given pre-tender and should be maintained post-tender, even after columns have been given an instance mark, ie C01 etc.
Columns - Steel	**SC*XX* / 250UB25.7**, where *XX* denotes column type number. This number should match the 'Type Mark', which appears in schedules.
Walls - Concrete	**CW*XX* / NRP_RC 200mm**, where *XX* denotes wall type number. This number should match the 'Type Mark', which appears in schedules.
Walls - Masonry	**BW*XX* / NRP_Block 190mm**, where *XX* denotes wall type number. This number should match the 'Type Mark', which appears in schedules.
Walls - Precast	**PC*XX* / NRP_Precast 200mm**, where *XX* denotes wall type number. This number should match the 'Type Mark', which appears in schedules.
Framing – Concrete	**CB*XX* / 300D x 1200W**, where *XX* denotes beam type number. Generally, concrete framing members will not need to be scheduled and hence no type mark or change to the type

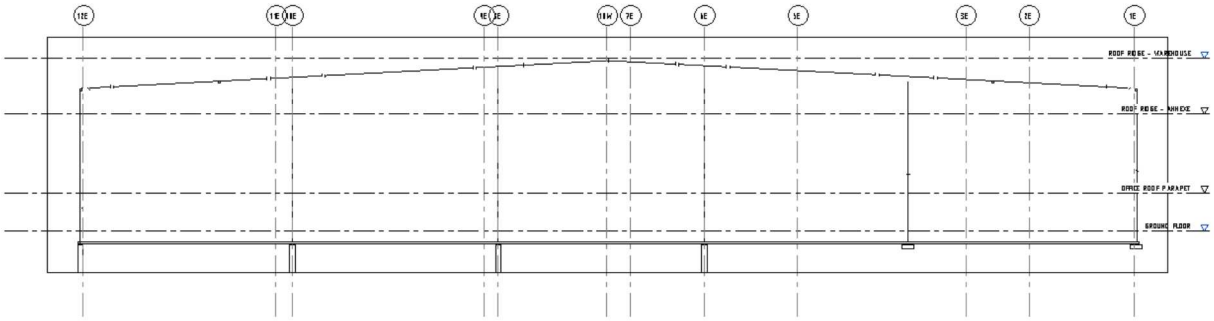
	name will be required, however in the event beams are scheduled the above convention should be used.
Framing - Steel	**SB*XX* / 250UB25.7**, where *XX* denotes framing member type number. Depending on the project requirements, '*SB*' may be substitued with 'P' if member is a purlin, 'R' if a rafter, 'S' if a strut and so on. Consult the Project Draftsperson for clarification as required.
Foundations - Isolated	**PF*XX* / 1200 x 1200 x 600D**, where *XX* denotes foundation type number. Again, '*PF*' should be substitued with 'SF' if element is a strip footing, 'P' if a pile and so on. Consult the Project Draftsperson for clarification as required.
Foundations - Walls	**RW*XX* / NRP_RC 200mm**, where *XX* denotes foundation wall type number. This number should match the 'Type Mark', which appears in schedules.

5.4 Steel Framing and Building Elevations:

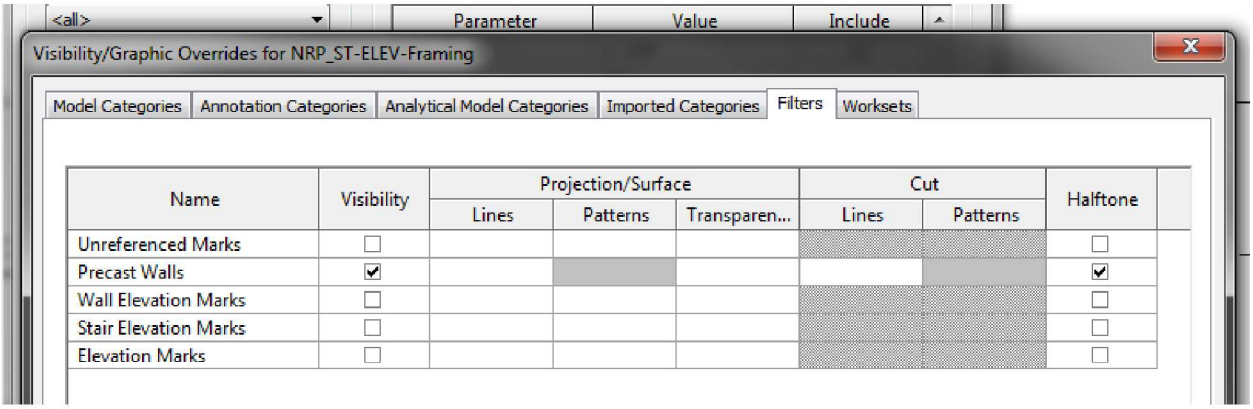
Once the steel framing has been modelled, it will need to be determined which frame(s) require their own elevation, which are similar to others etc. Once this has been decided, create a section along each required frame with a '*Far Clip Offset'* value of '*1000*' or as to suit.



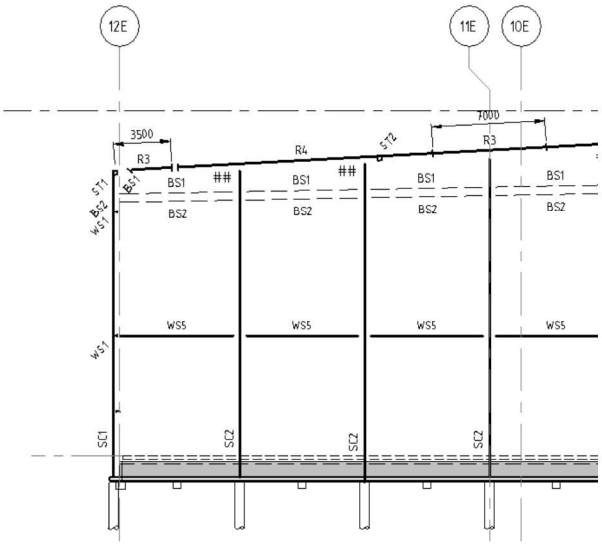
Rename the resulting views to *'EL_Warehouse Frame XX'* or similar to suit project and apply the '*NRP_ST-ELEV-Framing'* view template.



Ensure appropriate Filters have been applied to the view. It may be the case that the filters should be included as part of the *'NRP_ST-ELEV-Framing'* view template. If unsure, consult the projects Model Manager/Lead Draftsperson or BIM Manager for more information.



It's now just a matter of tagging the framing elements represented in the elevation, all of which are available from the Family Browser. Once annotated, the resulting wall elevation should look similar to that in the screenshot below;

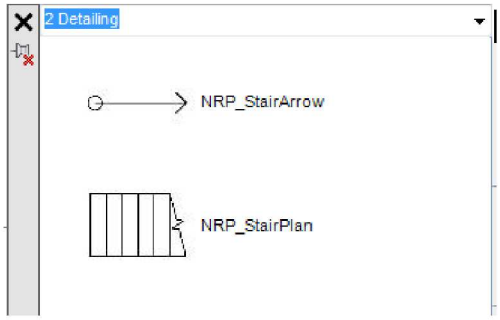


5.5 Stairs:

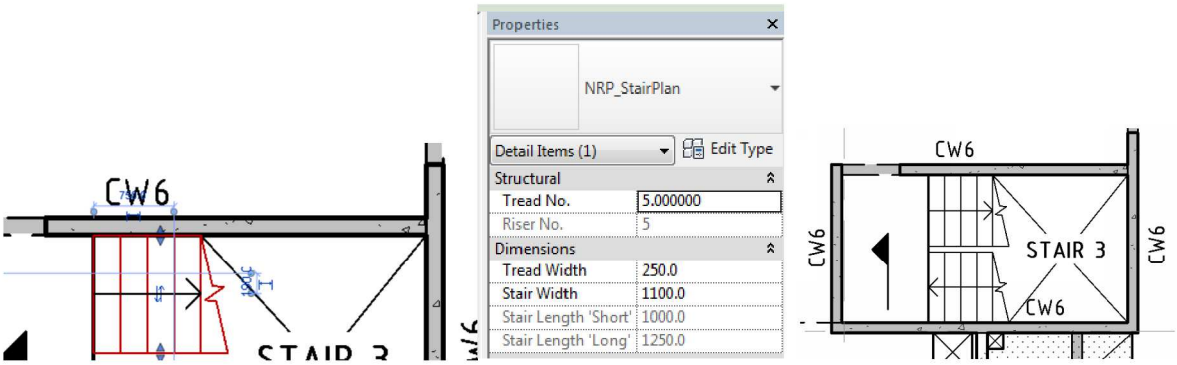
5.5.1 Stairs in Plan:

As Revit does not represent modelled stairs in plan in a way which suits the Northrop drafting standard (ie, the flight down ignores view range and the entire flight is shown with the flight up being cut correctly) the model category 'stairs' is turned off by default in the *'NRP_ST-PLAN-Profile'* view template. Modelled stairs however remain visible in the *'NRP_ST-PLAN-Working'* view.

Therefore, in order to represent stairs on a profile plan a series of detail components are used. These are available from the Family Browser, Detailing>Stairs.

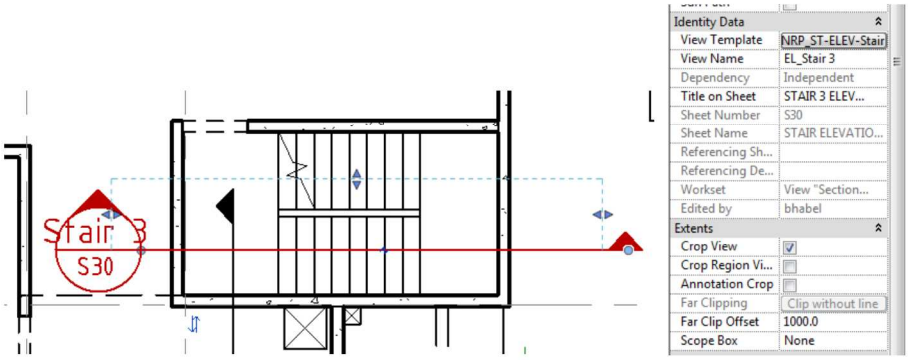


Insert both the *'NRP_StairArrow'* and the '*NRP_StairPlan'*, position and adjust to suit. Use detail lines to indicate the stair void extent.

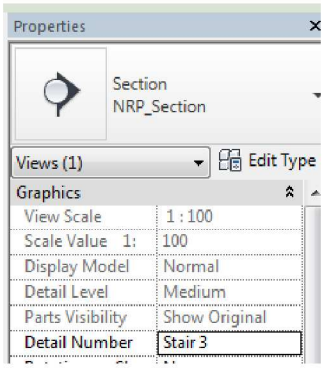


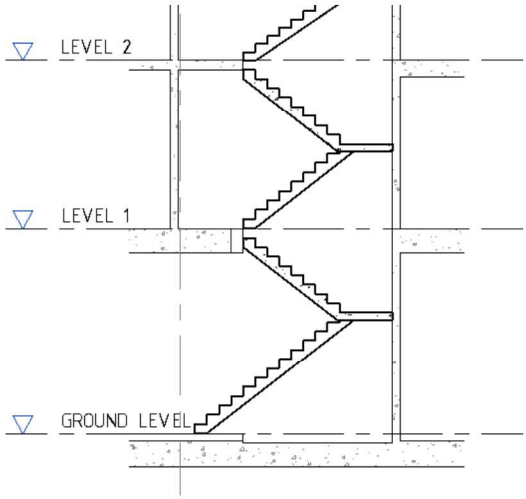
5.5.2 Stair Elevations:

Once the stairs are modelled, create a section through the stair flight with a '*Far Clip Offset'* value of '*1000*' or as to suit (see below screenshot). Rename the resulting view to *'EL_Stair XX'* and apply the *'NRP_ST-ELEV-Stair'* view template.



The section 'Detail Number' should also be named as *'Stair XX'*. This is important as Filters have been added to a number of View Templates which rely on the stair section 'Detail Number' being named as such. The resulting stair elevation should look similar to the example below;



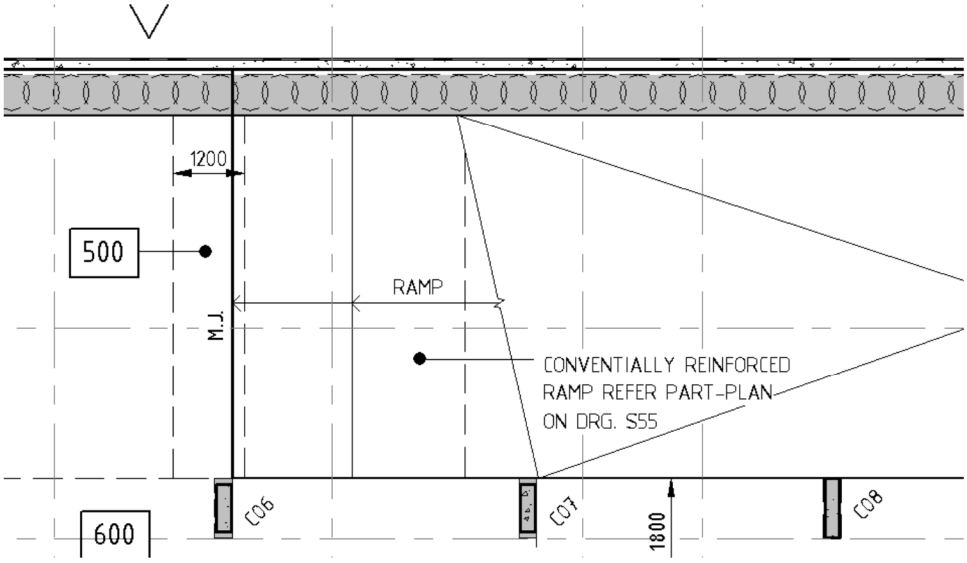


Next step, if the project requires it, is to tag the individual stair flights and landings. These tags are available from the Family Browser.

5.6 Ramps:

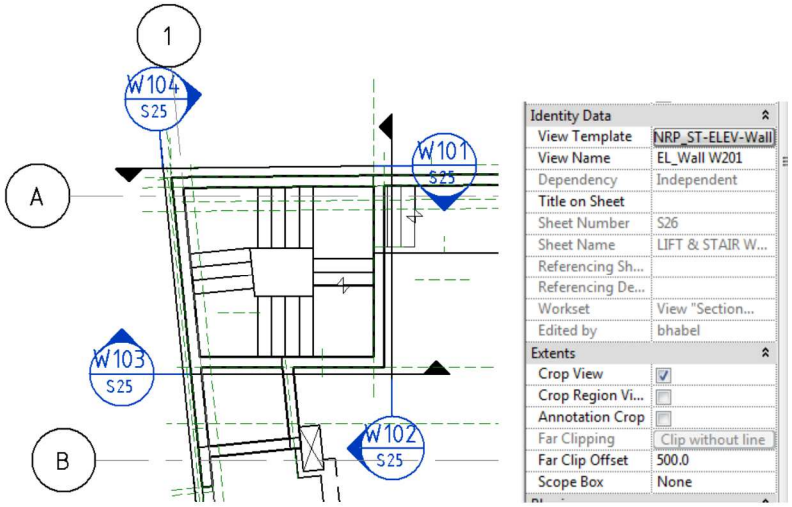
Ramps, like stairs, do not represent in plan in a way which suits the Northrop drafting standard (ie, the ramp ignores view range and the entire ramp is shown) and therefore the model category 'Ramps' is turned off by default in the *'NRP_ST-PLAN-Profile'* view template. Modelled ramps however remain visible in the 'NRP_ST-PLAN-Working' view.

Therefore, in order to represent ramps on a profile plan detail lines should be used. See below example;

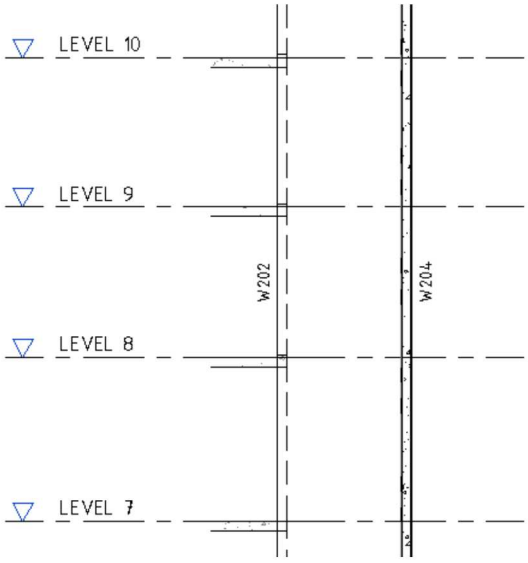


5.7 Wall Elevations:

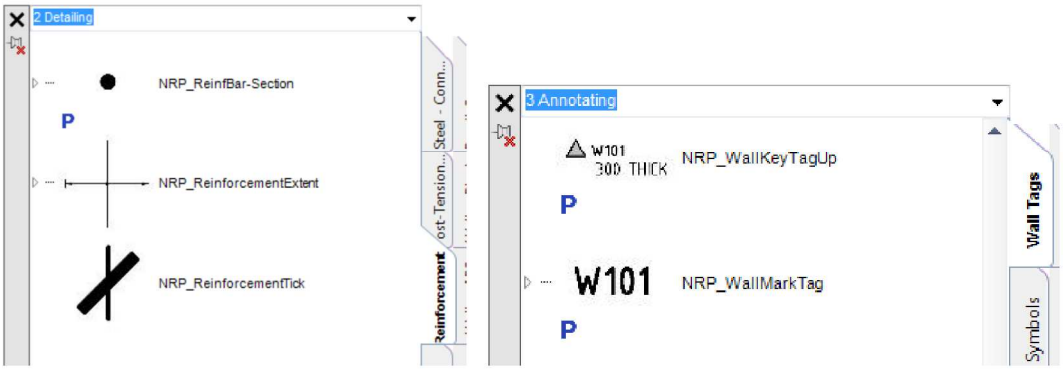
Once the core walls have been modelled, create a section along each wall face with a '*Far Clip Offset'* value of '*500*' or as to suit (see below screenshot). Rename the resulting views to 'EL_Wall W*XXX*' and apply the *'NRP_ST-ELEV-Wall'* view template.



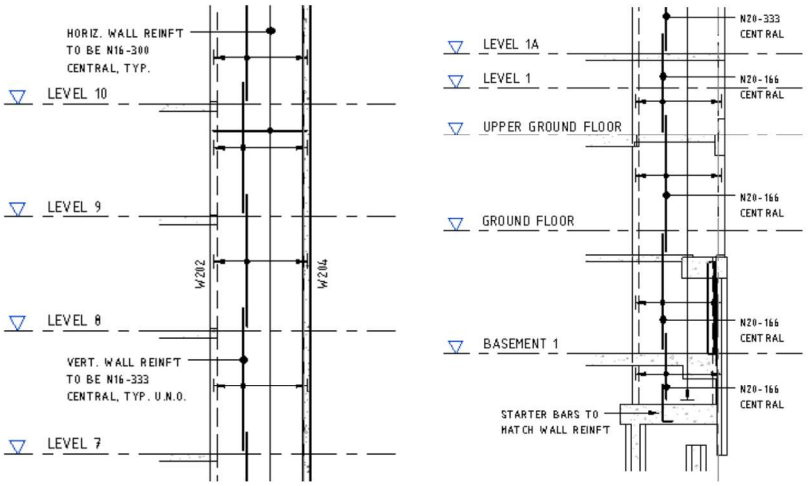
The section 'Detail Number' should also be named as 'W*XXX*'. This is important as Filters have been added to a number of View Templates which rely on the walls 'Detail Number' being named as such. The resulting wall elevation should look similar to the example below;



Next step is to add the reinforcement and other annotation, these families are available from the Family Browser; Annotating>Wall Tags>NRP_WallMarkTag, Detailing>Reinforcement>NRP_ReinforcementExtent etc.



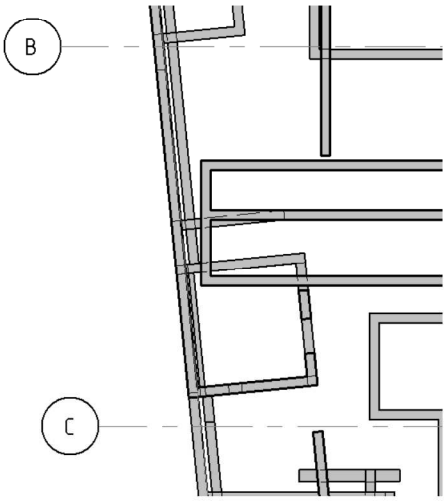
The resulting wall elevation should look similar to that in the screenshots below;



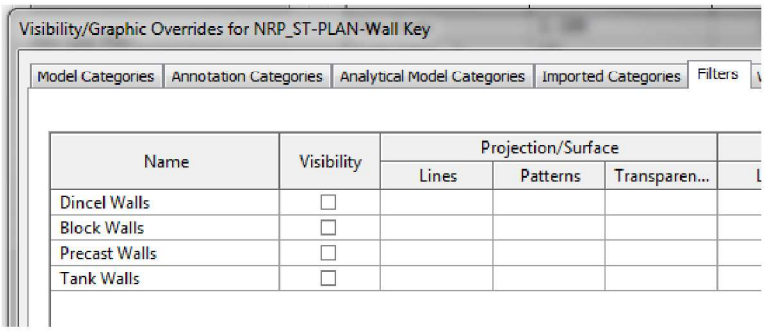
5.8 Key Plans:

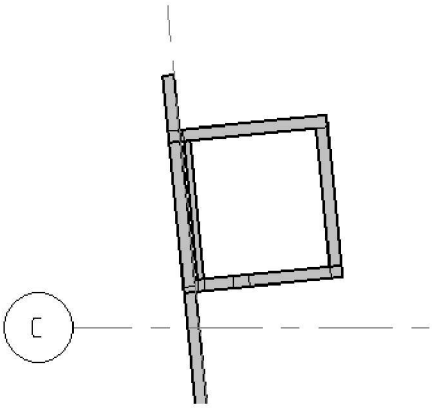
5.8.1 Core Walls:

If a project has multiple cores, whether they be for lift and/or stairs, a core key plan will help identify the location of the core(s) when documenting the wall elevations. In order to create the view, duplicate a view whose 'associated level' is the 'top' level in the project, most likely a 'roof' level. Apply the *'NRP_ST-PLAN-Wall Key'* view template.

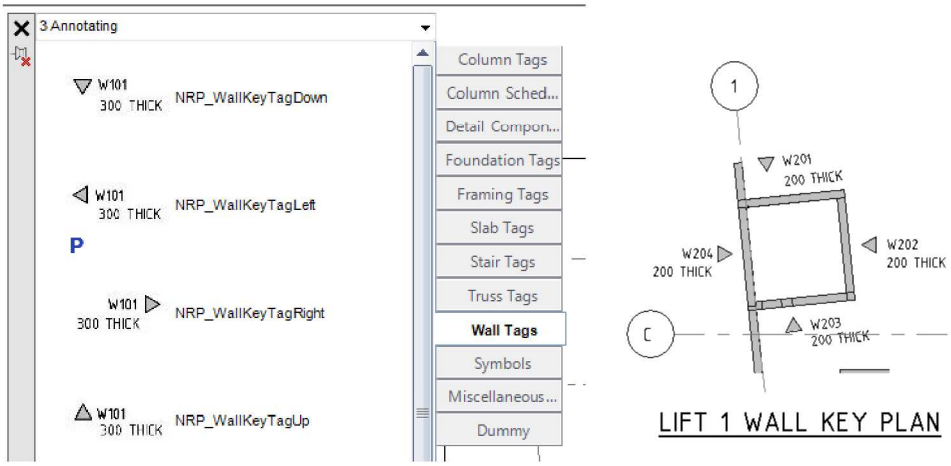


Depending on the project, filters may need to be applied to the generated key plan view in order to only show the core walls.





Adjust the crop region to suit. Now, it's just a matter of adding the tags and placing the view in the top right (ideally) of each wall elevation sheet. These are available from Family Browser under Annotating>Wall Tags.



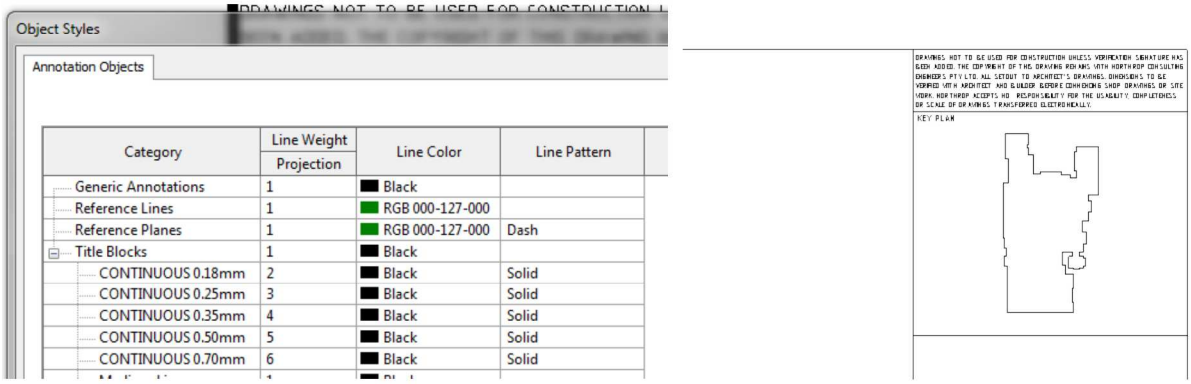
5.8.2 Building:

If a project's footprint requires that plans need to be split across multiple sheets, a key plan should be added to the project title sheet to aid in indicating the extent a particular plan covers.

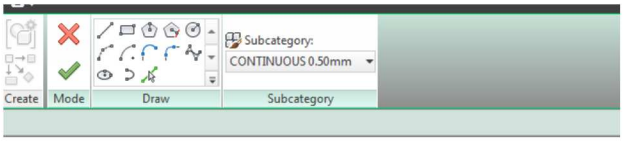
Open the project's sheet and decide on a location for the key plan, ideally it should be located in the bounds of the sheet however this may not always be possible (consult the Project Draftsperson/Model Manager if unsure).

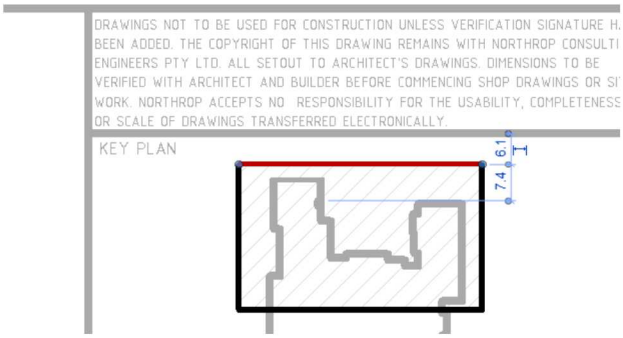
Once the location has been decided upon, the extents of the building needs to be indicated. The easiest way to achieve this is to;

- Insert a DWG file which shows the extent (an architectural plan is perfect for this).
- Scale to the desired size.
- Using one of the pre-defined title block line types (ideally '*CONTINUOUS 0.70mm'*), sketch the extent of the building. If a new line style is required, be sure it's named correctly, ie *'CONTINUOUS 0.*50mm' and the line weight, colour and pattern suits.

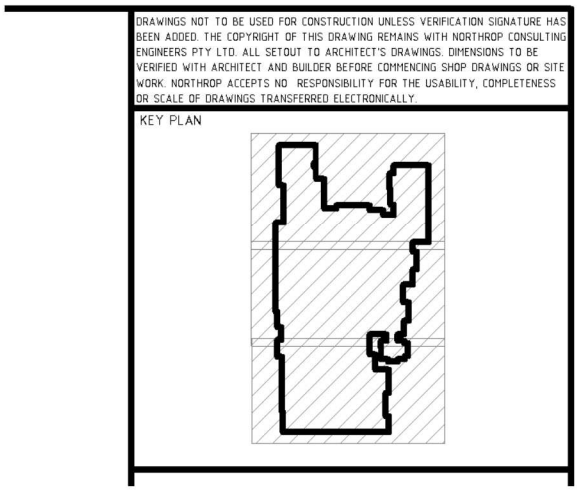


Next step is to create a series of filled regions which match the extents of each of the sheets. When creating the filled regions, the 'Key Plan' filled region type and a boundary subcategory of '*CONTINUOUS 0.50mm'* should be used.



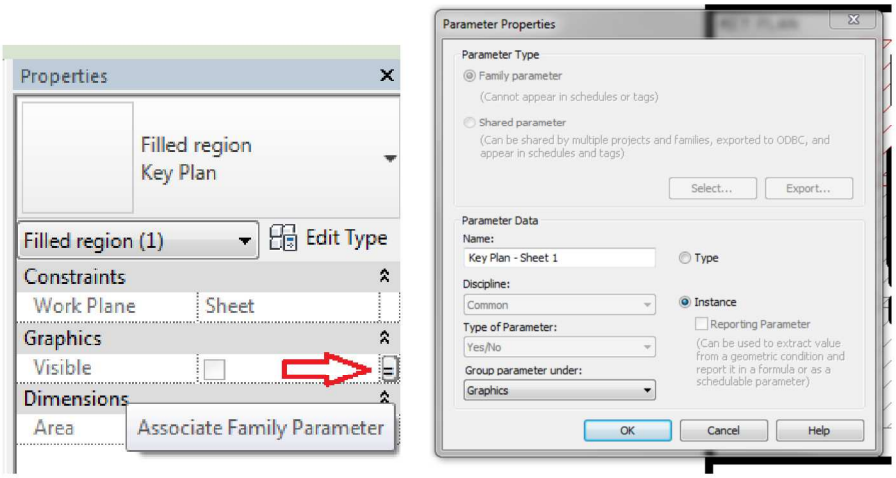


Repeat this for each sheet split.

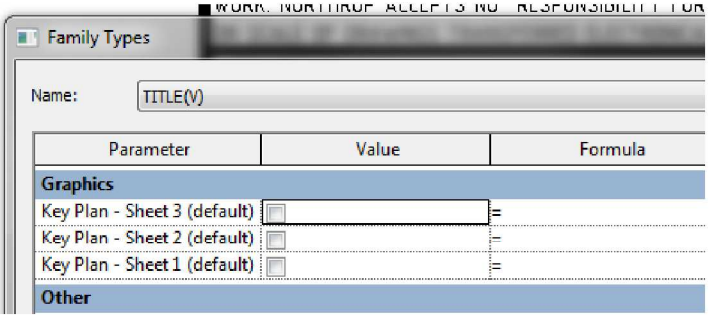


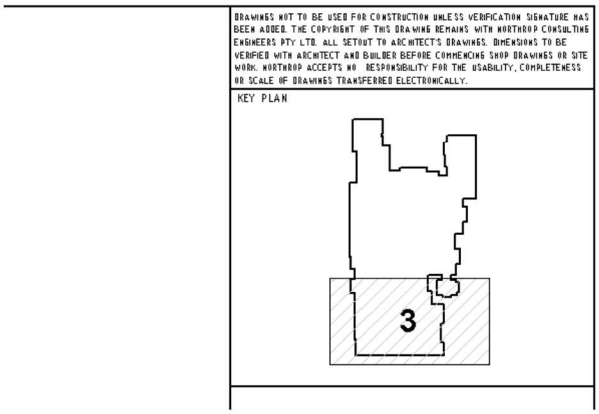
As different drawings in the project will require different filled regions to indicate their particular extent (or show no extent at all in the case of drawings containing only details etc.), visibilty control parameters will need to be created and associated to each of the filled regions. To do this;

- Select one of the filled regions and click the small '*Associate Family Parameter'* button.
- Add a parameter.
- Name it 'Key Plan – Sheet 1' (Sheet can be changed to Zone etc. depending on the project).
- Ensure it's an *'Instance'* parameter and it's grouped under *'Graphics'.*



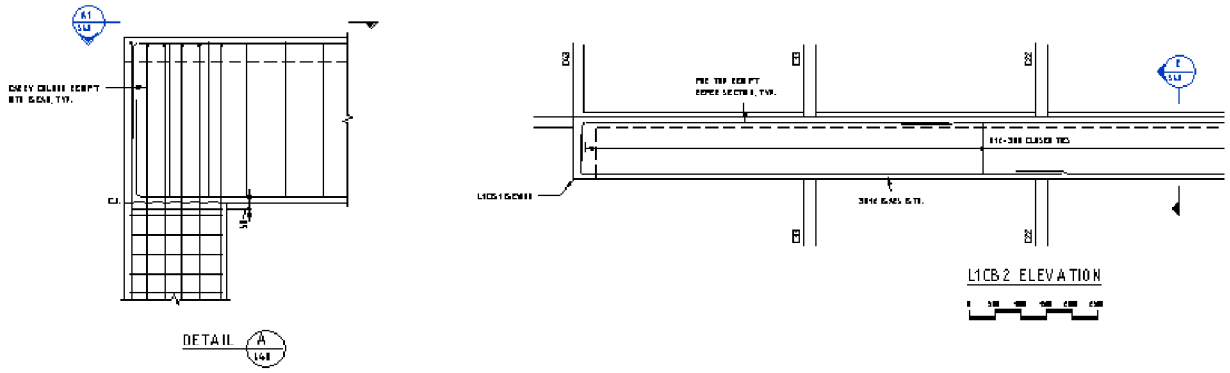
Repeat this process for the remaining Filled Regions. By default each of the Filled Regions should be 'off' this is so when a sheet is inserted no area is defined and the user can select which one applies. Control this through the '*Family Types'* dialog.



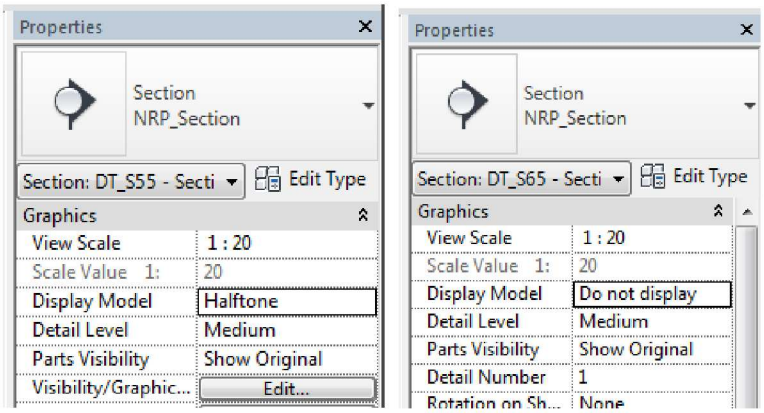


5.9 2D Detailing:

When producing 2D-only details (non 'live' sections, details or elevations. ie, those which require detail lines, components etc. to be used to generate the required detail such as reinforcement etc.) there are two ways to achieve this depending on user preference. The first of which is to simply create a 'Drafting View' and generate the detail through the use of detail items and components;

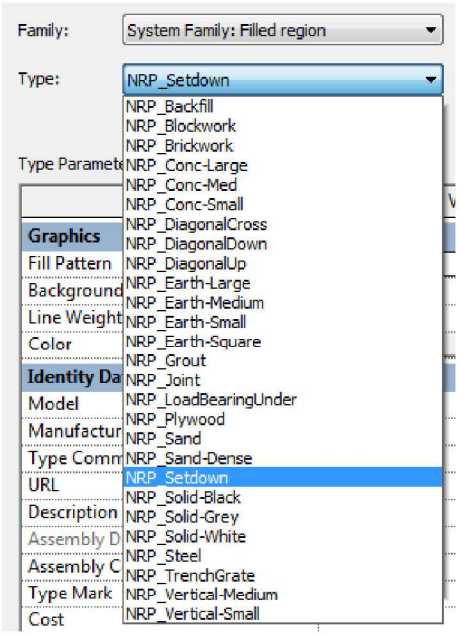


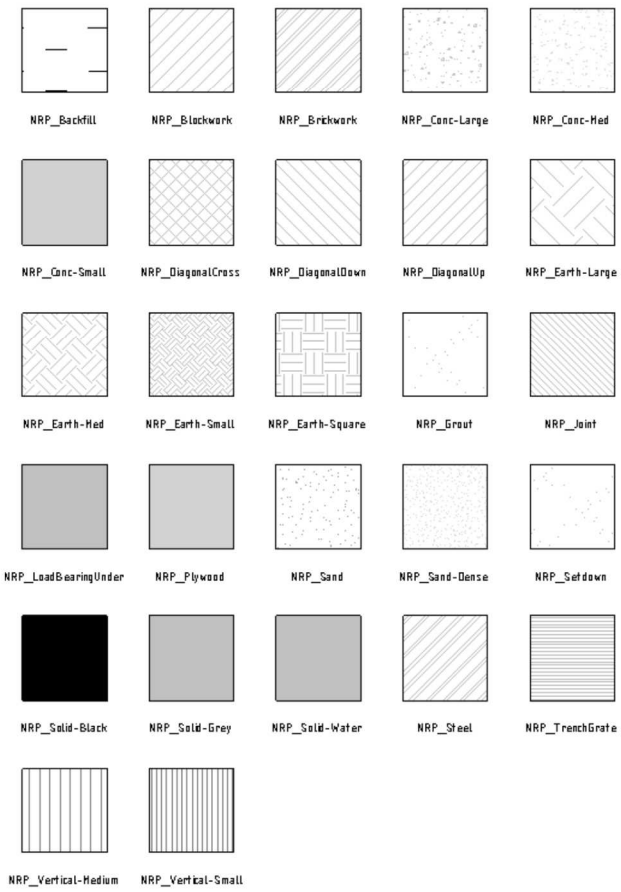
The second method is to cut a 'live' section and set the views '*Display Model'* parameter to '*Halftone*'. This will provide a 'backdrop' and aid in the creation of the section by providing depths, extents etc. to snap to as the model will be able to be seen in the view. Once the 2D detail is created and detail lines, components etc. have been added, it's then simply a matter of changing the *'Display Model'* parameter to '*Do Not Display'* and the model will no longer be seen in the view. If changes occur to the model, ie beam depths change, then the views '*Display Model'* can be reverted to '*Halftone*' and the detail elements revised to suit.



5.10 Filled Regions and Uses:

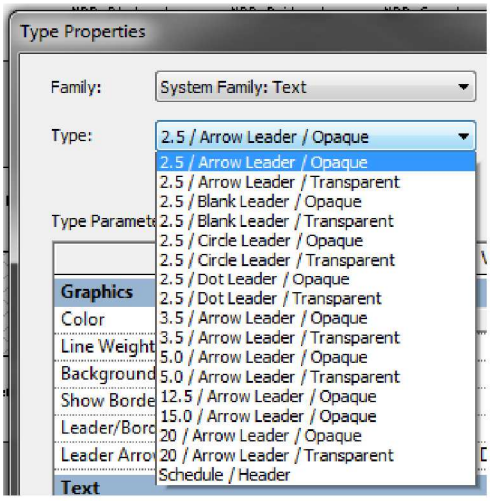
A number of Northrop standard Filled Regions are included in the Structural Template for use. If additional filled regions are required on a project please consult the BIM Manager for the inclusion/creation of these. It should be noted all Filled Regions are transparent.





5.11 Text Styles

A number of Northrop standard Text Styles are included in the Structural Template for use.



If additional text styles are required they must adhere to the standard naming convention which is as follows;

Text Height / Leader Type / Transparent or Opaque / Other

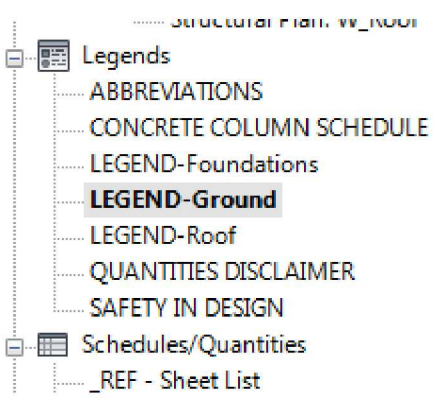
Examples of which are;

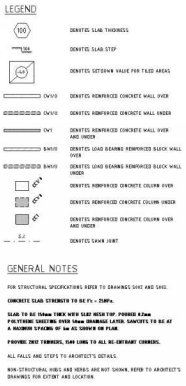
2.5 / Arrow Leader / Opaque / Border	NORTHROP
3.5 / Arrow Leader / Transparent	NORTHROP

Note that all of the standard Northrop Text Styles are based on the '*ISCOEUR*' font.

5.12 General Sheet Notes and Legends

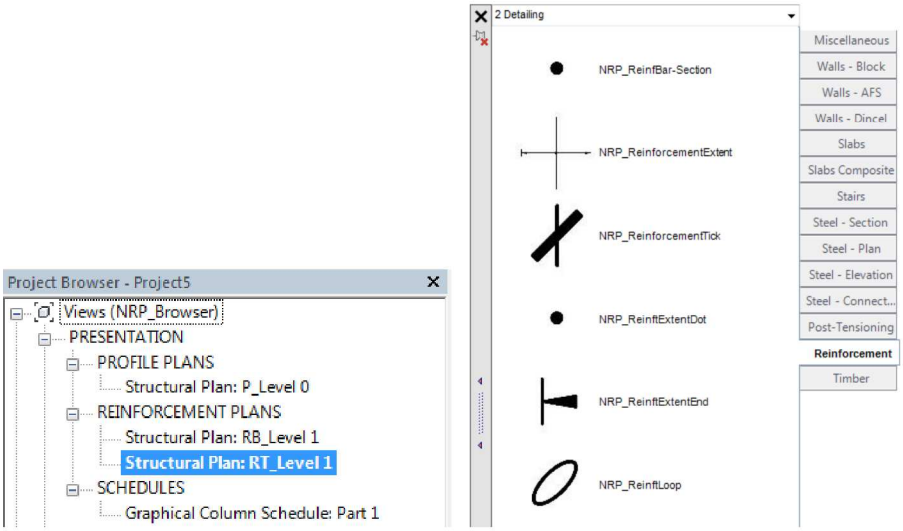
A number of General Sheet Notes and Legends are available in the Structural Template, and hence your project by default, and should be used as a base and modified to suit each particular project but only in terms of content.



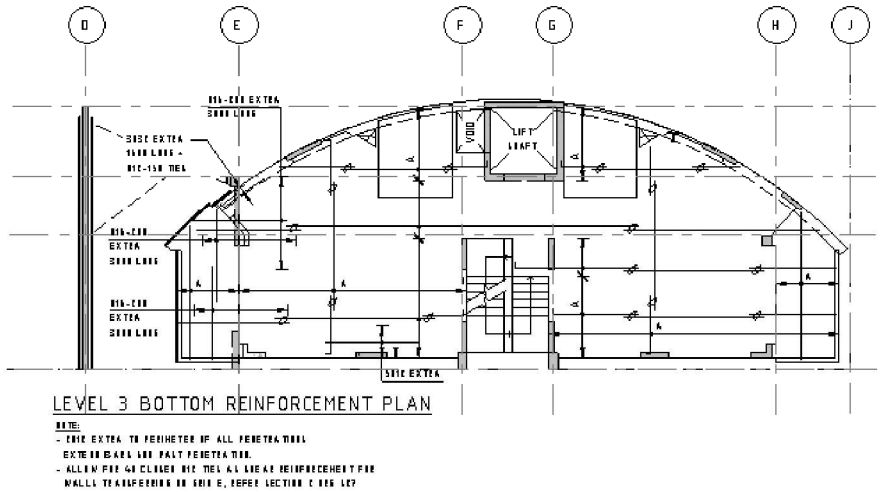


5.13 Reinforcement in Plan:

If a project requires reinforcement plans to be generated, whether they be post-tensioning or traditional reinforcement, a series of plan views will need to be created. First step is to duplicate an existing plan view and then apply the '*NRP_ST-PLAN-Reinforcement'* view template. Rename the view as per the convention mentioned in '*3.8.1 Presentation Views'*.

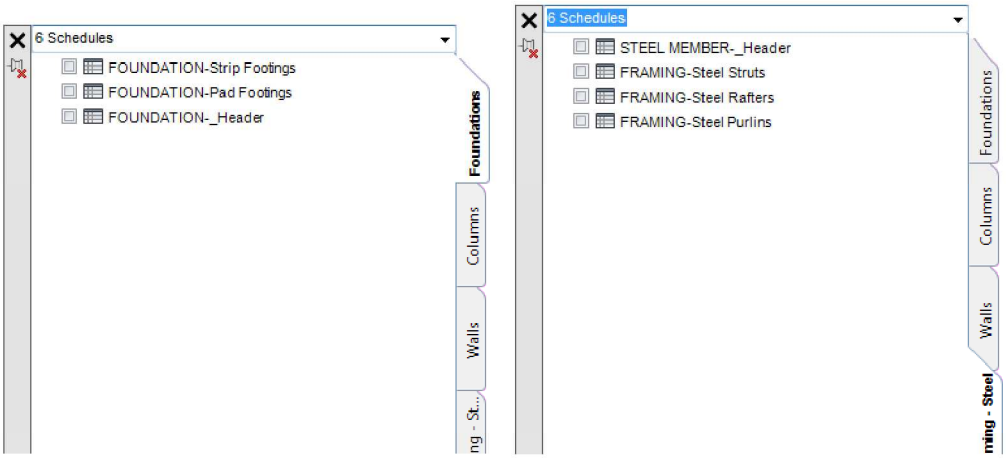


Then through the use of the detail components available from Detailing>Reinforcement in the Family Browser and the use of detail lines the reinforcement can be detailed in plan. An example of which is below;



5.14 Scheduling:

A number of standard schedules are available from the Family Browsers under the 'Schedules' group.



In order to achieve a schedule which adheres to the Northrop documentation standard, a number of steps are required to put together the schedule. First of which is to select and import the schedules you require, both the 'body' schedules (ie, '*FOUNDATION-Pad Footings'*) and the corresponding 'header' (ie, *'FOUNDATION-_Header'*).

FOUNDATION SCHEDULE		
MARK	SIZE	COMMENT(S)

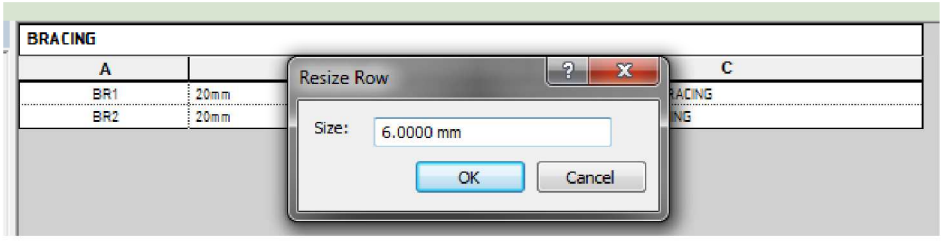
PAD FOOTINGS		
PF1	2500 x 2500 x 1000 DEEP	
PF2	2400 x 2200 x 1000 DEEP	
PF3	2400 x 2400 x 1000 DEEP	
PF4	2500 x 2500 x 1000 DEEP	
PF5	3900 x 2200 x 1000 DEEP	
PF6	4900 x 2200 x 1000 DEEP	

Once the schedules have been brought into the project, they should start populating. Note that the schedules employ Filters to distinguish between elements, ie the '*Pad Footings'* schedules filters by '*Type Mark'* beginning with 'PF'. So it's important that the type marks are consistent adhere to the standard Northrop naming convention.

From here the schedules will need to be positioned, 'put together' and then grouped. The advantage of the schedules being grouped is that if additional members are added to the project (and hence the schedule) the group can be edited, the schedules repositioned and then the schedules will update on all sheets the appear rather than having to revise the schedules per-sheet.

FOUNDATION SCHEDULE		
MARK	SIZE	COMMENT(S)
PAD FOOTINGS		
PF1	2500 x 2500 x 1000 DEEP	
PF2	2400 x 2200 x 1000 DEEP	
PF3	2400 x 2400 x 1000 DEEP	
PF4	2500 x 2500 x 1000 DEEP	
PF5	3900 x 2200 x 1000 DEEP	
PF6	4900 x 2200 x 1000 DEEP	
STRIP FOOTINGS		
SF1	800 WIDE x 600 DEEP	

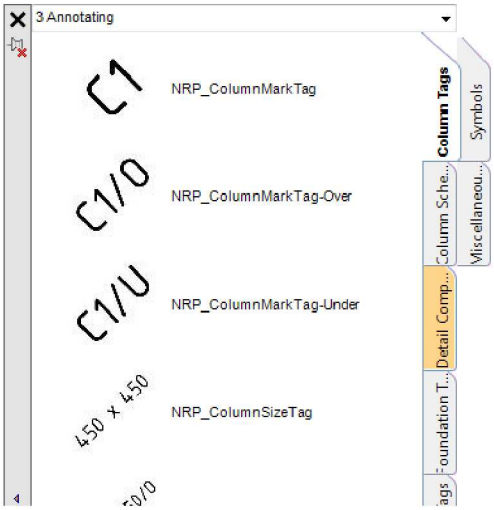
If additional schedules are required, which aren't available from the Family Browser, these should be created ensuring they adhere to the naming convention standard of those already available. It should also be noted that the 'body' schedules header cell height should be set to 6mm, with the texts horizontal alignment set to 'left'. Similarly, the 'header' schedules header cell height should be set to 10mm.



6. Annotation

6.1 Tagging of Elements:

All tags are available from the Family Browser under 'Annotating' and for convienience a number of the most used tags have been pre-loaded into the template. If a project requires a custom tag please consult the projects Model Manager/Lead Draftsperson or BIM Manager.



7. Drawing Sheets

7.1 Creation of Project-Specific Sheets:

Once the decision has been made which sheet size and title block orientation shall be used on a project, open the corresponding standard Northrop sheet all of which are available here;

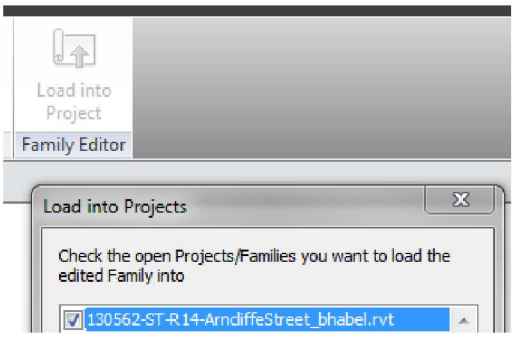
X:\REVIT\REVIT STRUCTURE\2014\Titleblocks\Horizontal (or Vertical)

Next step is to save that sheet in the project's Revit standards folder, which is located here;

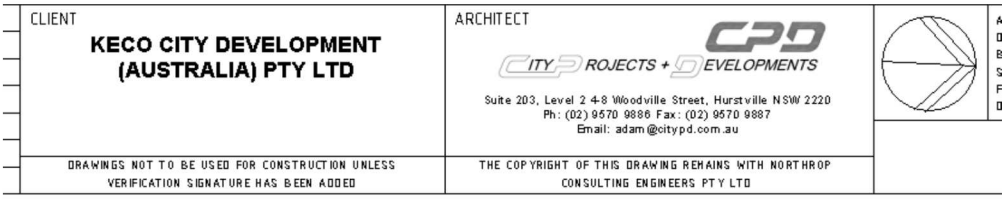
O:\20xx jobs\ProjectName\C-Drawings\D-Northrop\G-STRUCTURAL\6-REVIT MODELS\C-STANDARDS

And name it as follows; *JOBNO-R14-A1Horiz.rfa*

Now that we have the project sheet created, the client, architect and project information can be added. If no logos exist or are available for any of these three groups then it's simply a matter of loading the sheet into the project and then entering the required information into the necessary fields.



If logos do exist for any/all of the client, architect and project then insert these into the sheet family, resize and position to suit.



Also rotate the North Point to match the projects North orientation. Then load the sheet into the project and enter remaining fields (project number etc.).

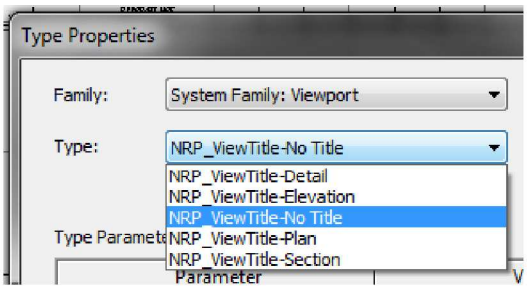
Next step is to insert the '*NRP_CoverSheetHeader'* into the project and place on the cover sheet. This available from;

X:\REVIT\REVIT STRUCTURE\2014\Titleblocks\NRP_CoverSheetHeader.rfa

Fill in the three fields for 'Project Name', 'Project Address' and 'Sheet Discipline' and centre on the sheet using the provided location line.

7.2 Placing Views on Sheets:

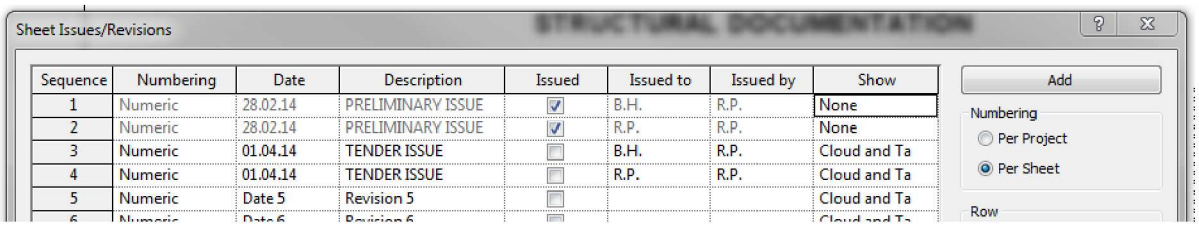
When placing views on sheets, there a five 'Viewport' types that are available, those being;



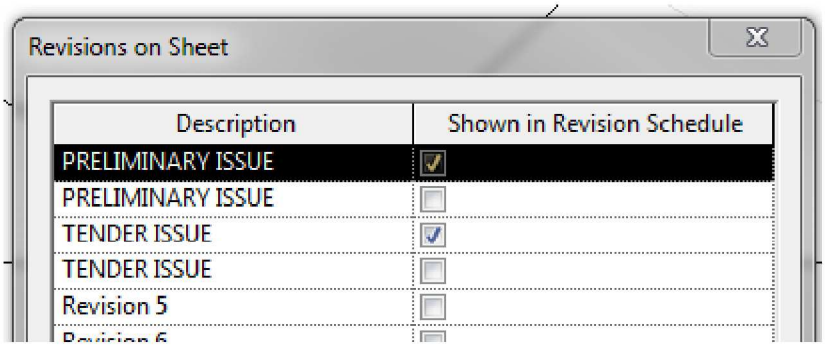
NRP_ViewTitle-Detail	Used for 'Detail' views and when placed on a sheet will include a title showing; DETAIL A S011
NRP_ViewTitle-Elevation	Used for 'Elevation' views and when placed on a sheet will include a title showing; ELEVATION A S011
NRP_ViewTitle-NoTitle	Used for 'Plan' views when that view is the only plan on the sheet. Can also be used for Notes, Legends or any other view that does not require an indentifying title.
NRP_ViewTitle-Plan	Used for 'Plan' views when there are multiple plan views on a sheet and each needs to be identified.When placed on a sheet will include a title showing the 'Title on Sheet' parameter.
NRP_ViewTitle-Section	Used for 'Section' views and when placed on a sheet will include a title showing; SECTION 1 S011

7.3 Revisioning:

Before revising a series of drawing sheets the '*Sheet Issues/Revisions'* must first be set up to suit the Northrop standard drawing sheets. The standard Northrop drawing sheets are created in a way that the '*Issued to'* and '*Issued by'* parameters relate to the 'Issued' and 'Approved' initials panels on our sheet. This should be kept in mind when populating the 'Sheet Issues/Revisions' dialog.



If multiple draftspersons are working on the same issue, and hence differing sheets will require different initials in the 'Issued' initials panel, simply create a sequence for each draftspersons initials and select the corresponding revision sequence when selecting the revision for the sheet.



REV	DESCRIPTION	ISSUED	VER'D	APP'D	DATE	CL
1	PRELIMINARY ISSUE	B.H.		R.P.	28.02.14	
2	TENDER ISSUE	R.P.		R.P.	01.04.14	

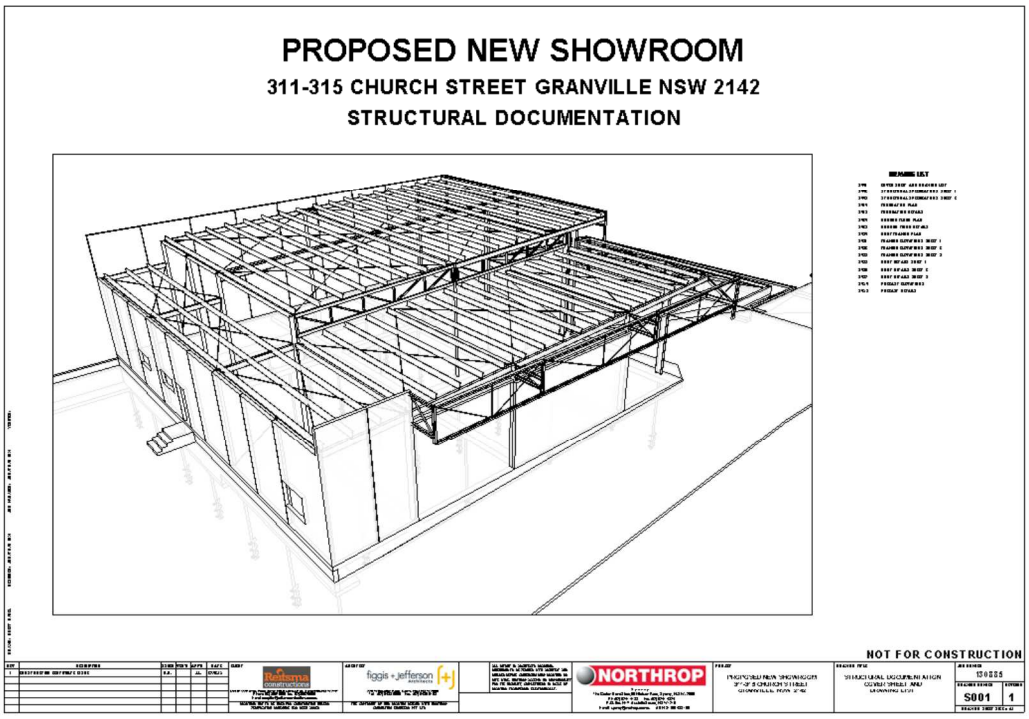
REV	DESCRIPTION	ISSUED	VER'D	APP'D	DATE	CL
1	PRELIMINARY ISSUE	B.H.		R.P.	28.02.14	
2	TENDER ISSUE	B.H.		R.P.	01.04.14	

7.4 Cover Sheet Template:

Generally, a project's cover sheet for the Structural documentation should contain the following items;

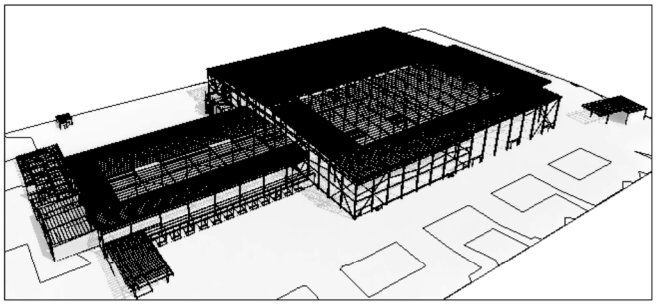
- Project name, address and discipline type ('*NRP_CoverSheetHeader'* family will generate this).
- Drawing List Schedule
- 3D View of the project
- And if quantities are to be provided, add the *'Quantities Disclaimer'* Legend and relevant Quantities Schedules.

Examples of a number of project cover sheets are shown below;



PROPOSED RAND FACILITY

PART LOT 2304, TEMPLAR ROAD, ERSKINE PARK NSW 2759



DRAWING LIST

USE OF THIS BUILDING INFORMATION MODEL (BIM)

ESTIMATED QUANTITIES AS EXTRACTED FROM THE REVIT MODEL

CONSTRUCTION

ISSUE	DESCRIPTION	DRAWN	CHKD	DATE	PROJECT
B	ISSUED FOR DEVELOPMENT	RD		04.11.2015	
A	STRUCTURAL STEEL ISSUED FOR TENDER	RD		04.11.2015	
A	STRUCTURAL NOTES ISSUED FOR TENDER	RD		04.11.2015	
C	STEEL FRAMING ISSUED	RD		04.11.2015	
B	ISSUED FOR DEVELOPMENT	RD	SA	04.11.2015	
B	ISSUED FOR DEVELOPMENT	AD	SA	03.10.15	

CIP

REIDCAMPBELL

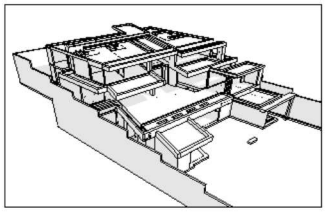
NORTHROP

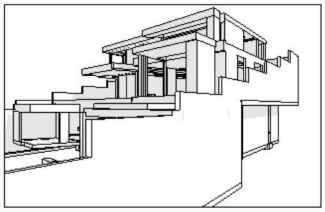
Rand

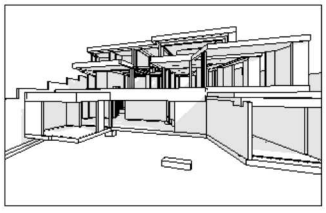
JOB NUMBER	150417
DRAWING NUMBER	S00
ISSUE	E

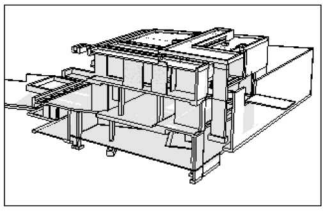
GOLD RESIDENCE

1C ARBUTUS STREET, MOSMAN NSW 2088









DRAWING LIST

S01	COVER SHEET AND DRAWING LIST
S02	STRUCTURAL NOTES SHEET 1
S03	STRUCTURAL NOTES SHEET 2
S04	TYPICAL FOUNDATION DETAILS
S06	TYPICAL COLUMN AND WALL DETAILS
S10	LOWER GROUND FLOOR PLAN
S11	LOWER GROUND FLOOR DETAILS SHEET 1
S20	UPPER GROUND FLOOR PLAN
S21	UPPER GROUND FLOOR DETAILS SHEET 1
S22	UPPER GROUND FLOOR DETAILS SHEET 2
S30	FIRST FLOOR PLAN
S31	FIRST FLOOR DETAILS SHEET 1
S32	FIRST FLOOR DETAILS SHEET 2
S40	ROOF AND UPPER ROOF PLANS
S50	UPPER GROUND FLOOR DRAINAGE SETDOWNS
S51	FIRST FLOOR DRAINAGE SETDOWNS
S100	CONSTRUCTION DETAILS SERIES

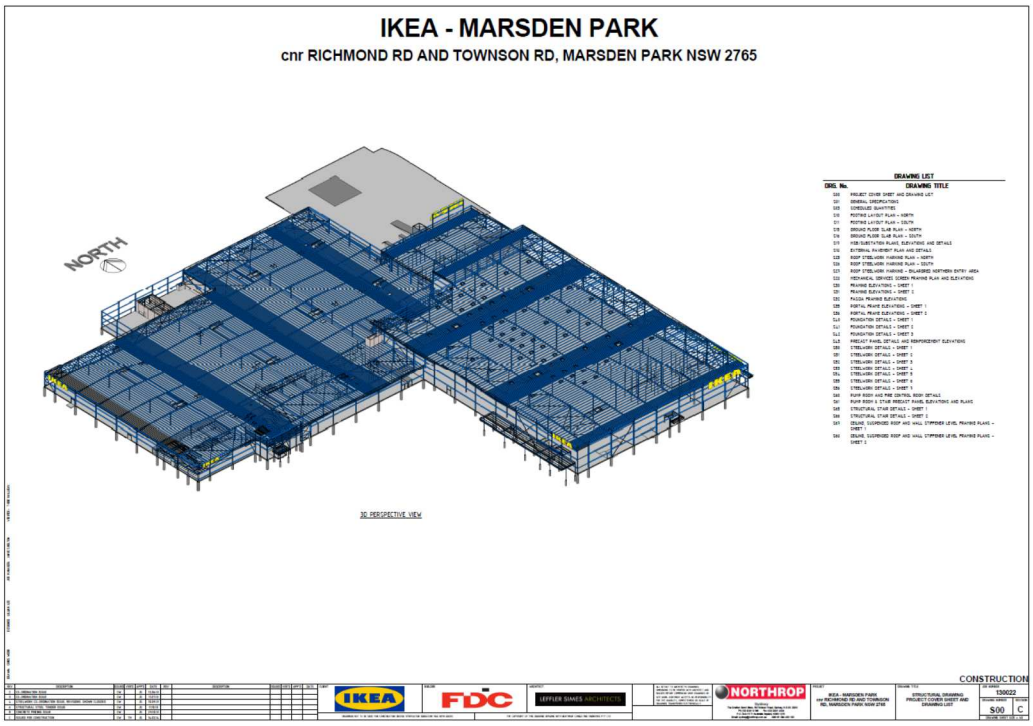
CONSTRUCTION

ISSUE	DESCRIPTION	DRAWN	CHKD	DATE	PROJECT
B	ISSUED FOR TENDER	RA		04.11.2015	
A	ISSUED FOR DEVELOPMENT	RA		04.11.2015	

TKDArchitects

NORTHROP

JOB NUMBER	120104
DRAWING NUMBER	S01
ISSUE	A



8. Collaboration

8.1 Structural/Architectural Workflow:

To be completed.

9. Best-Practice Reference Project File:

To be completed.

10. Useful Links

To be completed.

Revit Model Audit Checklist

Last Revised: 2013-11-06

This document contains the Revit Audit checklist protocols to ensure consistency is maintained across the various Northrop offices. The Revit Model Audit Checklist should be read in conjuction with the Northrop Revit Best-Practices Manual. This audit should be carried out by the project Model Manager at major milestones throughout the project.

Project Name:	
Date of Audit:	
Audit completed by:	

No	Audit	Objective Evidence	Item			Action(s) and/or Comment(s)
			Y	N	N/A	
Open up Windows Explorer to start audit						
1	Windows Explorer Organisation	Refer to *Section 3.2* of Revit Best-Practices Manual				
2	Consultant Incoming CAD files	Latest consultant Revit model(s) in '*Current*' folder				
3	Revit File Naming	Refer to *Section 3.2* of Revit Best-Practices Manual				
Open up Revit to continue audit						
4	Worksets	Are all elements on the correct Workset? Refer to *Section 3.11* of Revit Best-Practices Manual				
5	Location of Project	Are shared co-ordinates, true north and project north set up correctly?				
6	View Naming	Refer to *Section 3.8* of Revit Best-Practices Manual				
7	View Templates	Do all views have correct View Template applied and associated?				
8	Legends Naming	Refer to *Section 3.8* of Revit Best-Practices Manual				
9	Schedule Naming	Refer to *Section 3.8* of Revit Best-Practices Manual				
10	Family Naming	Do all families have a Type Mark (and Type Name Prefix if required), Mark (if tagged individually) which adheres to the standard Naming				

		convention?				
11	Walls	Are all walls modelled level-to-level and attached to associated slabs?				
12	Concrete Columns	Are all concrete columns modelled level-to-level and attached to associated slabs?				
13	Steel Framing	Are all steel framing members associated to an appropriate work/reference plane?				
14	Group Naming	Is there groups in the project, if so why? And do they adhere to Naming Conventions?				
15	Filters	Have appropriate Filters been applied to views? ie, 'Unreferenced Marks' etc. to Profile Plans.				
16	Scope Boxes	Do Profile Plans have correct Scope Box applied (if job requires)				
17	Materials	Are all elements using Northrop standard materials?				
18	Project Parameters	Is there any rogue project parameters in the file, if so why?				
19	Filled Regions	Are all Filled Region Northrop standard types?				
20	Line Styles	Are all line styles Northrop standard line styles? Refer to *Section 3.5* of Revit Best-Practices Manual				
21	Line Weights	Do the line weights match Refer to Revit line protocols if not why?				
22	Line Patterns	Is there any rogue project line patterns in the model, if so why?				
23	DWG files	Are there any DWG inserted (as opposed to Linked) into the Revit project, if so why?				
24	Phases	Are all elements phased correctly and do phases adhere to Northrop Standard?				
25	Model Lines	Is there any rogue model lines in the file, if so why?				
26	Detail Lines	Is there any rogue detail lines on any of the floor plans, if so why?				
27	Reference planes	Have all unnecessary reference planes been deleted with only 'named' planes remaining?				
28	In-Place Families	Are there any in-place families in the model, if so why? If so, are they named correctly?				

29	Dimensions Types	Does the project have any custom dimensions in it, refer to Refer to Revit naming protocols				
30	Text Styles	Does the model have any custom text styles in it, if so why?				
Print all sheets out to complete the rest of the audit						
31	Titleblocks - Drawing Location	Have the floor plan drawings been placed in a consistent spot on the title block for every level				
32	Sheets - North Point	Has the north point been turned off on all elevations, sections & details sheets				