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Structural Precast for Revit – Fast and Accurate Modeling in a Single BIM Model

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Learning Objectives

- Learn how to use Structural Precast for Revit for faster and more accurate modeling
- Learn how to achieve multidisciplinary coordination in a Revit model
- Learn how to drive fabrication of precast elements via CAM files
- Learn about other productivity and modeling precast tools for Revit

Description

Autodesk brings into play a new automated workflow for Precast Elements, turning Slabs and Walls into Assemblies via automatic Segmentation. Automatic Reinforcement, Shop Drawings and CAM files then step in to complete the design process. Respecting Designers' and Fabricators' perspectives and switching between different Levels of Development are some more key benefits of embracing a Revit based workflow. But no model is truly complete until multi-disciplinary coordination between Structure, MEP and Architecture is achieved, which is greatly enabled in this all Revit based solution. The purpose of this class is to demonstrate a BIM-connected design to fabrication workflow from Revit for a precast model, and we will also explore some other great productivity and modelling tools dedicated to Precast that are delivered by Autodesk's partners.

Speaker

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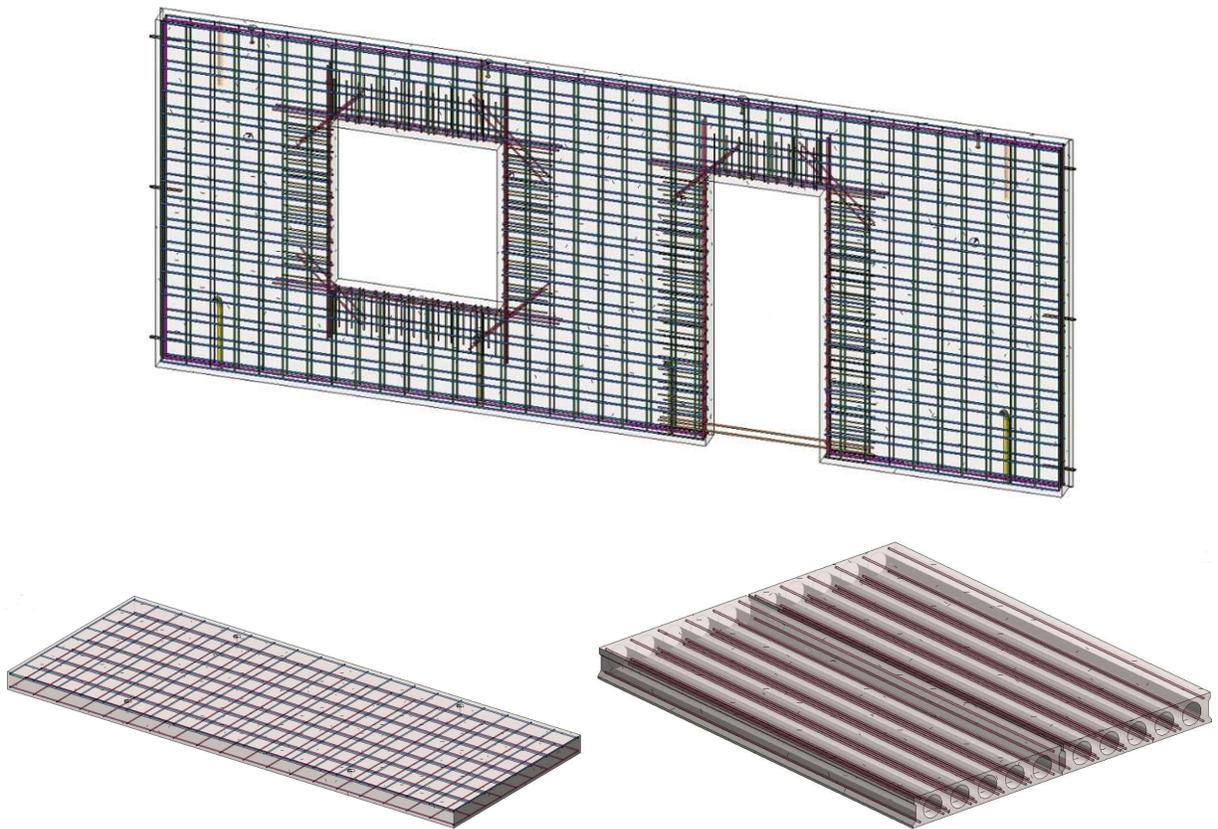
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Structural Precast for Revit – faster and more accurate modeling

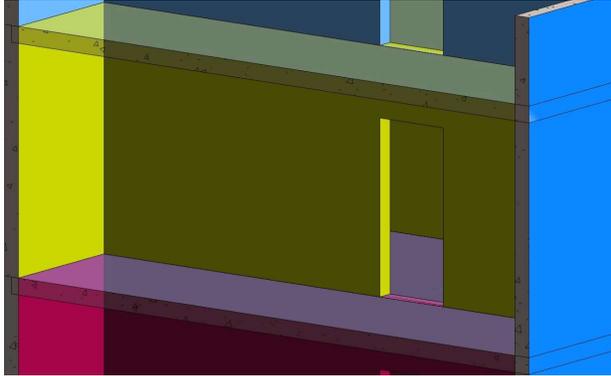
Introduction to Precast for Revit

In the summer of 2017, Autodesk brought into play a new automated workflow for the precast concrete industry. The Autodesk Structural Precast Extension for Revit 2018 provides access to powerful tools for automatic rule-based segmentation, reinforcement, shop drawings and CAM files generation of precast concrete planar elements. This app supports workflows for typical building projects that are made up of slabs and walls that are produced in factories with a high level of automation. Currently, three types of elements are supported by the new app: Solid Walls, Solid Slabs and Hollow Core Slabs.

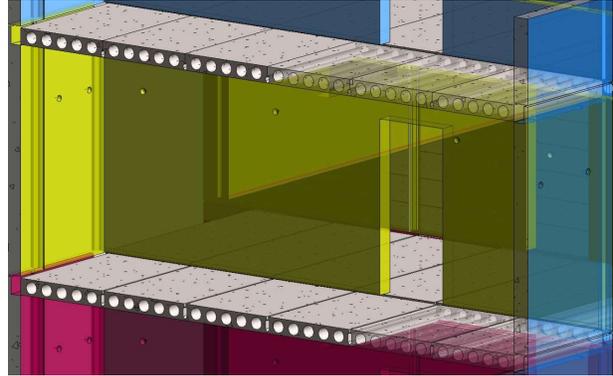


SAMPLE SOLID WALL, SOLID SLAB AND HOLLOW-CORE SLAB IN REVIT

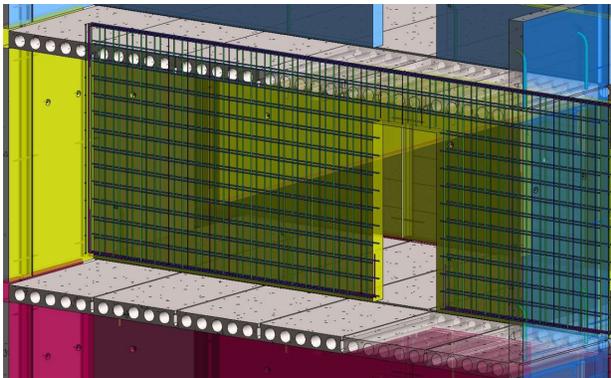
Leveraging the concept of [Parts](#), which support the construction modeling process by letting you divide certain elements from the design intent model into discrete parts, the app provides the opportunity of having one single source of truth for various personas that need to work with the model. This way, designers' and fabricators' perspectives are respected and various Levels of Development can be displayed – two key benefits of embracing a Revit-based workflow for Precast projects.



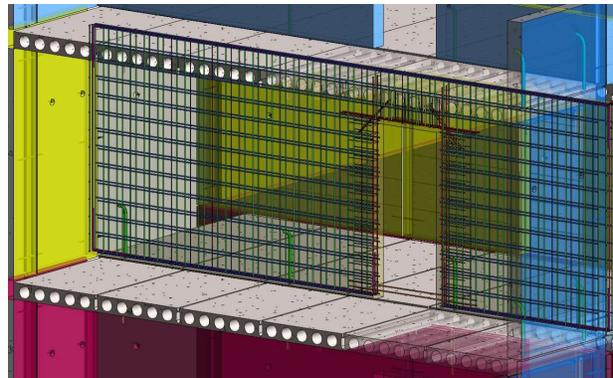
ONE MODEL – MULTIPLE STAGES - LOD 200



ONE MODEL – MULTIPLE STAGES - LOD 300



ONE MODEL – MULTIPLE STAGES - LOD 350



ONE MODEL – MULTIPLE STAGES - LOD 400

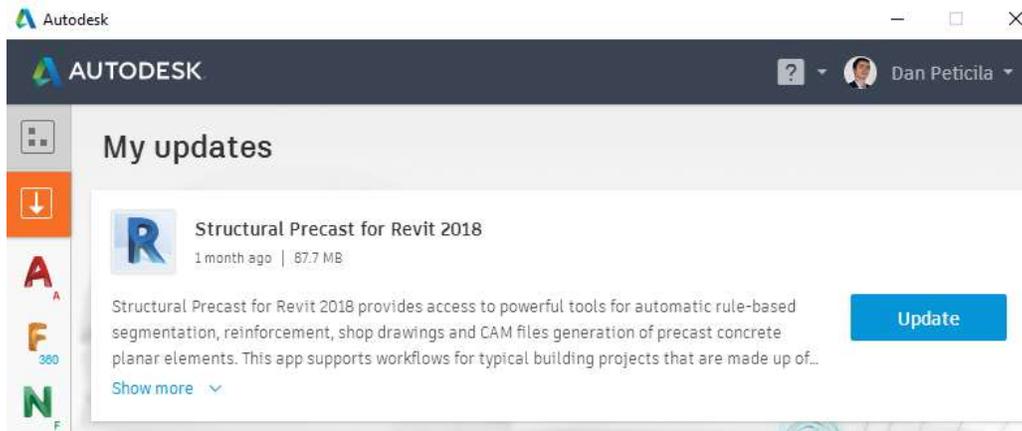
Before going into the full details, it is important to keep in mind the following recommended workflow:

- Configure the segmentation, reinforcement, shop drawings and CAM export parameters for the relevant element types used in the project
- Segment the elements. The divided elements are automatically fitted with connectors, lifters and bushings. This can be done for all elements of the same type at once. (e.g all solid walls, all hollow-core slabs or all solid slabs)
- Reinforce the elements. This can be done automatically per element type. Custom Fabric Sheets can also be defined for reinforcing the elements, using the dedicated command.
- Automatically add other embedded parts in the precast assemblies. This is done for all supported elements and supported embeds Revit categories (e.g. family instances, conduits)
- Better coordinate or link precast model with other disciplines using Revit such as MEP and Architecture.
- Automatically create the shop drawings. This can be done based on company standards: for all elements at once, all elements per submittal or per element.
- Make assembly changes and update the shop drawings.
- Automatically create the CAM files. This can be done for all elements at once, in one or more of the available formats: Unitechnik 5.2, Unitechnik 6.0 and PXML 1.3.

- Export the Revit model to Autodesk® Navisworks® Manage and Autodesk® BIM 360® Team for construction coordination, planning and execution.
- Combine with other disciplines and export to Revit LIVE to help communicate the design intent with the client.

Installation

The app is available via the Autodesk Desktop App and on the Autodesk App Store page and runs on top of any Revit 2018 version.



STRUCTURAL PRECAST FOR REVIT 2018 IN AUTODESK DESKTOP APP



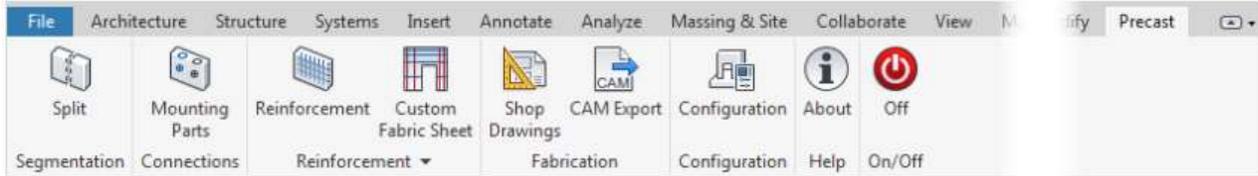
STRUCTURAL PRECAST FOR REVIT 2018 IN AUTODESK APP STORE

The app is available in English, German and French, having both the User Interface and the Content localized in these three languages.

Once installed, the new “Precast” ribbon in Revit is visible and new content (Revit templates and families) is added to the app’s dedicated folder structure: C:\ProgramData\Autodesk\Structural Precast for Revit 2018\Families.

The content shipped along with the app comprises of annotations, sample hollow-core slab families, mounting parts (lifters, anchor plates, lifters etc.), division profiles between panels, symbols and title blocks.

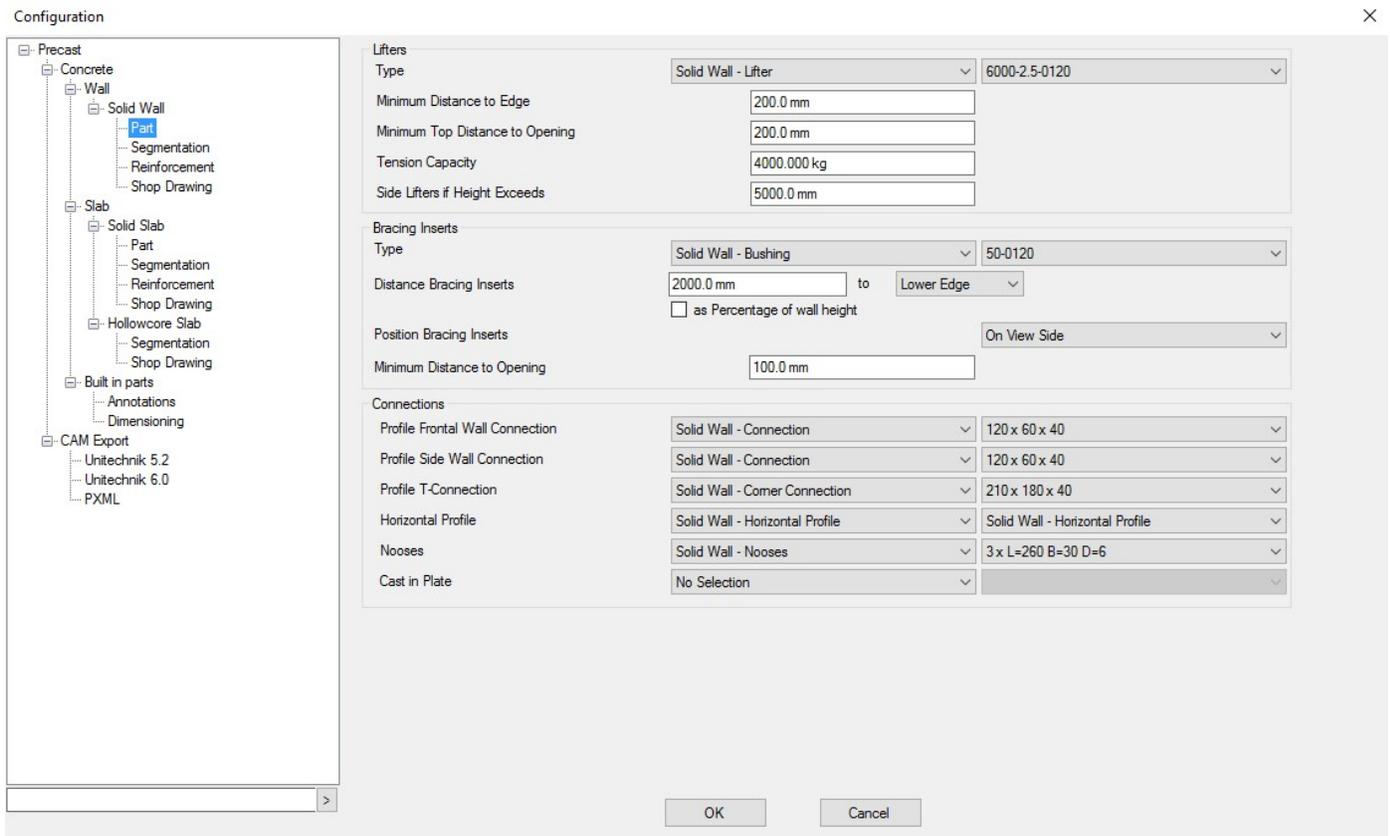
⚠ Tip: Make sure Windows’ “Show hidden files, folders, and drives” option is selected.



"PRECAST" REVIT RIBBON

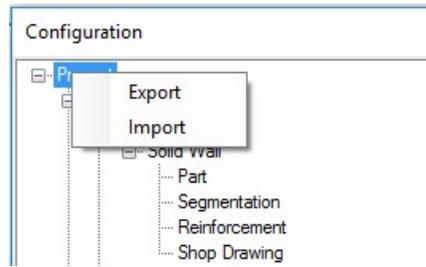
Configuration settings

The first step when working with Precast for Revit should be the Configuration of all the parameters that will be used to drive the automated steps. These settings control how each type of precast element is segmented and reinforced, how mounting parts are added and how shop drawings should look like. It also defines the rules for annotating and dimensioning the built-in parts and the text parameters to be written to the CAM files.



CONFIGURATION DIALOGUE BOX

Tip: The configuration settings can be imported or exported via XML files for easy sharing the rules across several users, working on the same project. It also allows the re-use of settings from previous projects or create a library of settings specific to each precast factory. To do this, right click in the tree view and select "Export" or "Import" from the contextual menu.



EXPORT/IMPORT THE CONFIGURATION SETTINGS

Solid Wall settings

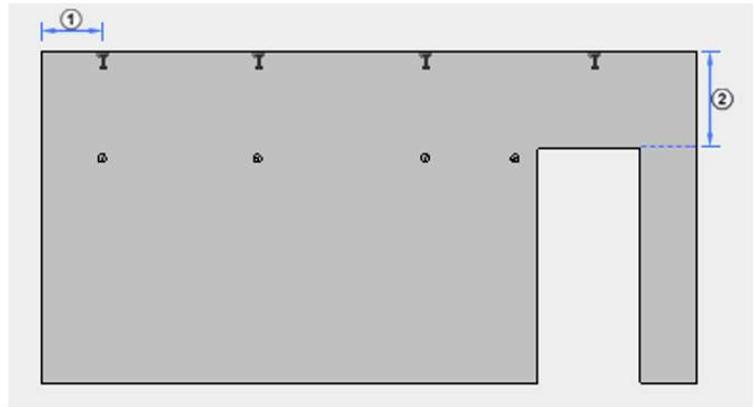
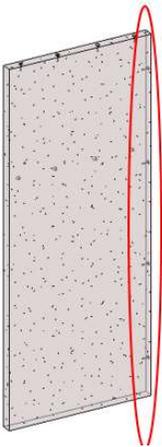
These settings are divided into four sections, namely:

- Part – defines rules for types and positions of lifters, bracing inserts (i.e. bushings) and connections
- ⚠ **Tip:** All the connections and built-in parts are Revit families and can be customized according to the project’s requirements. In order to be available in the dropdown menus, they have to be loaded in the corresponding aforementioned content folders of the App. They should also respect the naming convention, so if family needs to be visible in the setting of the Solid Wall, then the name of the family should be “Solid Wall – xxxx.rfa”.

Lifters		
Type	Solid Wall - Lifter	6000-2.5-0120
Minimum Distance to Edge	200.0 mm	
Minimum Top Distance to Opening	200.0 mm	
Tension Capacity	4000.000 kg	
Side Lifters if Height Exceeds	5000.0 mm	
Bracing Inserts		
Type	Solid Wall - Bushing	50-0120
Distance Bracing Inserts	2000.0 mm to Lower Edge	
	<input type="checkbox"/> as Percentage of wall height	
Position Bracing Inserts	On View Side	
Minimum Distance to Opening	100.0 mm	
Connections		
Profile Frontal Wall Connection	Solid Wall - Connection	120 x 60 x 40
Profile Side Wall Connection	Solid Wall - Connection	120 x 60 x 40
Profile T-Connection	Solid Wall - Corner Connection	210 x 180 x 40
Horizontal Profile	Solid Wall - Horizontal Profile	Solid Wall - Horizontal Profile
Nooses	Solid Wall - Nooses	3 x L=260 B=30 D=6
Cast in Plate	No Selection	

SOLID WALL – OVERVIEW OF PART CONFIGURATION

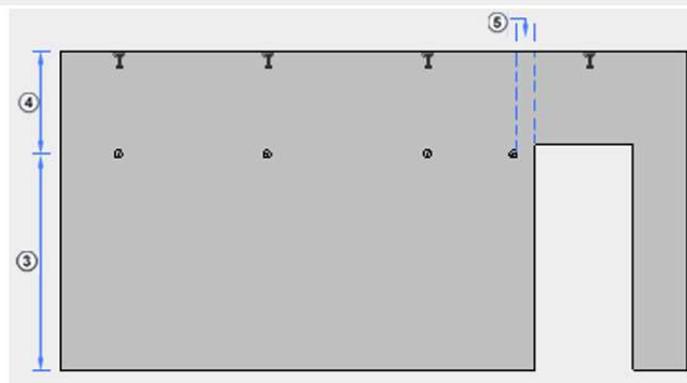
Lifters	
Type	Solid Wall - Lifter 6000-2.5-0120
Minimum Distance to Ed ^①	200.0
Minimum Top Distance to Openi ^②	200.0
Tension Capacity	4000.000 kg
Side Lifters if Height Exceeds	5000.0



SOLID WALL – LIFTERS CONFIGURATION

⚠ NOTE: THE USER INTERFACE IN THIS PICTURE IS ENHANCED WITH ADDITIONAL GRAPHICS FOR BETTER LEARNING PURPOSES

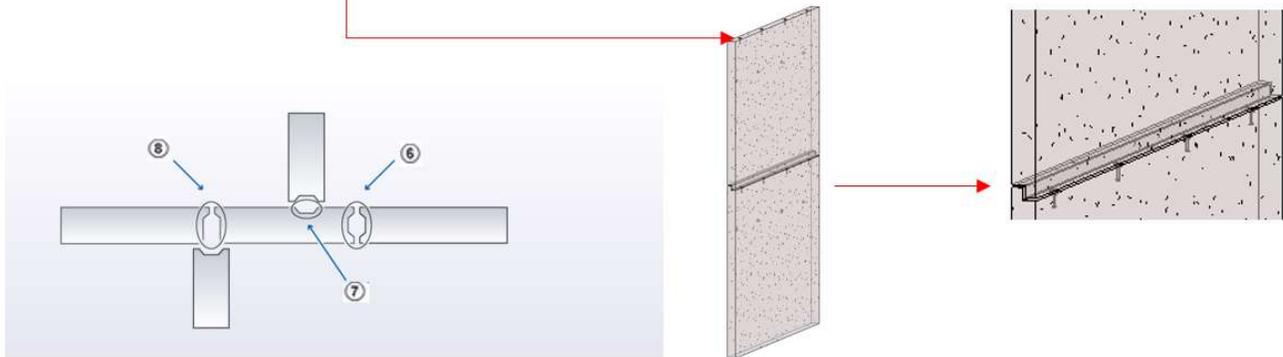
Bracing Inserts	
Type	Solid Wall - Bushing 50-0120
Distance Bracing Inserts	5000.0 to Lower Edge
	<input type="checkbox"/> as Percentage of wall height
Position Bracing Inserts	On View Side
Minimum Distance to Opening	100.0



SOLID WALL – BRACING INSERTS CONFIGURATION

⚠ NOTE: THE USER INTERFACE IN THIS PICTURE IS ENHANCED WITH ADDITIONAL GRAPHICS FOR BETTER LEARNING PURPOSES

Connections		
Profile Frontal Wall Connection ⑥	Solid Wall - Connection	120 x 60 x 40
Profile Side Wall Connection ⑦	Solid Wall - Connection	120 x 60 x 40
Profile T-Connection ⑧	Solid Wall - Corner Connection	210 x 180 x 40
Horizontal Profile	Solid Wall - Horizontal Profile	Solid Wall - Horizontal Profile
Nooses	Solid Wall - Nooses	3 x L=260 B=30 D=6
Cast in Plate	No Selection	

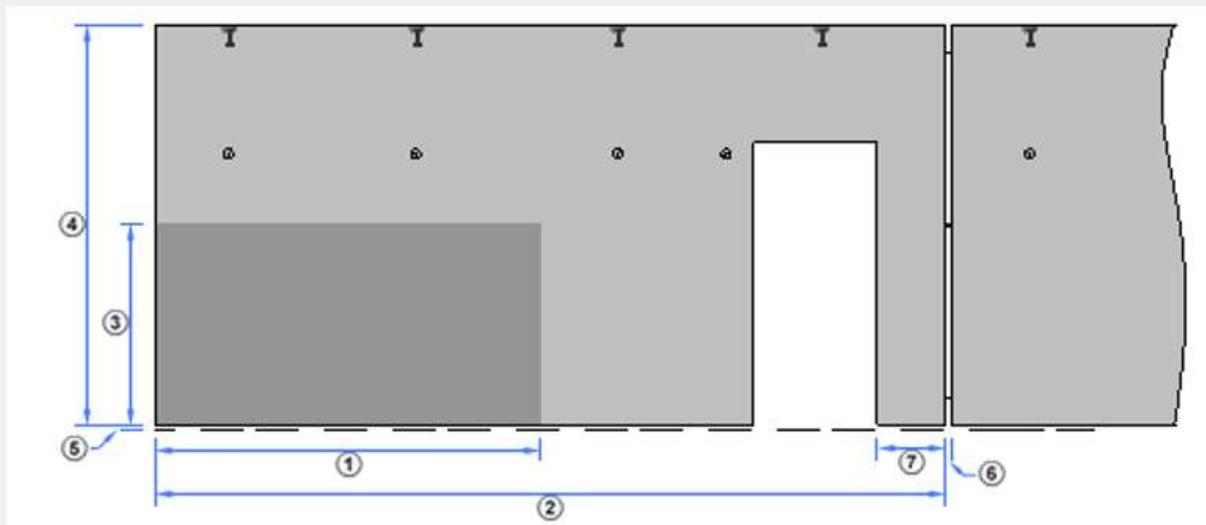
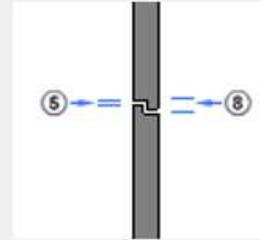


SOLID WALL – CONNECTIONS CONFIGURATION

⚠ NOTE: THE USER INTERFACE IN THIS PICTURE IS ENHANCED WITH ADDITIONAL GRAPHICS FOR BETTER LEARNING PURPOSES

- Segmentation – defines rules for splitting the design intent, unsegmented, wall into precast assemblies, based on fabrication, transportation, esthetical or functional requirements

Min. Wall Length	①	1500.0
Max. Wall Length	②	8000.0
Min. Wall Height	③	1500.0
Max. Wall Height	④	4000.0
Max. Weight		12000.000 kg
Horizontal Gap	⑤	20.0
Vertical Gap	⑥	20.0
Min. Distance to Openings	⑦	500.0
Profile Overlap Height	⑧	100.0



SOLID WALL – SEGMENTATION CONFIGURATION

⚠ NOTE: THE USER INTERFACE IN THIS PICTURE IS ENHANCED WITH ADDITIONAL GRAPHICS FOR BETTER LEARNING PURPOSES

- Reinforcement – defines rules for reinforcing the solid wall with area reinforcement (of rebar sets) and fabric sheets. The reinforcement can be done with one or two layers.
 - ⚠ Tip:** The reinforcement settings can be overridden for a given selection right before launching the “Reinforcement” command.
 - ⚠ Tip:** If rebars need to go outside of the element, you can specify a negative distance in the “Bar Length Offset” section
 - ⚠ Tip:** To reinforce a wall with more or less than two layers of reinforcement, press the “+” or “X” buttons on the right corner of the “Rebar Two Layers” configuration. In this case, it is recommended to rename that configuration (e.g. “Rebar Three Layers”)

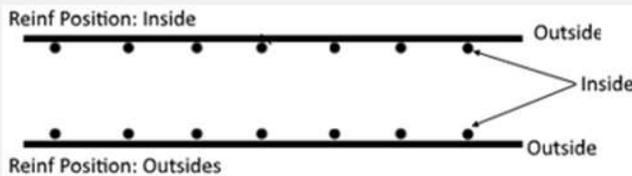
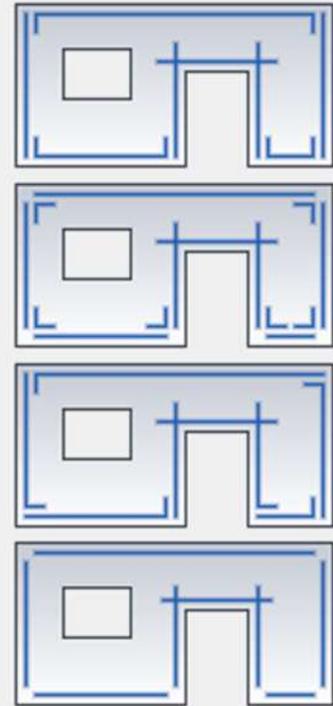
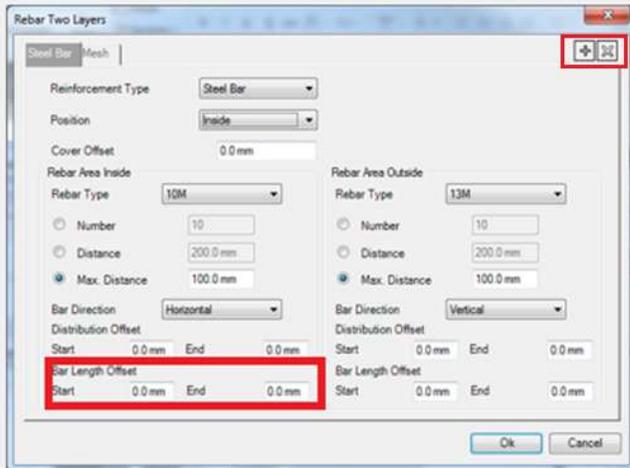
Reinforcement Types for Wall Parts

Area Reinforcement Type

▶ Rebar Two Layers	Edit
Rebar One Layer	Edit
Fabric Two Layers	Edit
Fabric One Layer	Edit
*	

Edge Reinforcement

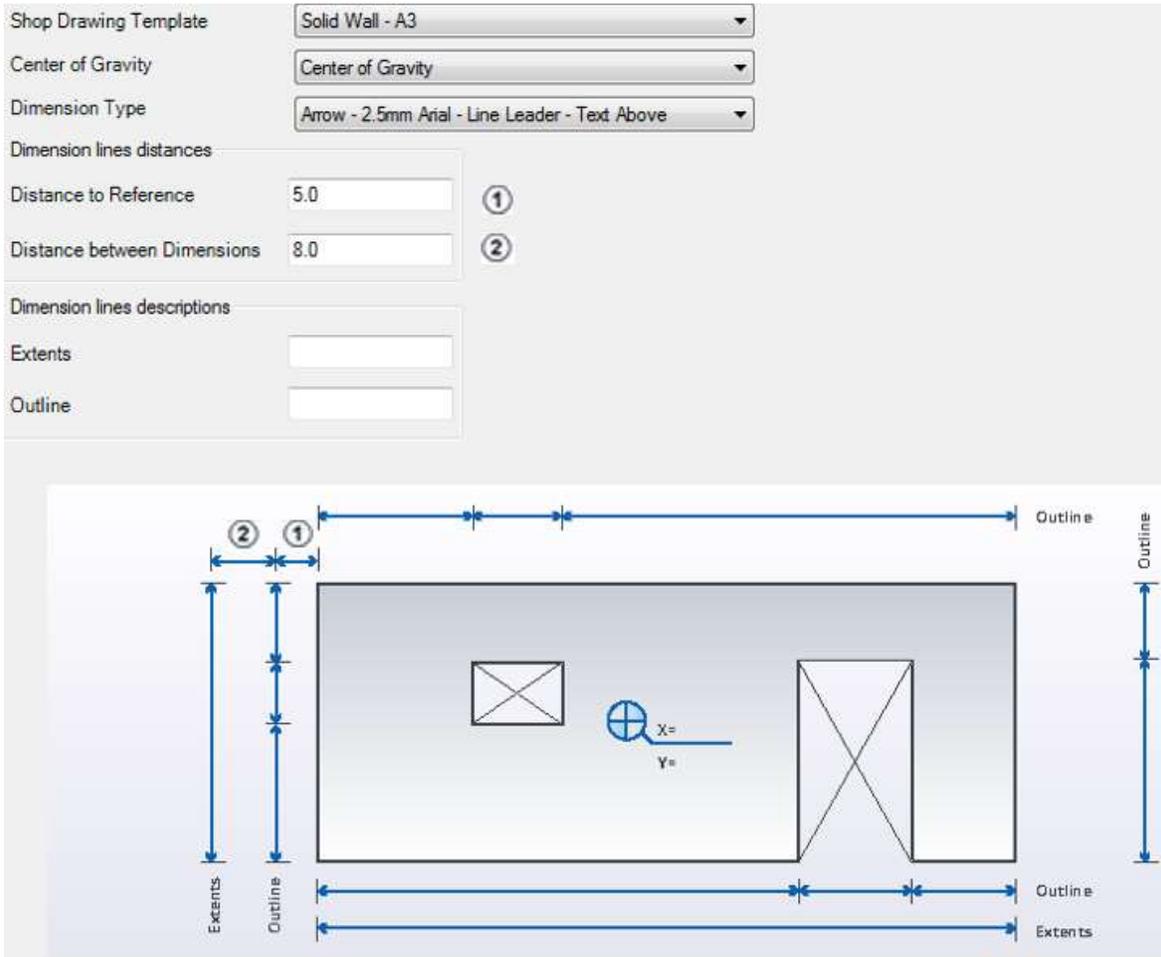
▶ Corner Bars	Edit
'U' Bars	Edit
'L' Bars	Edit
Straight Bars	Edit
*	



SOLID WALL – REINFORCEMENT CONFIGURATION

⚠ NOTE: THE USER INTERFACE IN THIS PICTURE IS ENHANCED WITH ADDITIONAL GRAPHICS FOR BETTER LEARNING PURPOSES

- Shop Drawing – defines the rules for the template to be used, the types of dimensions and distances between dimensions and referenced objects

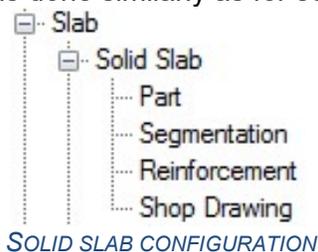


SOLID WALL – SHOP DRAWING CONFIGURATION

⚠ NOTE: THE USER INTERFACE IN THIS PICTURE IS ENHANCED WITH ADDITIONAL GRAPHICS FOR BETTER LEARNING PURPOSES

Solid slabs settings

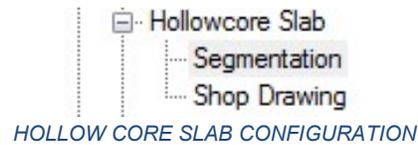
The configuration of the solid slabs is done similarly as for solid walls.



SOLID SLAB CONFIGURATION

Hollow core slabs settings

The configuration of the hollow core slabs for segmentation and shop drawings is done similarly as for solid walls.



The hollow core family is used to get the actual geometry of the element (bounding box), the position and shape of the voids and the position of strands.



HOLLOW CORE SLAB – FAMILY SELECTION

Tip: The thickness of the hollow core family has to match the thickness of floor, so that the segmentation can be performed.

The hollow core slab families can be found at the following location:
 C:\ProgramData\Autodesk\Structural Precast for Revit 2018\Families\[language]\Custom Slabs.
 To be able to see the hollow core family in the Configuration, the naming of the family should start with the string 'Hollow Core Slab'. All user's families should be saved in the same location so that they can be accessed them in the Configuration settings.

The hollow core profile families must be created from the "(Metric) Generic Model face based" family template and must contain an extrusion body as a placeholder for a complete hollow core element. The voids for the hollow core type are placed in this body. The vertical position of the void from the reference plane must be defined by the "Position from top" shared parameter, which must also be used to define the family origin.

Division Profile

The division profile family is used to apply it at the position of division lines for parts. This family can have any kind of geometry supported by Revit.

The division profile families can be found at the following location:
 C:\ProgramData\Autodesk\Structural Precast for Revit 2018\Families\[language]\Profiles. To be able to see the division profile family in the Configuration, the naming of the family should start with the string 'Hollow Core Slab'.

The division profile must be a family created from the "(Metric) Division Profile" template and must be saved in the "Profiles" folder. Division profiles are defined as a section view through the profile and when applied will be extruded along the element.

Minimum Width

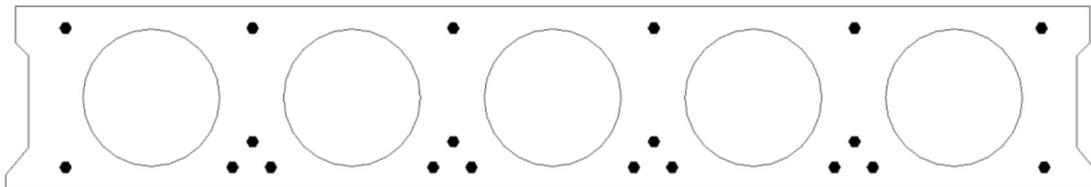
This segmentation parameter allows the user to prevent the segmentation to be performed under the specified value. If the last hollow core is less than the specified minimum width the segmentation will not be performed.

Segmentation Gap

Allows the specification of the gap between two adjacent hollow core slabs.

Strand Diameter

This property allows the user to specify the diameter for the strands found in the hollow core slab family. At the position of each extrusion in the hollow core family the add-on will create a free form rebar with the specified diameter.



HOLLOW CORE SLAB – TYPICAL STRAND PATTERN EXAMPLE

For further information about how to create custom hollow core families, please refer to Annexes.

Built-in parts settings

The Built-in parts node configures the settings for annotating and dimensioning of embedded parts. For each kind of embedded part which needs automatic tagging, in the “Annotations” section the Category, Family, Family Type, Annotation Family and Annotation Family Type should be specified. This allows for maximum flexibility in the generation of assembly shop drawings.

For dimensioning the embedded parts, a similar procedure should be followed:

- ⚠ **Tip:** If the Dimensioning section remains unfilled, the shop drawings will still have automatic dimensions indicating the position of the built-in parts and as “Description” will indicate the family type.

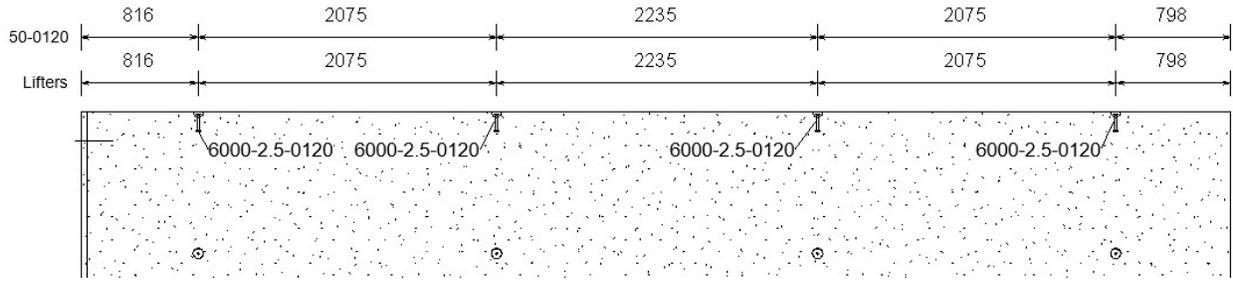
As exemplification, please observe the below configuration of the “Built-in parts” node and the outcome, applied to the superior half of a solid wall. Notice that for the lifters, the description for the dimensioning line and the annotations are according to the configured parameters, while for the bushings the family type is indicated by default (i.e. “50-0120”).

	Category	Family	Family Type	Annotation Family	Annotation Family Type
▶	Structural Connections *	▼ Solid Wall - Lifter	6000-2.5-0120	Structural Connection Tag	Structural Connection Tag
*	▼				

BUILT-IN PARTS – ANNOTATIONS CONFIGURATION EXAMPLE

	Category	Family	Family Type	Description
▶	Structural Connections *	▼ Solid Wall - Lifter	6000-2.5-0120	Lifters
*	▼			

BUILT-IN PARTS – DIMENSIONING CONFIGURATION EXAMPLE



SAMPLE OF BUILT-IN PARTS AUTOMATIC ANNOTATIONS AND DIMENSIONING

CAM Export settings

The app currently supports three types of CAM files export, namely Unitechnik 5.2, Unitechnik 6.0 and PXML 1.3. The settings from the “CAM Export” section allow the configuration of the parameters for each of file format. Many of the settings are actually text parameters that can be incorporated in the CAM files, per project requirements, or can serve to create custom file names.

General			
Order Number	<input type="text"/>	Component	<input type="text"/>
Storey	<input type="text"/>	Drawing Number	<input type="text"/>
Project Description			
Line 1	<input type="text"/>	Line 2	<input type="text"/>
Line 3	<input type="text"/>	Line 4	<input type="text"/>
Building Site			
Name	<input type="text"/>	Street	<input type="text"/>
Post Code	<input type="text"/>	Place	<input type="text"/>
Building Owner			
Name	<input type="text"/>	Street	<input type="text"/>
Post Code	<input type="text"/>	Place	<input type="text"/>
Drawing			
Drawing Date	<input type="text" value="Tuesday , October 24, 2011"/>	Drawing Revision	<input type="text"/>
Drawing Author	<input type="text"/>		
Output Filename			
Filename Rule	<input ."prodno:3:3:0:r'"="" type="text" value="'FileName:9"/>		
Filename Preview	<input type="text" value=".000"/>		

CONFIGURATION SETTINGS FOR UNITECHNIK 6.0 CAM FILES

⚠ Tip: For Unitechnik 5.2 and 6.0 export, filling in the “Order Number” filed is mandatory, per the format’s standards.

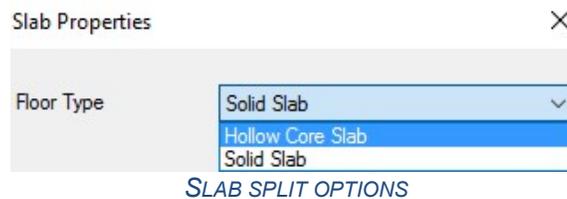
Segmentation of elements

Automatic segmentation

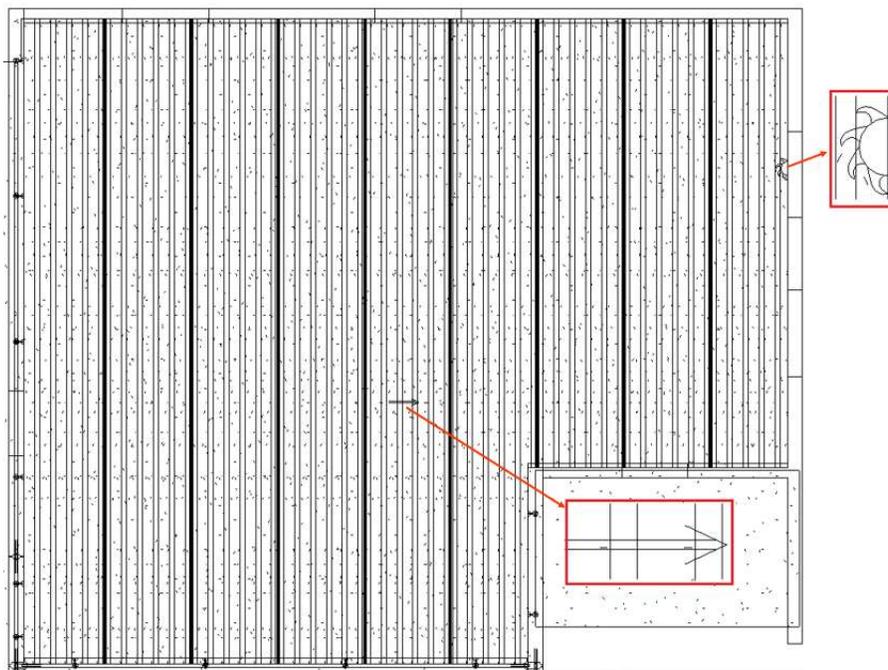
The automatic segmentation is done for the selected elements by pressing the “Split” button. It is based on the parameters specified in the Configuration settings for each type of element.

For walls, the process implies one click, turning each original wall into individual assemblies of solid walls.

For slabs, once the selection is done, a dropdown menu appears, inquiring the type of slab to be used: solid slab or hollow core slab.



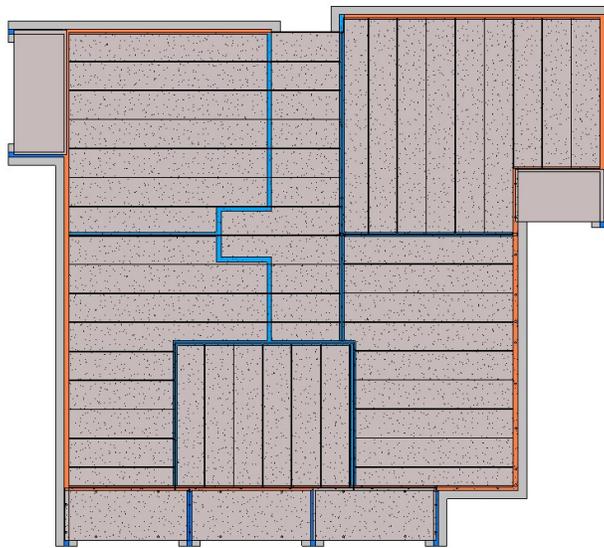
- ⚠ Tip: After segmentation of hollow core slabs, in the plan views symbols indicating the direction of installing the assemblies on site and which assemblies need to be cut, not having the standard width, are displayed.



Manual segmentation

When segmentation has to be performed in a custom way which does not allow for clear mathematical rules (e.g. architectural reasons) or when fabrication requirements, that deviate from the usual rules specified in the Configuration, require manual input, manual segmentation can be used to allow for such cases.

Another occasion when manual segmentation is useful is when the design intent needs to be respected, meaning, for example, that the slab span direction needs to vary across different regions. In the picture below, the same original slab is divided into multiple regions and split accordingly into hollow core slab assemblies. To achieve this, the span direction of the original slab needs to be changed before applying the “Split” command for each selection.

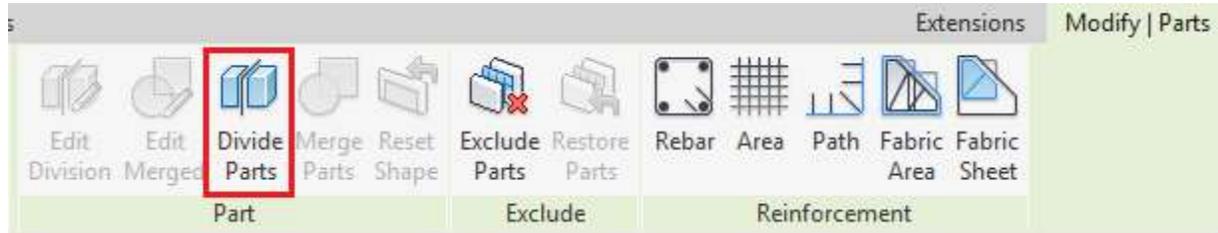
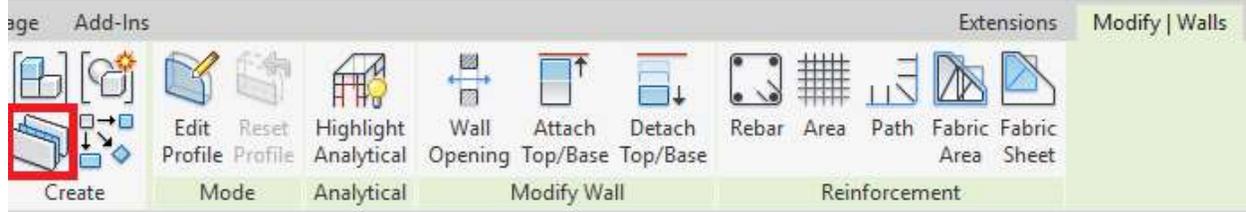


RESPECTING DESIGN INTENT DURING SEGMENTATION INTO HOLLOW CORE SLAB ASSEMBLIES

Manual segmentation is performed starting directly from the original, unsegmented element. The steps to follow are:

1. Convert the wall or the slab into Parts
2. Click “Divide Parts”
3. Click “Edit Sketch”
4. Draw the division line(s) to impose where segmentation should occur. Please note that the division line must go outside the bounding box surrounding the part (i.e. the dashed green line)
5. Accept and close the sketch edit mode
6. Accept and close the “Divide Parts” mode

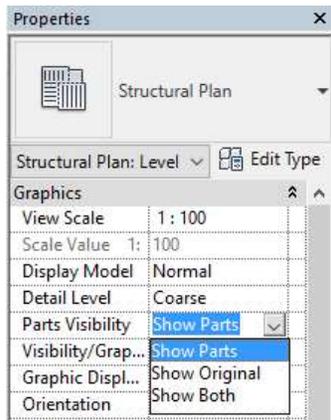
⚠ Tip: If one part is still larger/heavier/etc. than the specifications indicated in Configuration settings, it will be further divided, respecting those rules.



STEPS 1-4 TO MANUALLY SPLIT A WALL

Once manual segmentation is complete, the “Split” command can be used to convert the parts into precast assemblies.

- ⚠ **Tip:** If the original wall is selected, instead of the manually created parts, the manual segmentation is overridden and the wall is segmented according to the Configuration settings.
- ⚠ **Tip:** In order to see the resulted segmentation in a view, the “Show Both” or “Show Parts” has to be selected for that view.



PART VISIBILITY SETTINGS IN THE PROPERTIES PALLET

Reinforcement of elements

Solid wall reinforcement

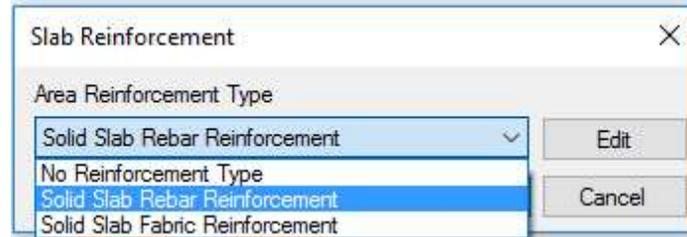
Once precast assemblies are selected, by pressing the “Reinforcement” command a window is displayed, allowing the selection of the desired reinforcing configuration. Area and Edge reinforcement setting can be separately specified or omitted (e.g. no edge reinforcement is required). The edge reinforcement can be made with corner, “U”, “L” or straight bars. For more details about reinforcement of solid walls, please refer to the “[Solid wall settings](#)” section.



SOLID WALL REINFORCEMENT SETTINGS

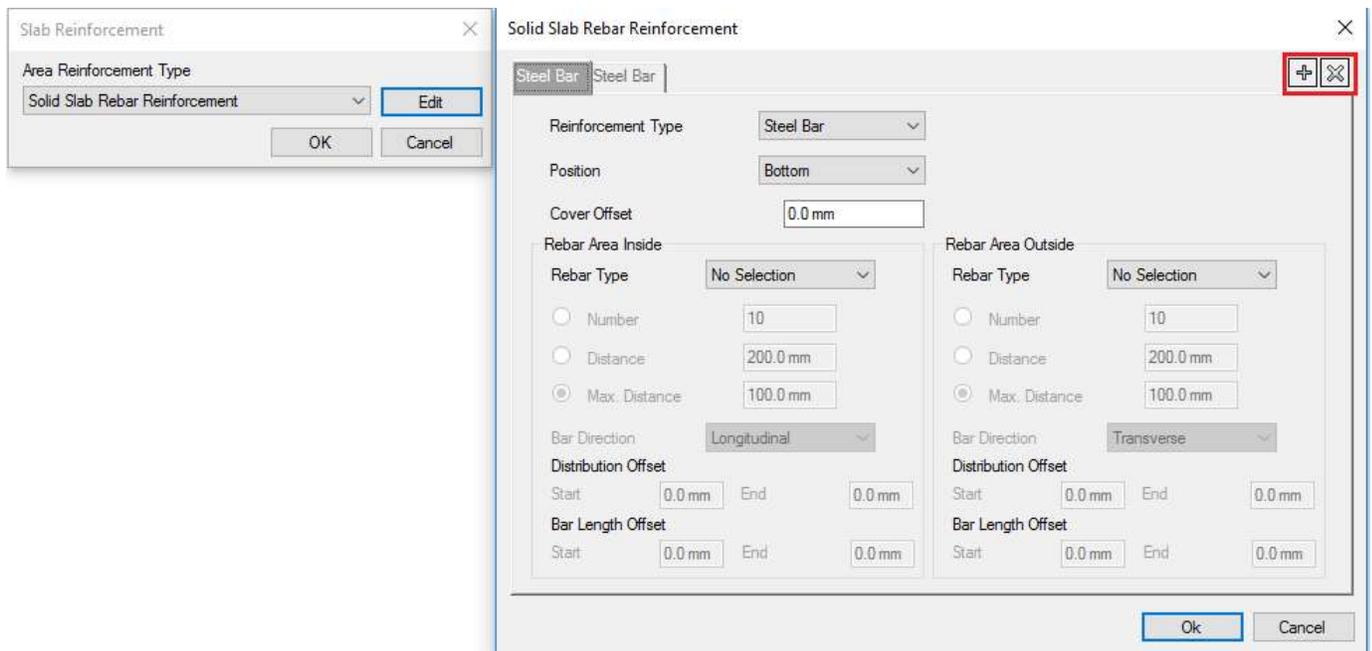
Solid slab reinforcement

Just like for solid walls, by pressing the “Reinforcement” command a window is displayed, allowing the selection of the desired reinforcing configuration. For solid slabs, both reinforcement with area reinforcement (of rebar sets) and fabric sheets is available.



SOLID SLAB REINFORCEMENT SETTINGS

- ⚠ **Tip:** To reinforce a slab with one single layer, top or bottom, press the “X” button on the top right corner of the “Solid slab rebar reinforcement”.
- ⚠ **Tip:** To reinforce a slab with more than two layers of reinforcement, press the “+” button on the right corner of the “Solid slab rebar reinforcement”.



SOLID SLAB REINFORCEMENT SETTINGS – ADDING OR REMOVING LAYERS

Hollow core slab reinforcement

Hollow core slabs are reinforced with strands, which are typically catalogue items, so the reinforcement pattern is already included in the hollow core slab family. See the [dedicated tip](#) regarding this topic.

Custom Fabric Sheets

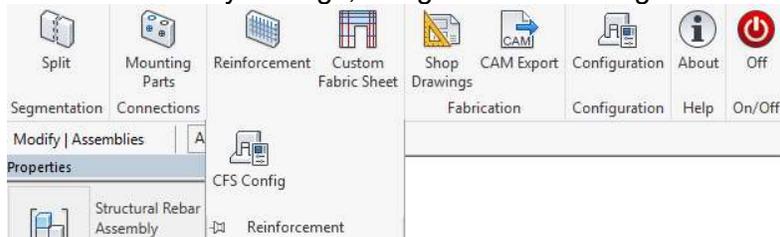
For optimizing the reinforcement patterns, Custom Fabric Sheets (CFS) can be modelled in slabs or walls. They have a fully customizable layout (each wire can have its own diameter, length and distance with respect to the adjacent wires), can be automatically cut by the host (i.e. around openings) and are useful both for optimizing the rebar consumption based on structural

analysis and for minimizing clashes with various MEP equipment that might be embedded or going through the panels.

In order to define a CFS a rebar assembly made of individual bars has to be selected. The result is CFS having the wires with the same diameters and geometry as the rebar assembly.

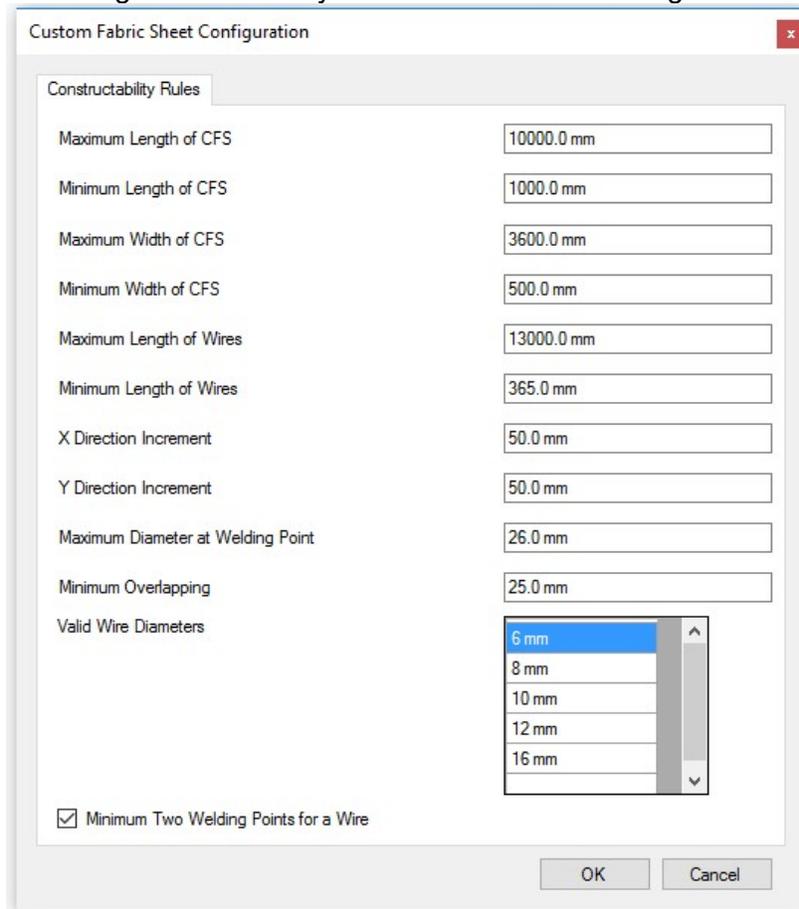
The proposed workflow is as follows:

1. Input the desired constructability settings, using the “CFS Config” command.



“CFS CONFIG” COMMAND LOCATION

The CFS has the following constructability rules found in “CFS Config”:



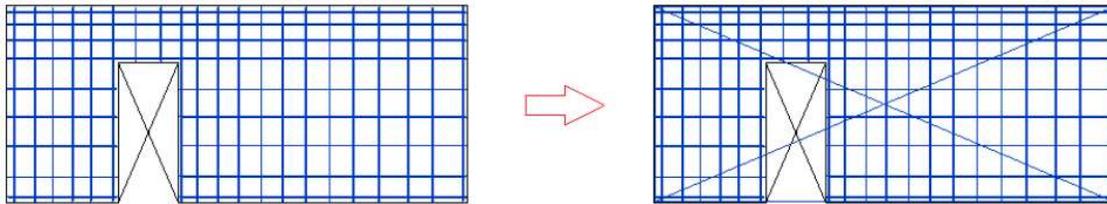
CFS CONFIG SETTINGS

Tip: Each factory has its own constructability rules, depending on the machines it is equipped with. It is recommended to first set these rules, then create custom fabric sheets.

2. Create individual bars (in the same view) and add them into an assembly containing only the rebars intended to be part of the CFS

Tip: The individual rebars defining the CFS have to be positioned in the same plane

3. Use “Custom Fabric Sheet” command to transform the rebar assembly into CFS. During the transformation, all the constructability rules found in “CFS Config” are checked. If any rule is not satisfied, the problem will be highlighted.



CONVERTING A REBAR ASSEMBLY INTO A CUSTOM FABRIC SHEET

Tip: Hooks from bars are ignored when converting to CFS

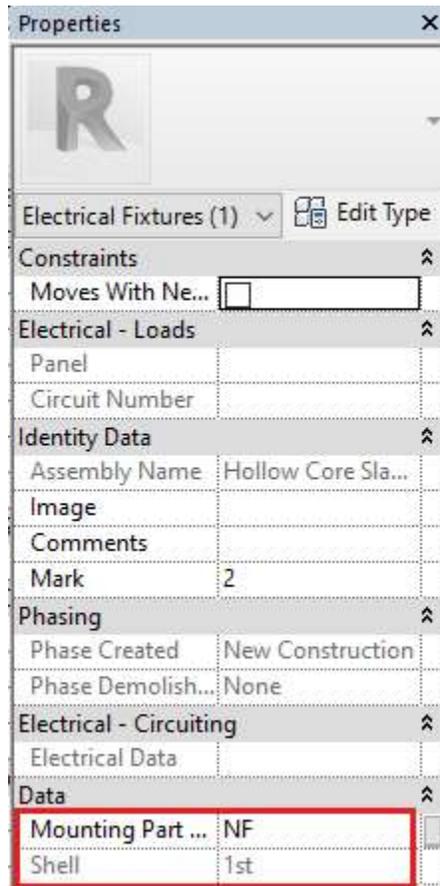
4. If the CFS needs additional modifications, by pressing once again “Custom Fabric Sheet” command you will obtain a rebar assembly with individual bars that can be modified according to your needs.
5. Once the CFS is defined, it can be added to the precast assembly by pressing the “Mounting Parts” command. This ensures that it is automatically scheduled in the assembly shop drawing and in the CAM files.

Mounting Parts and additional reinforcement

The app has a tool that automatically adds to the corresponding precast assemblies all the electrical sockets, cable ducts, extra rebars or any other kind of component that is in the model. This way, the precast walls and slabs will contain the logic that is required for fabrication, minimizing much of the hassle in the factory or on site.

The workflow is straightforward, meaning that after all the extra components or rebars have been modelled in the desired locations, by pressing the “Mounting Parts” commands, these are automatically added to the right assemblies, based on their location with respect to the boundaries of these assemblies.

Tip: All embeds from precast assemblies should have information needed in the fabrication process about their location with respect to the shell and the face. Solid walls, solid slabs and hollow core slabs are massive elements, having one shell. Each shell has two faces: near face – NF – (visible face when element is placed on the production table) and far face – FF – (invisible face when element is placed on the production table). By using the Mounting parts command, to all embeds the location parameters are automatically added.



EXAMPLE OF LOCATION FABRICATION PARAMETERS

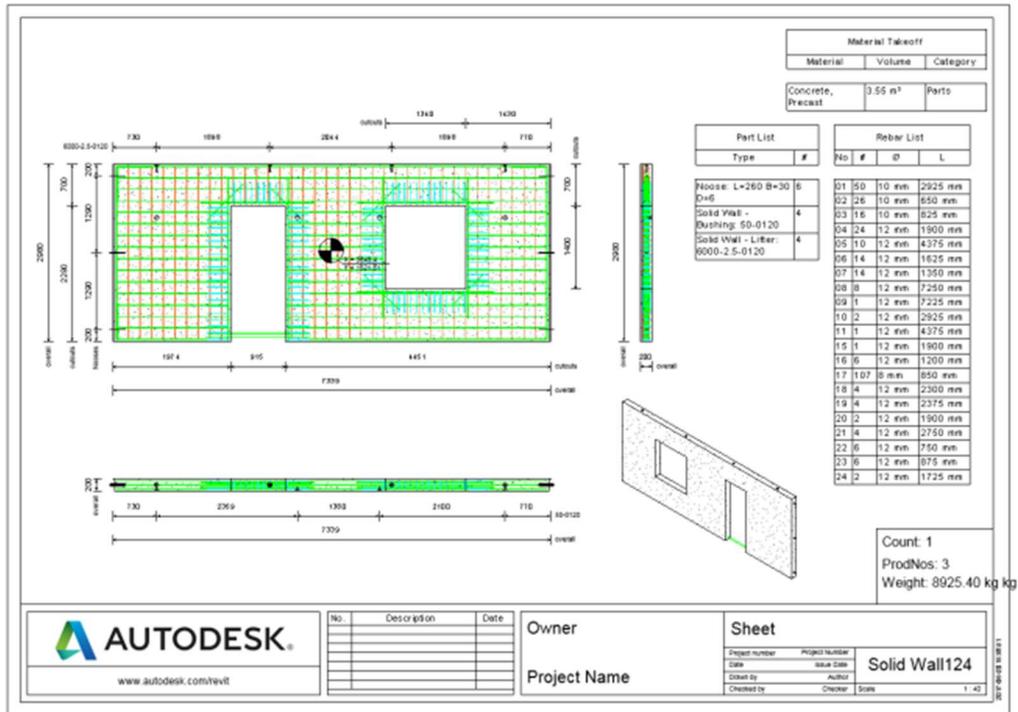
Tip: All mounting parts will be automatically annotated and dimensioned in the shop drawing, according to the configuration setting. For further details, please refer to the [“Built-in parts settings”](#) section.

Precast assemblies shop drawings

One particularly powerful tool that Structural Precast for Revit offers is Automatic Shop Drawings. Once the company’s standards related to drawing style and content are embedded in the drawing templates, for each precast element the drawing is created, with all relevant views and bills of materials. It’s also worth mentioning that this Automation tool can be used with company standards for all elements at once, all elements per submittal or per element.

To create assembly shop drawings, select the elements and use the “Shop Drawings” command.

Tip: The default templates of shop drawings specify in the lower right corner the number of identical assemblies, the production number and the weight of an assembly.

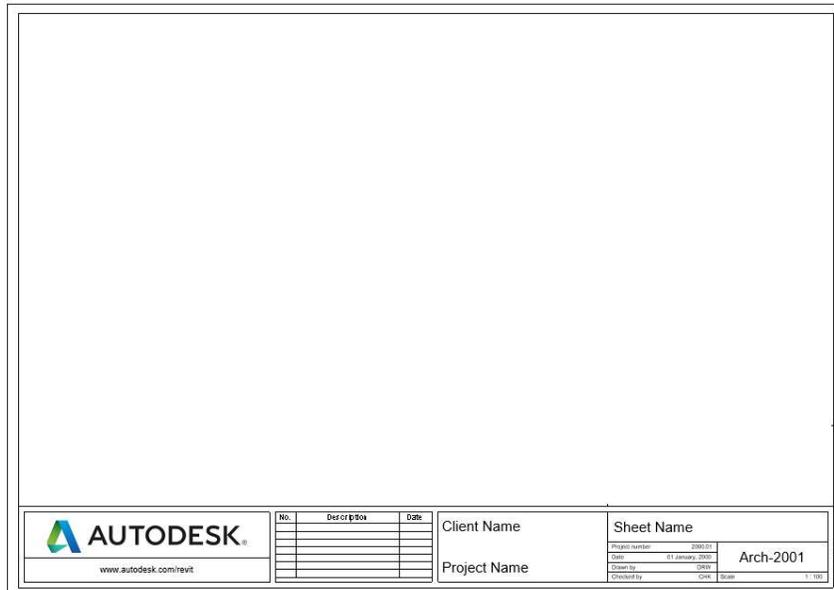


AUTOMATIC SHOP DRAWING SAMPLE FOR A PRECAST SOLID WALL

Customization of templates

To create automatic customized shop drawings, a title block needs to be defined. Here are the steps to define one:

1. Open the title block family you want to use as a template or create a new one.



2. Modify the title block as needed, adding data fields, company logo etc.

3. The following Shared Parameters with additional element information are available for labels on the title block:

- PosNoSheet – Position number of the element
- ListOfProductionNumbers – List of the production numbers for the element on the sheet
- NumberElementSheet – The number of elements that must be produced
- ThicknessSheet – Thickness of the element
- WeightSheet – Weight of the element
- VolumeSheet – Concrete volume of the element

⚠ Tip: All the shared parameters are located in the text file “Shared Parameters.txt”, available for each language, in C:\ProgramData\Autodesk\Structural Precast for Revit 2018\Families\[language]

To insert the labels:

- Create and place a label on the title block: Create → Text → Label.
- In the Edit Label dialog click the Add Parameters button.
- In the Parameter Properties dialog click the Select button and select the parameter you need. Close the dialog.
- Add the selected parameter to the label using the Add parameter(s) to label button (green arrow) and edit the prefix and suffix.
- Repeat as needed

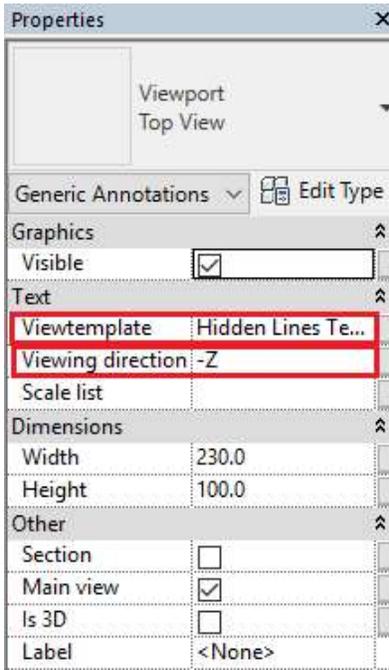
4. Load the “Viewport.rfa” and “Schedule.rfa” families: Insert → Load from Library → Load Family. The family is located in: C:\ProgramData\Autodesk\Structural Precast for Revit 2018\Families\[language].

5. Insert Viewpoints: Create → Detail → Symbol; before placing the view port, select the view port type from the properties. You can use the following view ports: Top View, Side View, Front View, 3D View, Material Takeoff, and Part List.

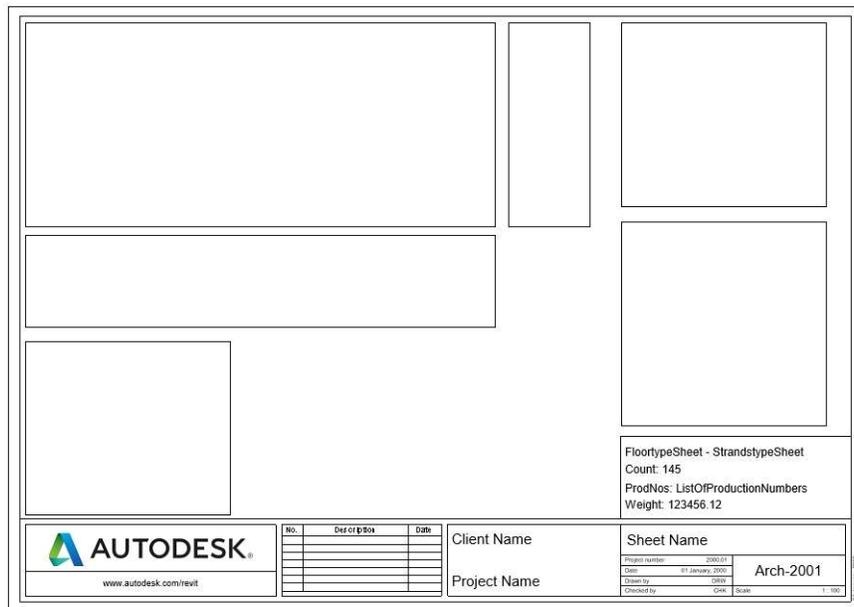
⚠ Tip: For each viewport, a view template can be applied [e.g. to display only rebars and no embeds, or to display elements with certain color schemes]. The view template has to be defined in the project and its name mentioned in the “Viewtemplate” box, in the Viewport’s properties.

⚠ Tip: The viewing direction for the wall indicate what type of view of the element is created. X implies a side view, Y implies a front view and Z implies a top view.

⚠ Tip: To customize the rebar schedules or the part lists, see the [dedicated section](#) in the Annex.



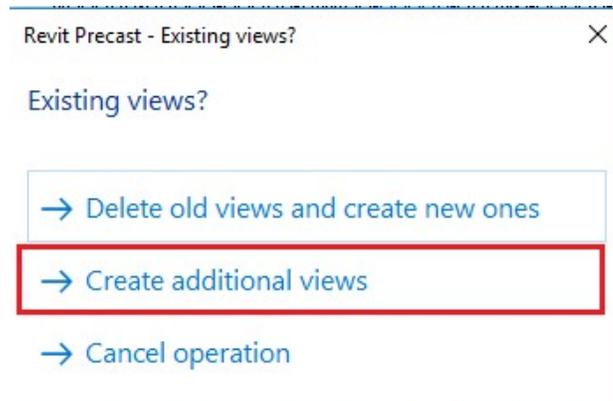
6. Select the inserted view port and modify the Width and Height parameters with the correct dimensions. Uncheck the Visible parameter of the view port. Here you can also specify the desired scale list and view template.
7. Repeat for all views that should be placed on the shop drawings:



8. Save the title block.

Multiple shop drawings per assembly

If required, multiple shop drawings for each assembly can be generated; for instance, one showing the reinforcement and one highlighting the position of the embeds. To achieve this, first create a set of drawings by choosing in the Configuration settings a drawing template whose view ports show reinforcement and not built-in parts. Then, change the drawing template to one whose viewports show built-in parts and no reinforcement. After clicking the “Shop Drawings” command, select “Create additional views” option.



Shop drawings for manually created assemblies

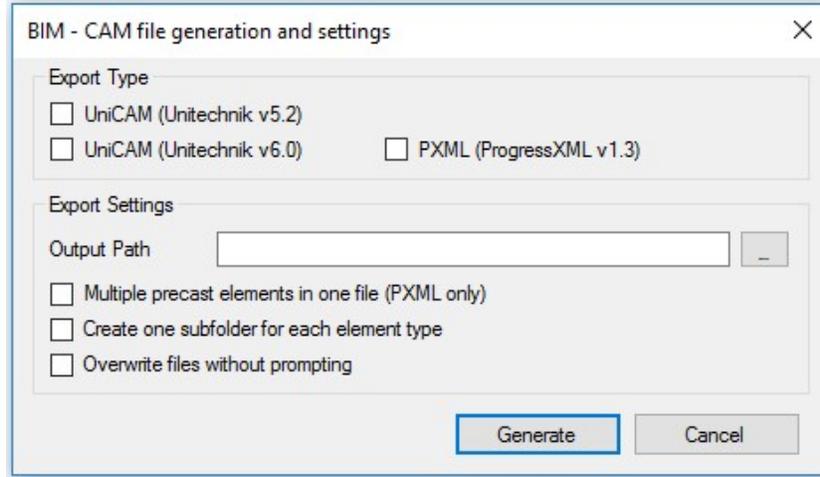
The app also allows the creation automatic shop drawings for slabs and walls that are manually created and reinforced. In order to achieve this, concrete element needs to be converted into a part. Then, by selecting it along with the corresponding reinforcement and embeds, it can be converted into an assembly. Now, an automatic shop drawing for it based on the predefined template selected in the Configuration window can be generated.

CAM Export

When Fabrication is ready to start, with just one click, the creation of CAM files is done. The “CAM Export” command generates files in the Unitechnik 5.2, Unitechnik 6.0 and PXML 1.3 formats for the selected precast assemblies. The export can be done simultaneously for multiple formats, the files being grouped in different subfolders, per each format.

There is the option of creating subfolders for each element type and for PXML files the export of elements can also be done in one single file.

⚠ Tip: For the detailed configuration of CAM file settings, please refer to the [dedicated section](#) in the Configuration settings.



CAM EXPORT SETTINGS

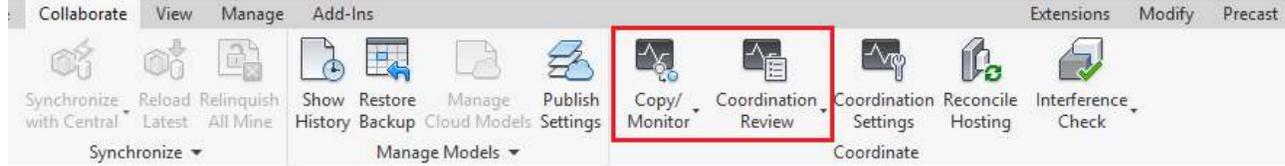
Multidisciplinary coordination in a Revit model

Given that the app is working on top of Revit, coordination of the precast model with Architecture and MEP comes as a natural benefit. In the highly likely event that changes need to be performed to the precast elements, change being a daily routine in the construction industry, the precast elements, shop drawings and bills of materials are automatically updated – helping to keep information up-to-date.

When architects, structural engineers, and mechanical engineers collaborate on a building project, they must share information about the design, so that all teams are working with the same assumptions. By coordinating efforts across disciplines, the teams avoid expensive errors and rework.

When multiple teams collaborate on a project, effectively monitoring and coordinating work can help to reduce mistakes and expensive rework. The “Copy/Monitor” tool can be used to ensure that design changes are communicated across teams. It monitors elements between the host project and a linked model, or within one project. When one team moves or changes a monitored element, other teams are notified so that they can adapt their designs or work with team members to resolve issues.

The “Coordination Review” is another useful tool to review warnings about changes to the monitored elements, communicate with other teams working on the same project, and resolve issues regarding changes to the building model. It displays a list of warnings about monitored elements that have moved or changed. This tool should be used after implementing “Copy/Monitor”. Teams can periodically review this list, specify an action (such as reject the change or modify the design), and enter comments to communicate with other teams.



COPY/MONITOR & COORDINATION REVIEW TOOLS – COORDINATE PANEL – COLLABORATE TAB

For further details, please refer to Revit's online help, [Multi-Discipline Coordination](#) section.

Multi-material structural modelling

Revit is the platform that allows structural engineers and detailers to model complex structures, made up of multiple materials. Not only precast concrete can be used in such a project, but also cast in place concrete, steel and even wood.

Being able to model everything in one place allows for a better coordination of the structural solutions used. Here are a couple of examples where this coordination can prove to be very helpful:

- Placement of grouting tubes in precast solid walls at ground floor over the rebars coming out of the cast in place concrete foundation
- Precast solid walls used for partitioning inside a steel structure: the cuts in the solid walls to allow steel beams to cross can be done easier and so can be the placement of lifters and bushings
- Using precast framing systems with hollow core slabs

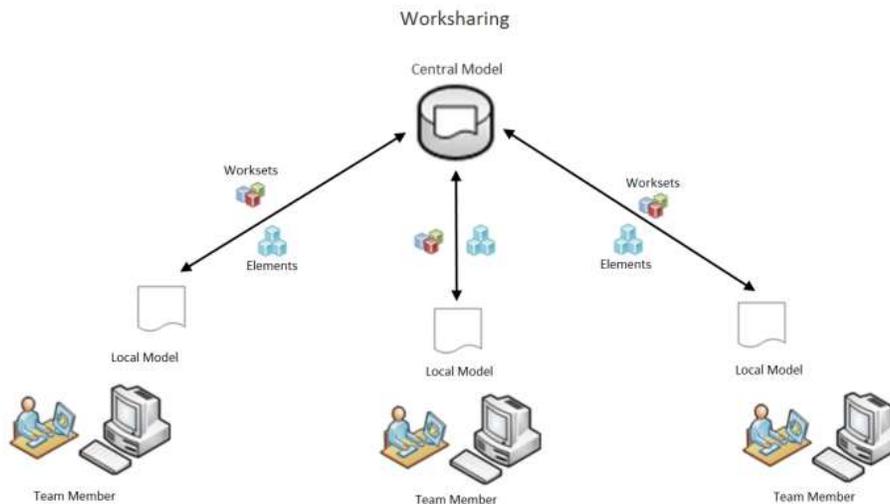
⚠ Tip: Revit 2018.2 comes with new precast families for beams, columns, slabs, and foundations. For further details, please refer to this [BIM and BEAM blog post](#).

Coordination with MEP Engineers and Architects

In order to achieve multi-disciplinary coordination, in Revit there are several choices to go, depending on preferences and established level of communication with other companies and partners.

Worksharing in one model

Worksharing is a design method that allows multiple team members to work on the same project model at the same time. On many projects, team members are assigned a specific functional area to work on. Team members share a central model.



Revit projects can be subdivided into worksets to accommodate such environments. Worksharing can be enabled to create a central model so that team members can simultaneously make design changes to a local copy of the central model.

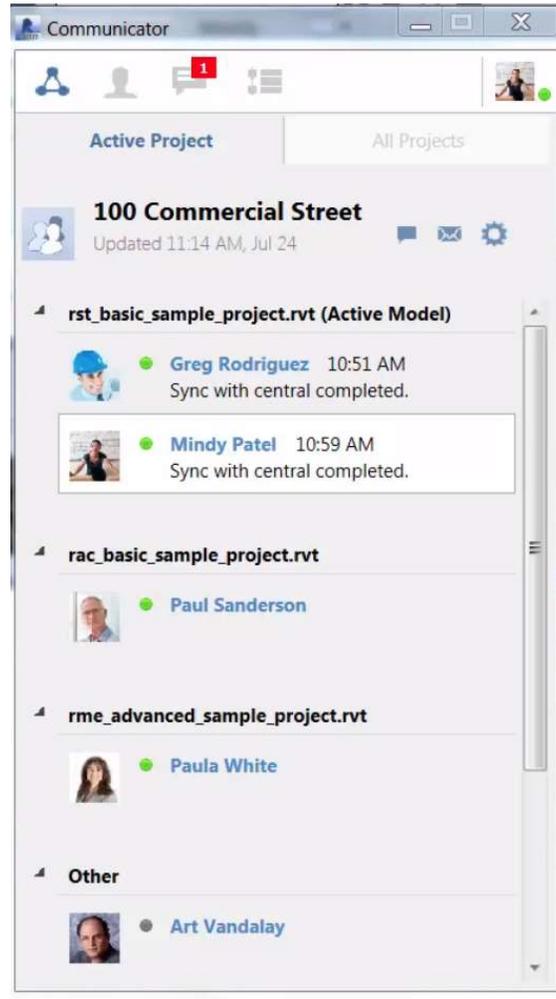
For further details, please refer to Revit's online help, [Worksharing in Revit](#) section.

Collaboration for Revit

The Collaboration for Revit service helps project teams from multiple disciplines, locations, or firms to collaborate in the cloud with centralized access to Revit models. It works in a similar manner to worksharing, but it offers the advantages of cloud storage of the model and a communicator chat tool.

As multiple personas are working in the model, communication in real time is possible using the chat tool and sharing snapshots adds more clarity to the discussion.

For further details, please refer to Revit's online help, [Collaboration for Revit](#) section.



COMMUNICATOR FOR REVIT

Linked models

Linked models can be used when individual buildings on a campus or different parts of a large building reside in separate project files, or when each discipline works in its own edition of a building model.

Architectural models, structural models, and MEP models.

Tip: Linked models are listed in the Revit Links branch of the Project Browser.

Tip: Linked Revit models can be converted to groups, and groups can be converted to linked Revit models.

For further details, please refer to Revit's online help, [Linked Models](#) section.

Revit, Dynamo and Navisworks for better MEP Coordination

Clash detection can be conducted on building elements like walls vs. ducts, walls vs. pipe, and beams vs. pipe in a Navisworks coordination model containing MEP and structural design models from Revit.

Using Dynamo within Revit, scripts can be created and run to perform a background clash test using the Navisworks core, and return visual feedback in the active Revit project with Clash Indicators and 3D Clash Views.

Running the Dynamo script, allows change of the Clash property of the analyzed elements, creates separate sectioned 3D views showing each clash, and places an indicator (by means of a 3D arrow with attributes) in the Revit model at the clash points.

Navisworks also gives the ability to change the status of clashes to Resolved, Approved or Reviewed. Comments can be added to keep team members informed regarding the clash.

For further details, please refer to this [BIM and BEAM blog post](#) and to Dieter Vermeulen's AU Online class – CS21553: Construction Dynam(o)ite—Explode Productivity with Dynamo (click on class title).

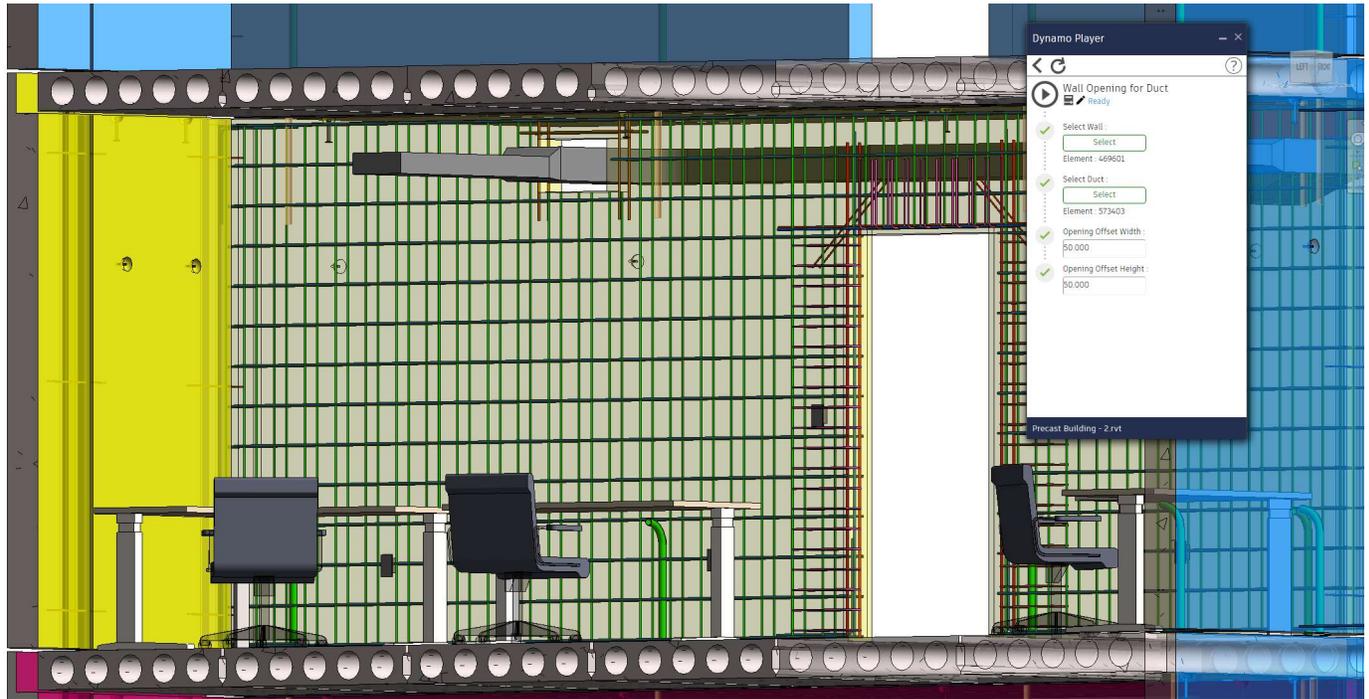
Dynamo Player for MEP openings in walls

Being a very powerful tool, Dynamo can be used also to generate openings for MEP ducts or pipes crossing through structural walls.

Once the script is created, its usage throughout various projects is eased by the Dynamo Player. It allows performing all the selections and parameter inputs directly in Revit, so that the clash prevention can be performed from one single environment.

Next step is to reinforce the openings and here the Dynamo Player can be used once again, to run a script that places rebars according to predefined rules.

Depending on the complexity of the scripts, multiple ducts and walls could be selected at the same time to generate multiple openings simultaneously and the same can be performed for the reinforcement stage.



DYNAMO PLAYER FOR MEP OPENINGS IN WALLS

Coordination using BIM 360 Team

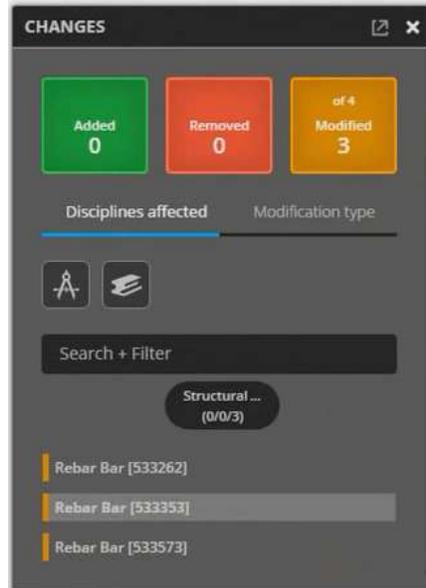
BIM 360 Team provides a cloud based project management workspace for all team members, helping them to communicate and stay organized at all times.

One of the main advantages of the platform is that it is available anywhere, on any device, and it runs in a web browser, so Revit is not needed to review the model or the shop drawings.

Feedback can be easily provided or solicited with comment and markup tools. Drawings can be redlined, complex 3D models can be commented on and all project feedback can be kept organized.

Multi-user, live review sessions, with built-in browser sharing facilitates more informed decision making, faster buy-in from clients, stakeholders, and design partners.

Version history ensures access to the latest information, historical design iterations, and eliminates the risk of project files getting lost or overwritten. The “Compare version” tool allows an easy visualization of the elements that have been added, removed or modified, filtered per discipline.



BIM 360 TEAM – COMPARE VERSIONS TOOL

Drive fabrication of precast elements via CAM files

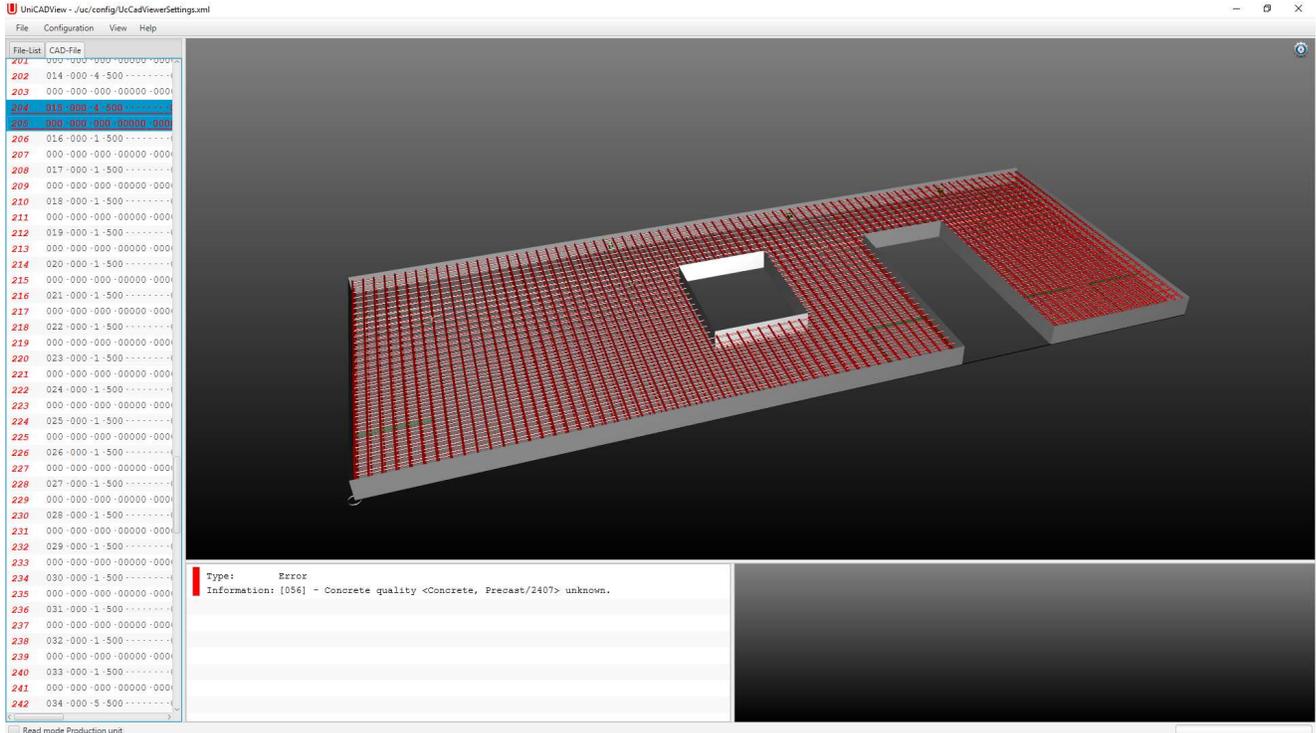
CAM files have a wide range of uses downstream, once the modelling and detailing in Revit of the precast element has been complete. It is consumed by Enterprise Resource Planning (ERP) software, by software for production validation of data generated from the Revit model or by logistics tools.

Factory uses of CAM files

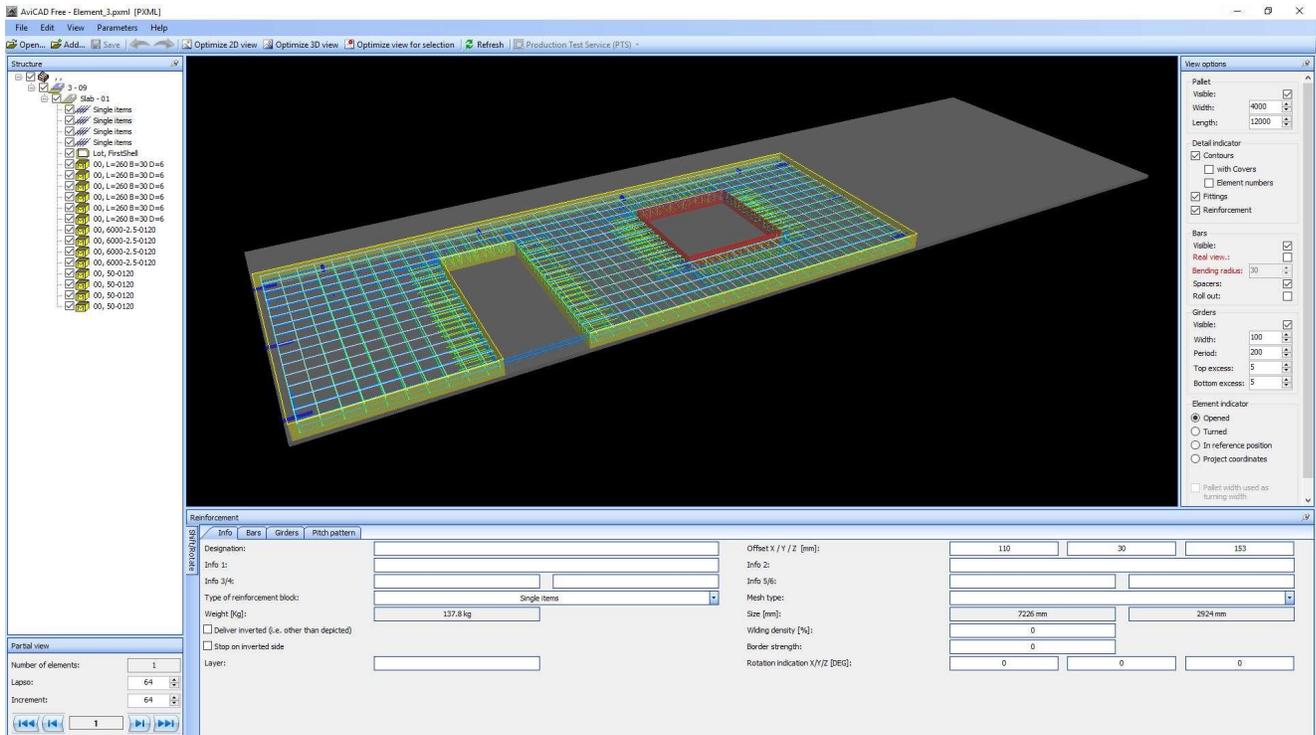
Any precast factory, depending on its level of automation, is equipped with industrial robots or machines that perform various tasks in the fabrication process of the precast elements. A sample list of machines that leverage either Unitechnik or PXML files could look like this:

- Shuttering robot
- Plotter that marks sports on the production table for embedded parts
- Mesh spacer robot
- Mesh welding machine
- Rebar bending machine
- Concrete distributor robot
- Slip form machine
- Curing chamber
- De-shuttering robot

All the geometrical characteristics defined in the Revit model are transferred via the CAM files to these robots. But before production can really start, each element has to be checked and this can be done using UniCADView, developed by Unitechnik Systems GmbH, or AviCAD, developed by Progress Maschinen & Automation.



PRECAST SOLID WALL CHECKED FOR PRODUCTION USING UNICADVIEW, BASED ON A UNITECHNIK FILE



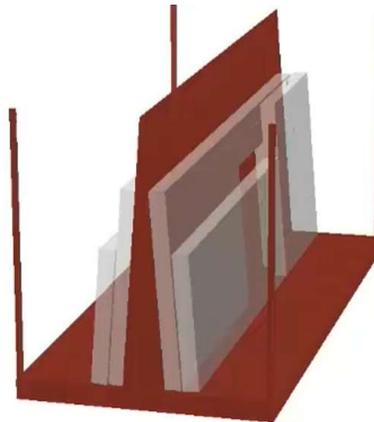
PRECAST SOLID WALL CHECKED FOR PRODUCTION USING AVICAD, BASED ON A PXML FILE

Logistics uses of CAM files

CAM files can also be directly used by logistics software for stacking and palletization of precast elements.

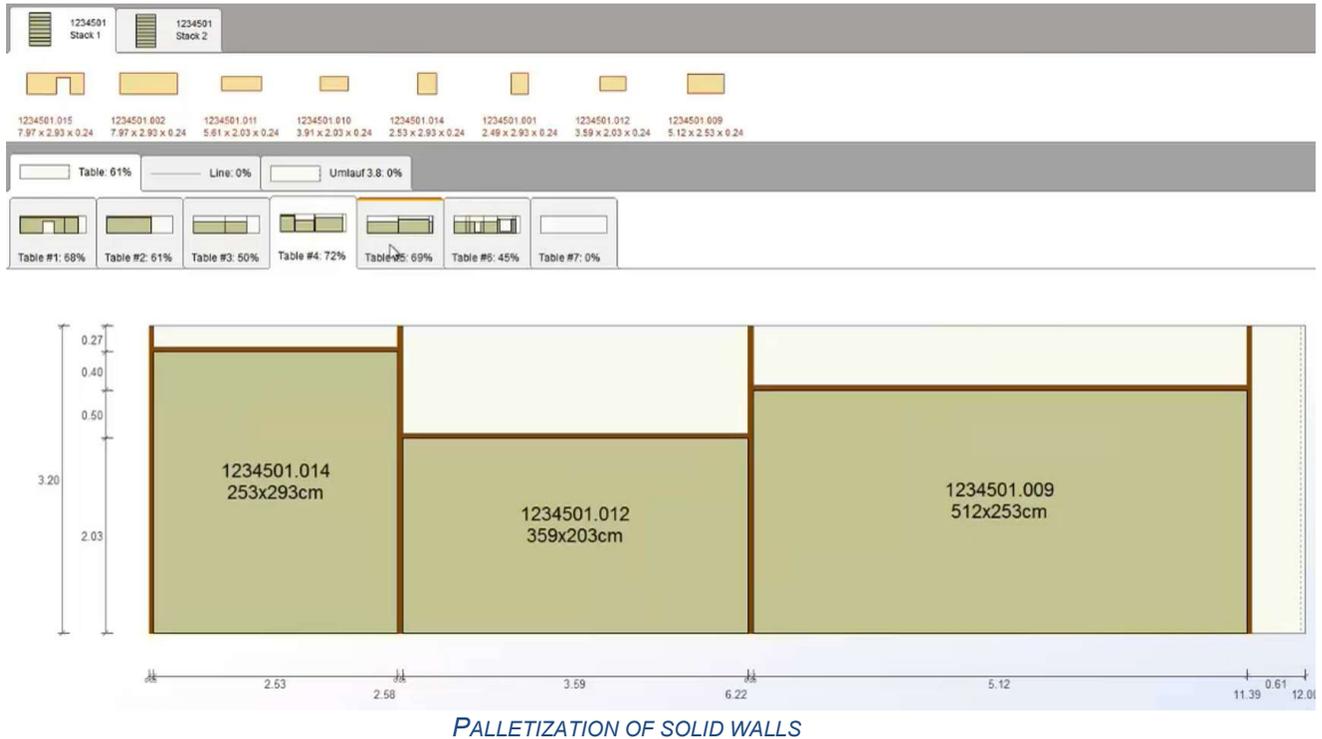
Two solutions in this field come from IDAT GmbH, and are called precisely “Stacker” and “Palletizer”. These programs work with the machine data generated by Precast for Revit and are therefore fully compatible with modern production technology and central computer systems. They can be run independently on separate PCs and Revit is not required.

The Stacker program is responsible for transport stacking. The transportation of precast units to the construction site can be planned here. The installation sequence on the construction site is also indirectly established here since the prefabricated units are stacked or unloaded on the construction site in reverse order.



STACKING OF SOLID WALLS

The Palletizer program is responsible for pallet or lane allocation during production. Palletizer works directly with machine data from the CAM file or stacking program.



Enterprise Resource Planning uses of CAM and Revit files

ERP software is typically used for technical and production planning, materials management, logistics, staff and finance planning. This is the place where multiple departments engaged in the project analyze and plan which specific materials and accessories can be used and when.

IDAT ERP

One solution that could be used for ERP is IDAT ERP, which covers the special requirements of the precast concrete industry and can be configured for each project's requirements. Through IDAT's web-based solution, tailored information is available to the user at any time, on any device, whether desktop, smartphone or tablet.

PTAC EDGE^ERP

PTAC's EDGE^ERP is another powerful solution that allows for production planning, tracks parts for inventory relief and provides the information required for cost accounting. It consumes EDGE^Revit models and it can be well integrated together with PTAC's coordination solution EDGE^Cloud.

Productivity and modeling precast tools for Revit

For an enhanced productivity during the modelling and detailing process in Revit, Autodesk’s partners in the structural space have created multiple tools. In this section, some of these are briefly reviewed, highlighting their main capabilities. These are tools that either help during the multi-disciplinary coordination stage, or they allow for a faster and more precise precast elements modelling, complementing Autodesk’s solutions.

AGA-CAD Precast Concrete

The Precast Concrete suite from AGA-CAD includes a set of features that enables modelling of prefabricated concrete walls, floors and columns.

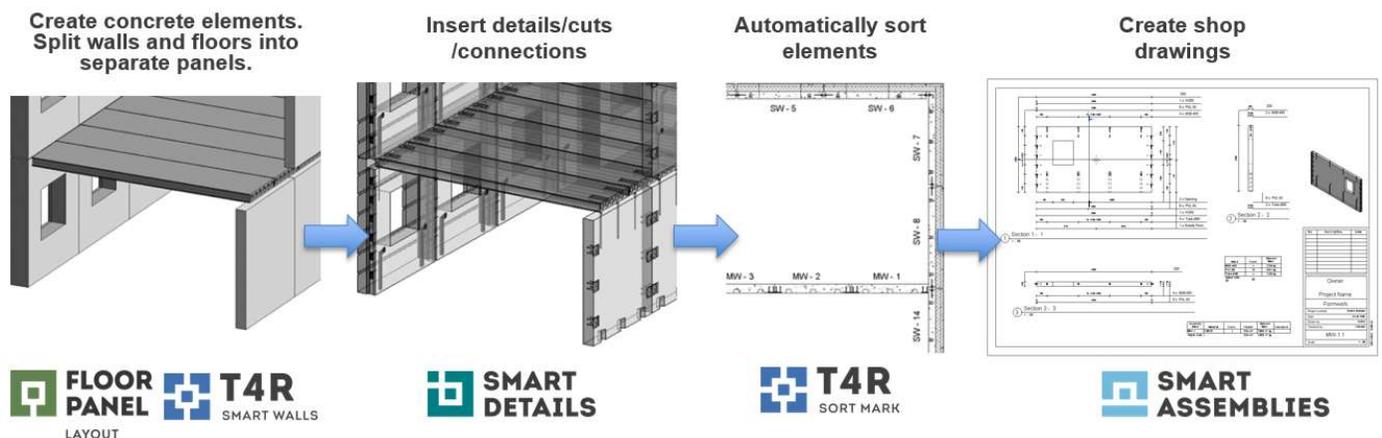
Floor Panel Layout – prefab floor paneling – automatically divides an architectural floor into regions by using supports, edges, and openings. It creates individual floor segments – solid or hollow core slabs – according to panel layout. The created panels can easily be controlled, aligned, modified, or additionally split.

Smart Walls – wall and join management – divides walls and controls, changes or updates gaps between them. It also decomposes multilayer walls into separate walls while keeping openings in place

Smart Details – connections, cuts and details – Inserts grout tubes, cast-in plates, anchor bolts, lifting bolts and cuts on any surface of beams and walls, based on rules.

Sort Mark – automatic sorting – sorts and adds “Mark” values to precast elements on the basis of their volume, location, ID, length or any other available parameters.

Smart Assemblies – automatic drawings – creates views of foundations, walls, stairs, beams, columns and floors with automatic dimensions and places them into sheets.



AGA-CAD PRECAST CONCRETE

AGA-CAD Tools4BIM for MEP coordination

The AGA-CAD TOOLS4BIM have a very useful feature, “Cut Opening”, for coordination with MEP objects. It creates openings with fire safety components throughout a Revit model where ducts, pipes, cable trays and conduits intersect with walls, floors, roofs, ceilings, beams and columns.

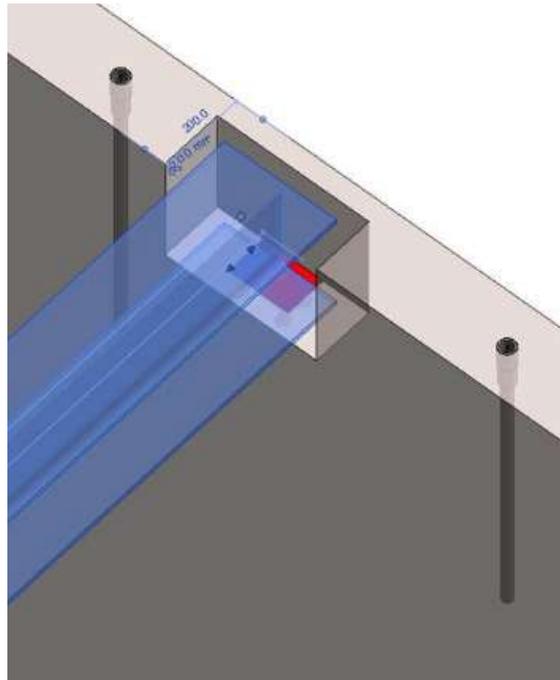
The software lets MEP engineers define and reserve holes which structural engineers and architects can review, revise if needed, and validate. It then automatically inserts openings with fire safety components into the architectural or structural model. It does so based on openings’ locations and types of clashes with building structures, as well as the predefined sizes and joining intervals for ducts, pipes, cable trays and conduits.



MEP OPENINGS GENERATED BY “CUT OPENING” TOOL

“Cut Opening” also works with IFC files. MEP objects can be link imported into current Revit model where real elements are placed.

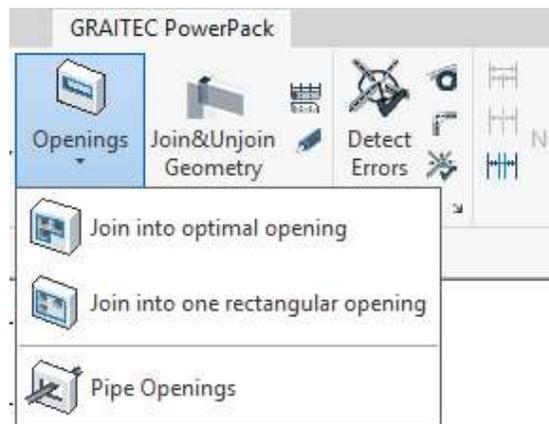
Additionally, the tool can be used to creates openings with special holding details for structural beams.



OPENINGS WITH SPECIAL HOLDING DETAILS FOR STRUCTURAL BEAMS

Graitec PowerPack for MEP coordination

The Graitec PowerPack for Revit comes with a tool that is particularly useful for creating and managing openings for MEP equipment at the intersections with structural elements. The “Openings” feature adds greater accuracy and control to the MEP modelling and office design practices and processes.



OPENING TOOL FEATURES

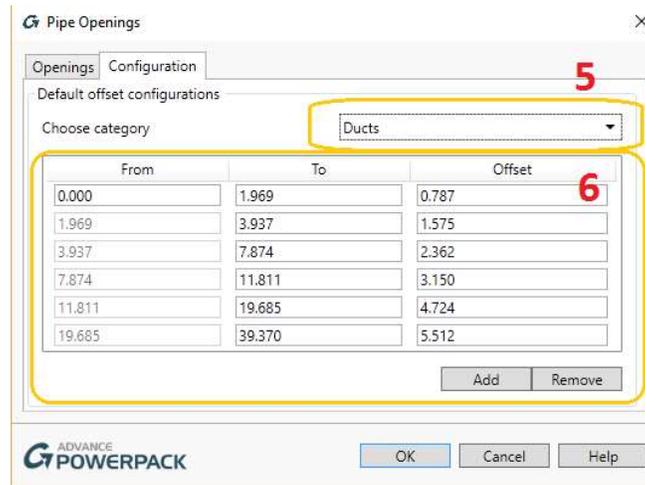
From a workflow perspective, it is recommended to start with the “Pipe openings” command, that allows the configuration and generation of openings. The following information can be managed via the two tabs, “Openings” and “Configuration”:

1. Openings Tab – View and control Openings in the current model

2. Configuration Tab – Adjust preference settings (see below)
3. Openings to Create – A display of possible openings not yet created and their details
4. Openings Already Created – A display of Openings and their status
5. Choose Category – Filter the type of element for which to adjust settings
6. Range Settings – Assign offset distances for different element size ranges
- 7.



PIPE OPENINGS – “OPENINGS” TAB



PIPE OPENINGS – “CONFIGURATION” TAB

Changes can be tracked and managed using this feature, with the help of color legends.

Linked models are also handled by the tool, so MEP engineers can work in separate files without any risk of affecting the coordination process.

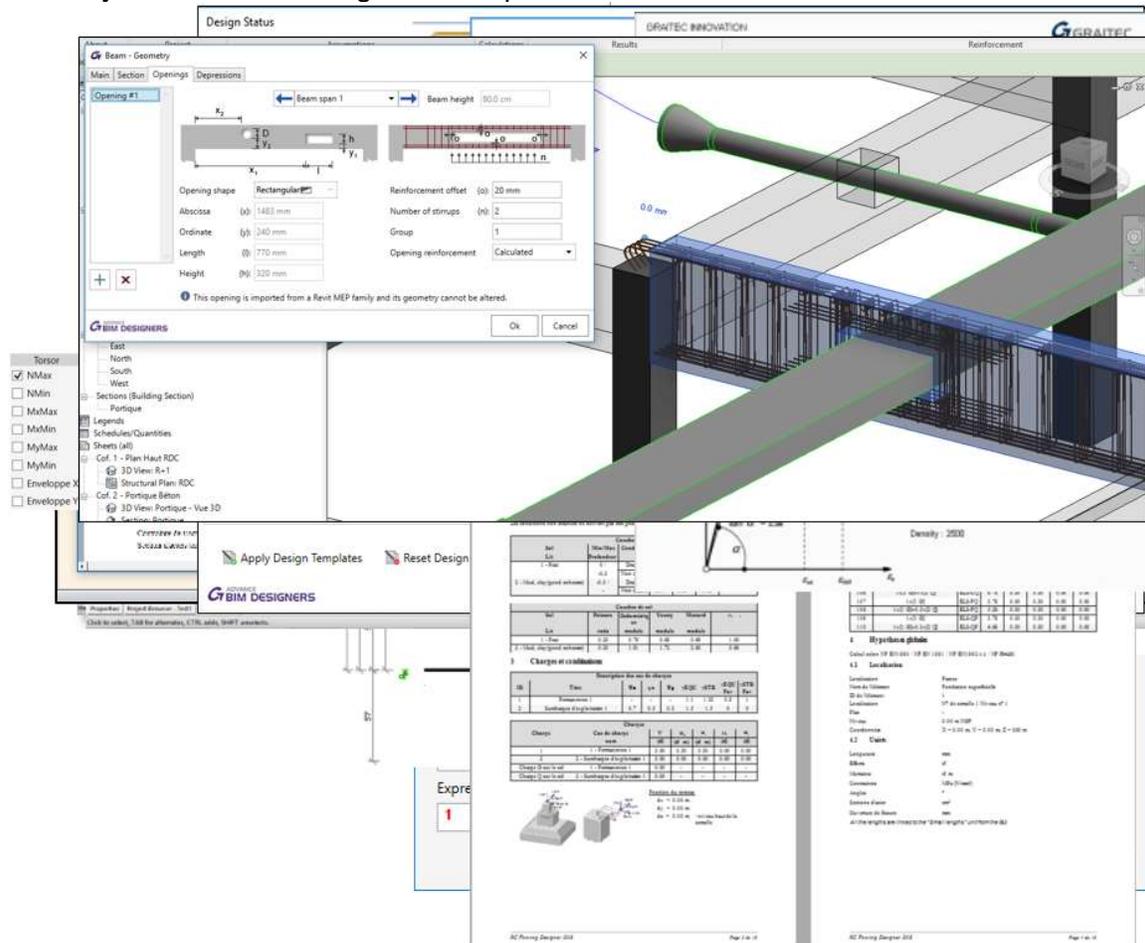
“Join into optimal” and “Rectangular” openings are for larger openings, more commonly used by Architects and Structural designers for elements such as lift shaft openings.

Graitec BIM Designers

The Graitec BIM Designers is a set of tools that can be used for precast projects with framing elements (columns and beams) and isolated foundations. It is a solution for improving structural projects management, helping users to create, design, document, track and control structural members of a BIM project.

The main features of the app are:

- Design rebar cages according to Eurocodes and North American codes
- Create parametric 3D rebar cages
- Groups of elements to design and produce 3D rebar cages on a group in one click
- Produce Design reports and graphical results
- Automates the creation of rebar views, 2D rebar details and lists
- Tools for easily editing rebar and adding bending schedules
- Fully customizable using Revit templates



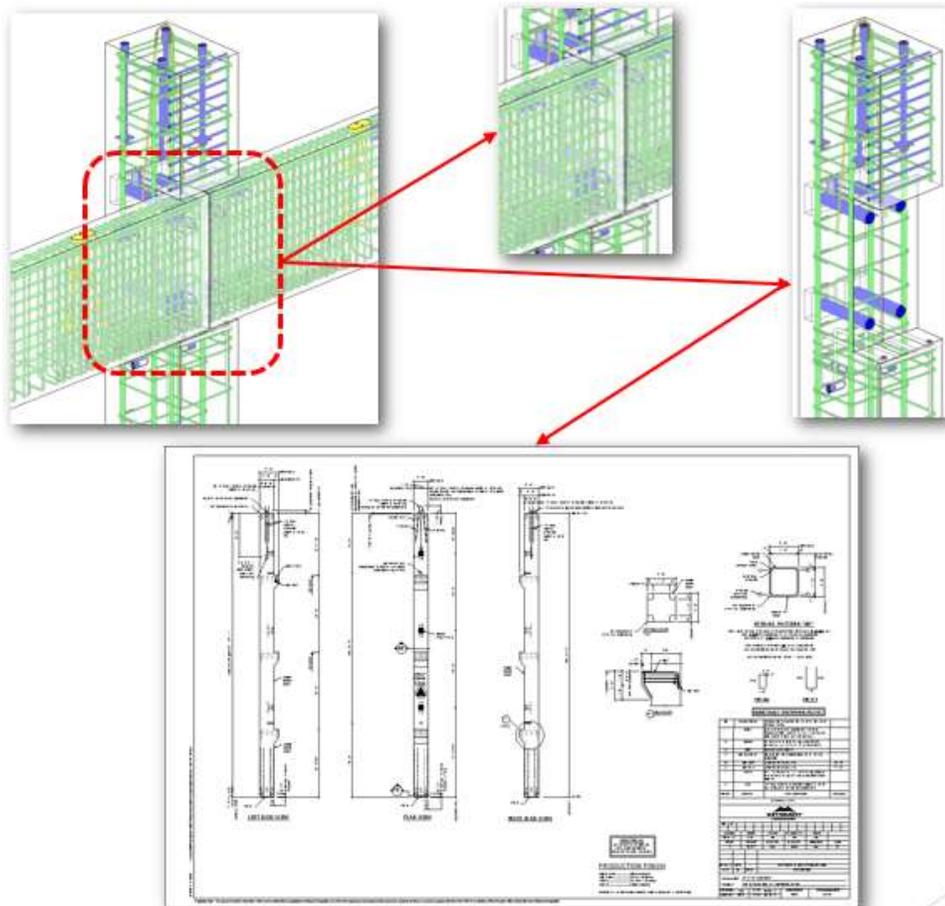
GRAITEC BIM DESIGNERS

PTAC EDGE^Revit

EDGE^Revit can be implemented for more seamless collaboration across multiple disciplines and it provides support for the estimation, production, and erection phases of the precast life cycle.

The main features of the app are:

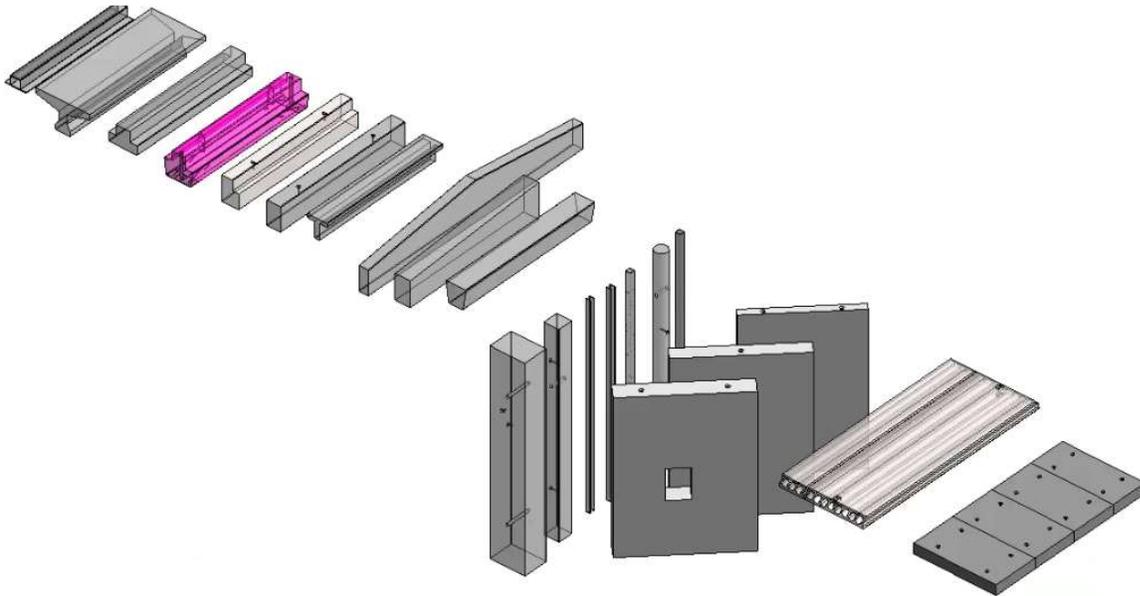
- Allows for continuous tracking of reinforcement
- Automatically assigns mark numbers
- Tracks all materials and purchased items for ordering
- Provides an interface from sales/estimating to fabrication
- Automates much of the fabrication drawing process
- Serves as an interface for project management of the precast lifecycle



PTAC EDGE^REVIT

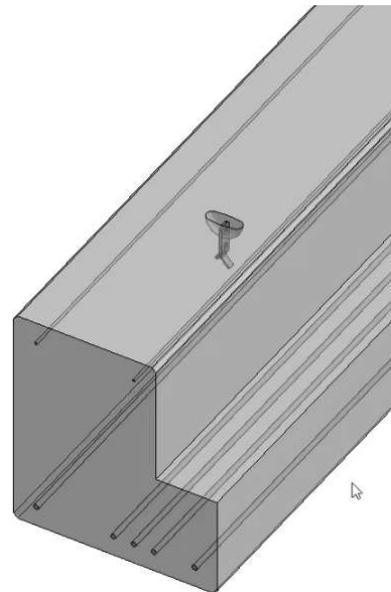
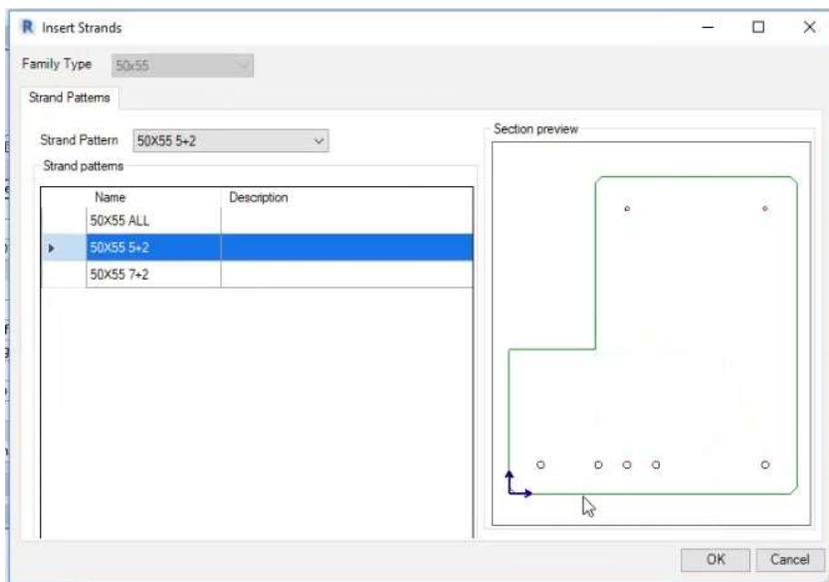
StruSoft IMPACT Revit

IMPACT Revit delivers a set of productivity tools for precast columns, beams, hollow core slabs, solid walls and solid slabs. It comes with a library of several precast modules with adjustable elements, depending on project's or company's requirements.



STRUSOFT IMPACT REVIT

Prestressed beams are also supported, having a versatile strands configuration.



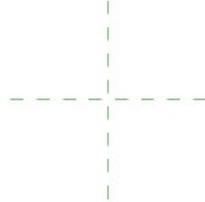
PRESTRESSED BEAMS CONFIGURATION

Built-in parts and reinforcement is added based on different configuration settings. Shop drawings can then be created for the supported types of elements.

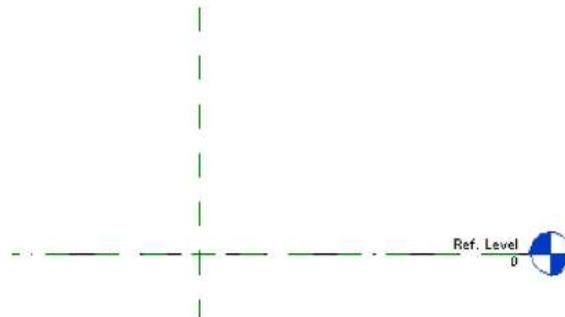
Annexes

Hollow core slab – Creation of a hollow core type family

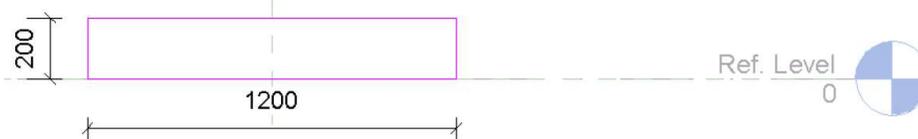
1. Create a new family using the “Metric Generic Model.rft” template



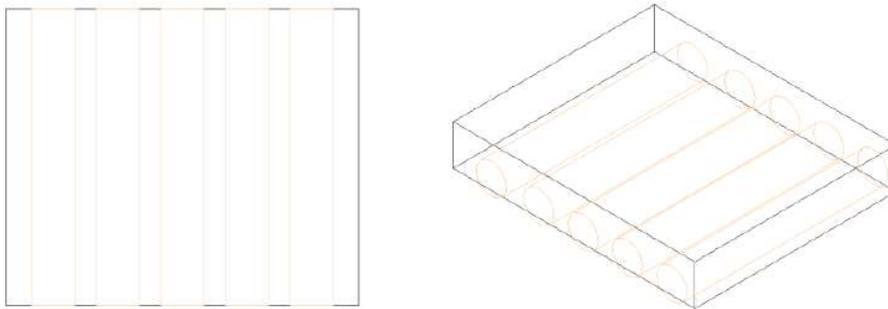
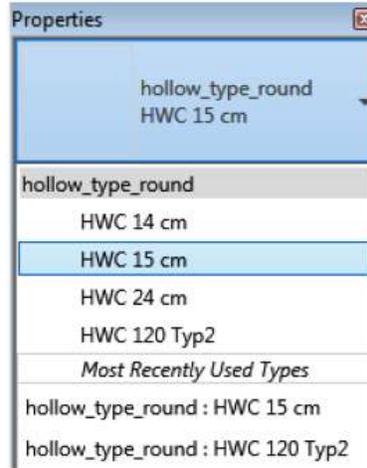
2. Switch to the front view



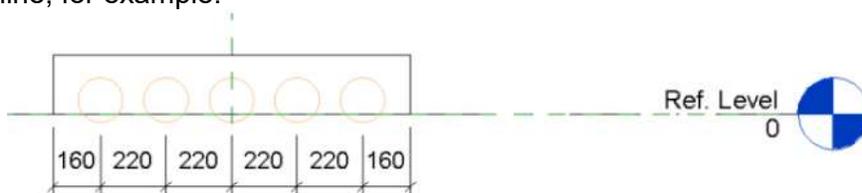
3. Create a new extrusion object: Create → Forms → Extrusion
4. Create a new rectangle above the reference level 0: Modify | Create Extrusion → Draw → Rectangle. The rectangle width will represent the width of the hollow core (here 1200 mm) and the rectangle height must be equal to the element height (here 200 mm). The extrusion can have any length (here 1000 mm).



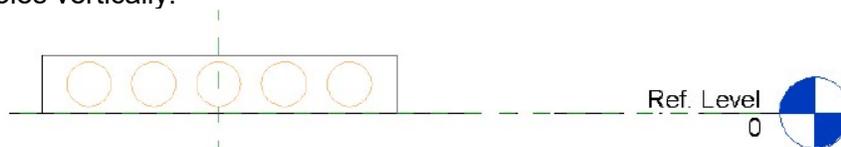
5. Finish the edit mode: Modify | Create Extrusion → Mode → Finish Edit Mode. The extrusion is the virtual hollow core element and will now be set up for the hollow core type.
6. Switch to the 3D view → view from top (the holes are placed on the top face).
7. Insert hole: Create → Model → Component. Load the void family, choose the family type and place the void in the extrusion body.



- Switch back to the Front view and correct the horizontal position of the holes by using dimension line, for example.

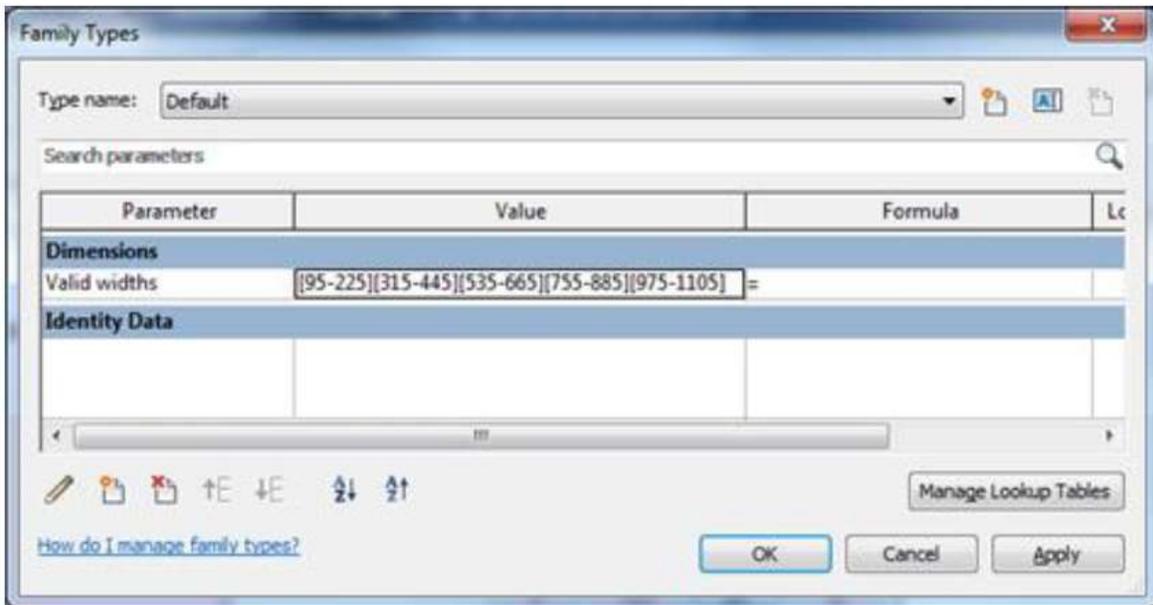


- Modify the vertical position of the holes by changing the “Position from top” parameter of the holes. In this example the parameter is set at 100 mm (half of the element thickness), to center the holes vertically.

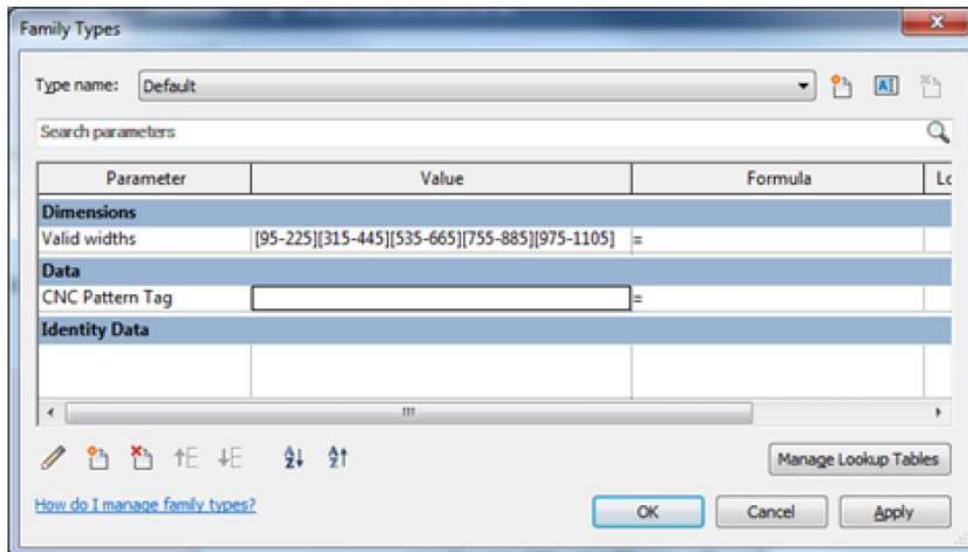


- Define the “Valid Widths” as parameter: Create → Properties → Family Types → Add... → In the new dialog select Shared Parameter, click the Select button to choose the shared parameter file “Shared Parameter.txt” from the Program Data folder, then select the “Valid Widths” parameter. Close the Shared Parameter dialog and the Parameter Properties dialog. Set its value to the valid widths for the hollow core types. These are the widths where the element can be cut. You can define any number of intervals in the [from-to] format. All values must be between 0mm and the element width.

Example: [95-225][315-445][535-665][755-885][795-1105].



- Repeat the previous steps to add the shared parameter “CNC Pattern Tag”. This parameter should be grouped under Data category. This string will be added in the CAM file for the hollow core slab under GenericInfo1.

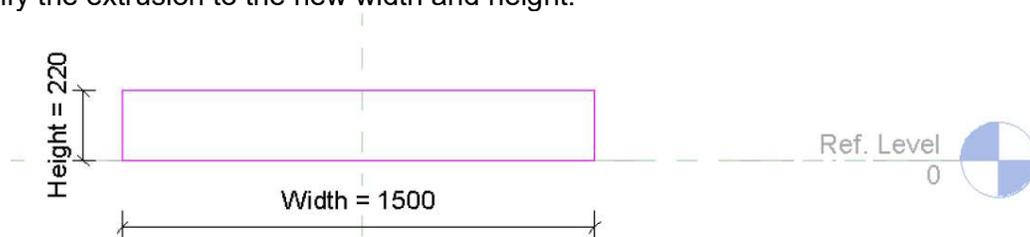


- If a family type has been created (for example if the “Name” box is not empty): create at least one type so that it can be seen in the Configuration.
- Close the dialog and save the family as “Hollow Core Slab....” in the “Custom Slabs” template folder.

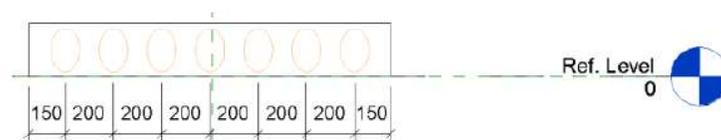
Creation of a hollow core type family by copying an existing one

An existing family (here the previously defined family with the element width of 1200 mm, height of 200 mm and round holes) is copied and as new family is created from the copy (here with the element width of 1500 mm, height of 220 mm and oval holes).

1. Open the “Hollow Core Slab.rfa” file and save it as the new “Hollow Core Slab 220 mm.rfa” file.
2. Switch to Front view.
3. Delete the old holes.
4. Select extrusion object of the box and go to Modify | Extrusion → Mode → Edit Extrusion.
5. Modify the extrusion to the new width and height.



6. Finish the edit mode: Modify | Extrusion → Edit Extrusion → Mode → Finish Edit Mode.
7. Switch to 3D view, move the camera to view from the top and place oval holes in the top face.
8. Switch back to Front view and position the holes horizontally and vertically, as described in the previous example.



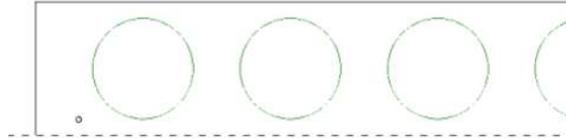
9. Modify the Profile Type and Valid Widths parameters: Create → Properties → Family Types.
10. The family type name, if defined, must be set to the new family name.
11. Close the dialog and save the file (double check that the filename is the new one, to prevent overwriting the old family type).

Hollow core slab – Create a hollow core type family with strands

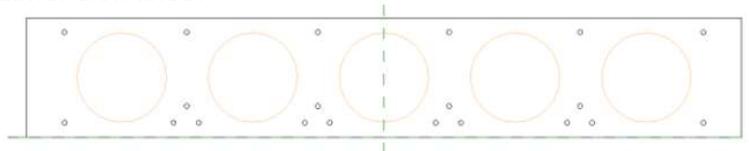
The easiest way to create a strands type family is to copy the corresponding hollow core type family. The element geometry is already there and the existing holes may help with positioning the strands.

1. Open the hollow core type family, for example, Hollow Core Slab.rfa and save it with a new name, Hollow Core Slab Strands1.rfa, for example.
2. Switch to the Front view and create the strands as cylindrical extrusions. The extrusion center will determine the centroid of strands. The extrusion can have any length.
 - Create extrusion: Create → Forms → Extrusion.

- Create a circle: Modify | Create Extrusion → Draw → Circle. Draw a circle with the strands diameter and position it roughly.
- Finish editing the extrusion: Modify | Create Extrusion → Mode → Finish Edit Mode.



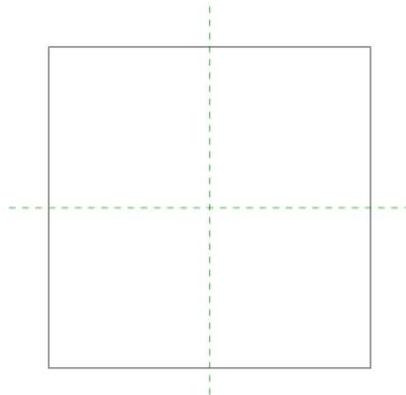
- Create new extrusions or copy the existing for all the strands. Position the strands exactly using dimension lines:



- Close the dialog and save the new family.

Hollow core slab – Creation of void family with elliptic profile

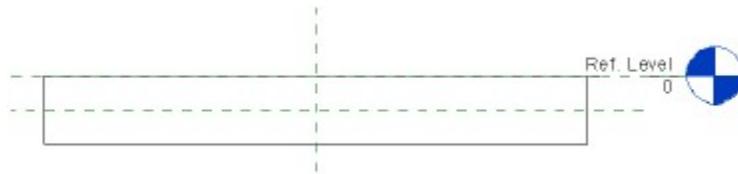
1. Create a new Family from the “(Metric) generic Model face based.rft” template.



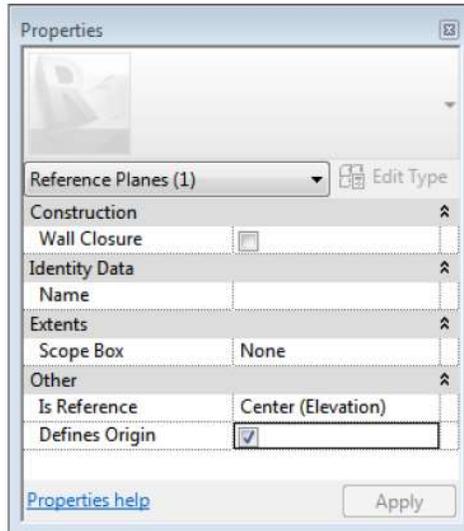
2. Switch to Front view:



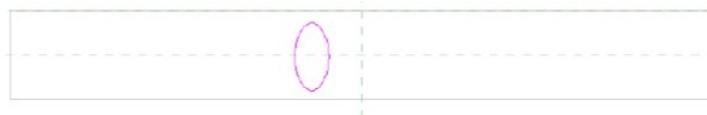
3. Create a new horizontal reference plane in the middle of the box: Create → Datum → Reference Plane:



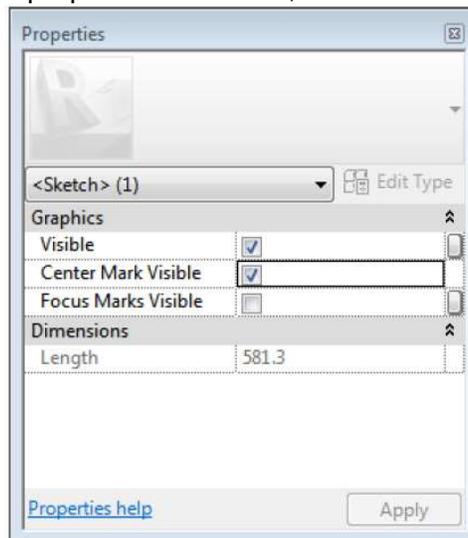
4. Select the new reference plane and in the properties, change the “Is Reference” parameter to the “Center” (Elevation)” value and set the checkbox for the “Defines Origin” parameter.



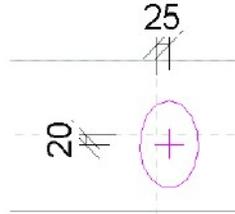
5. Create a new extrusion object: Create → Forms → Void Forms → Void Extrusion.
6. Create a new ellipse under the reference level 0: Modify | Create Void Extrusion → Draw → Ellipse.



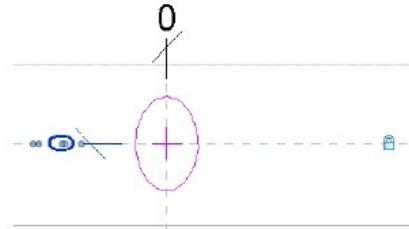
7. Select the ellipse and in the properties checkbox, check “Center Mark Visible”.



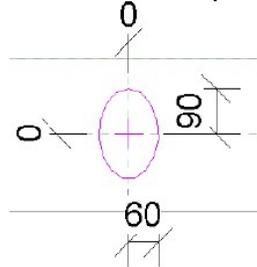
8. Create two dimension lines from the center mark of the ellipse tot the origin defined by the reference planes:



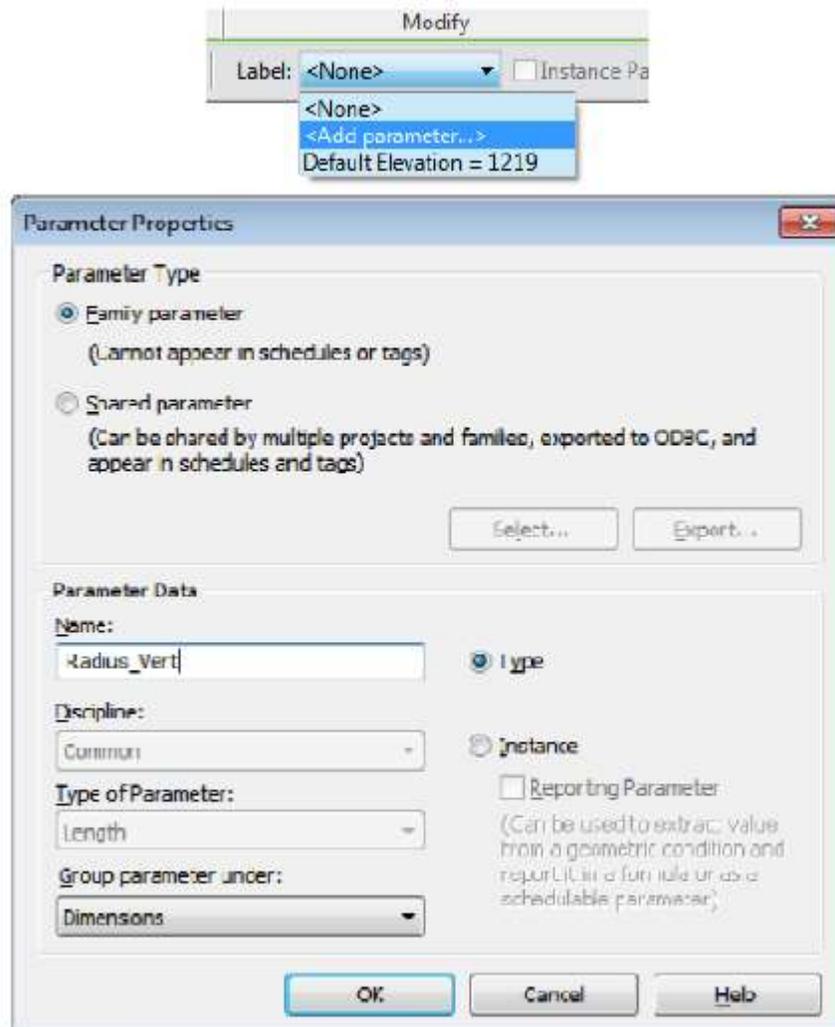
9. Select the ellipse, set both dimension values to 0 to move the ellipse tot the origin and close the locks to create a constraint.



10. Create dimension lines for both radiuses of the ellipse

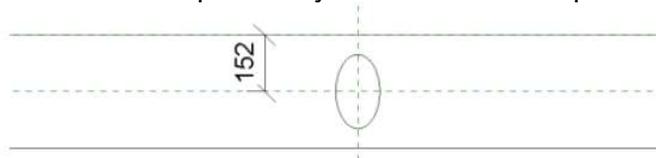


11. Optional: Define parameters to the dimension lines for the radiuses. For example, Radius_Vert and Radius_Horiz.

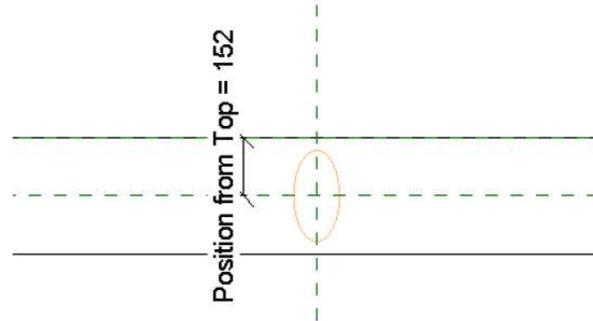


As type parameters, they are only necessary if family types for different sizes of the hole are created.

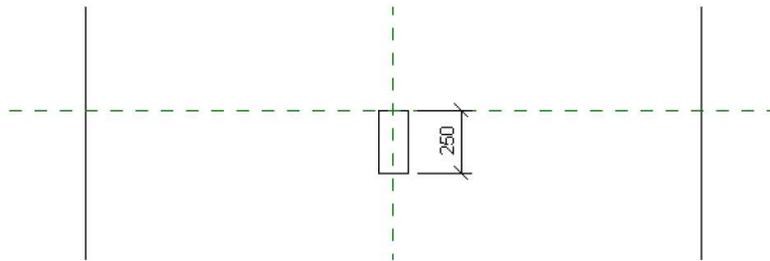
12. Finish the extrusion creation: Modify | Create Void Extrusion → Mode → Finish Edit Mode.
13. Create a dimension line from the previously created reference plane to the top edge.



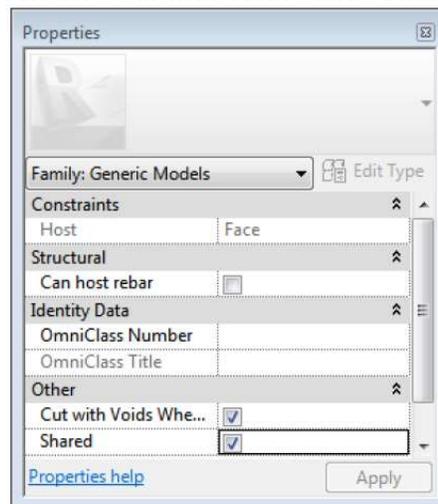
14. Step 14. Add the “Position from top” instance parameter as a shared parameter to this dimension line



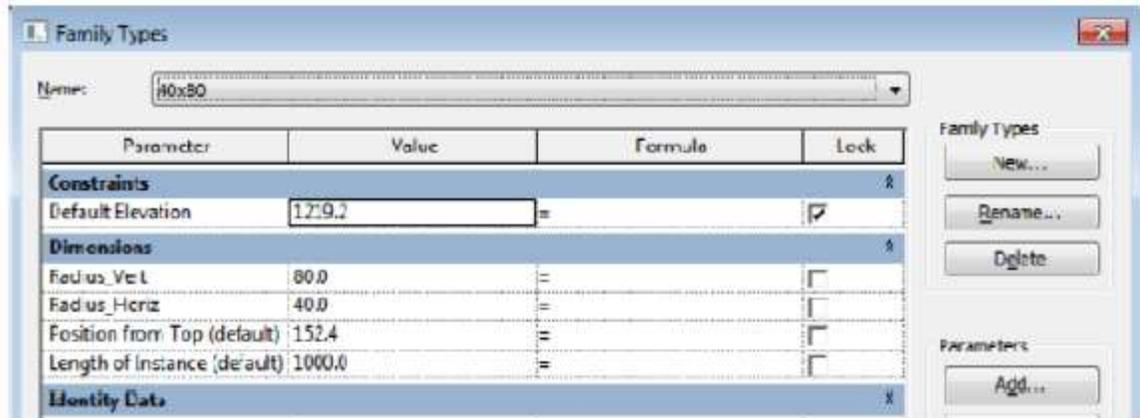
- Switch to the Floor Plan and select the extrusion object. In the properties, set the “Extrusion Start” parameter to 0.0. Then click on the small button next to the “Extrusion End” parameter and bind this to the “Length of Instance” shared parameter as instance parameter. Check if the extrusion starts at the origin reference plane: line.



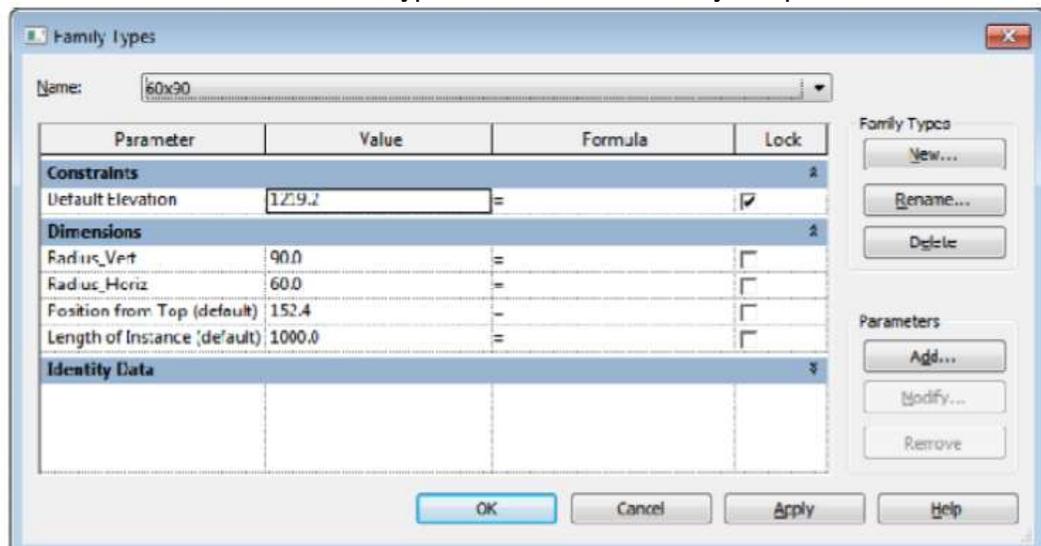
- In the family properties, check the “Cut with voids” and “Shared” parameters:



- Define family types: Create → Properties → Family Types. In this example, we will create two types: 40x80 and 60x90:
 - Type 40x80: Click the “New” button, type the name (40x80) and modify the parameters:



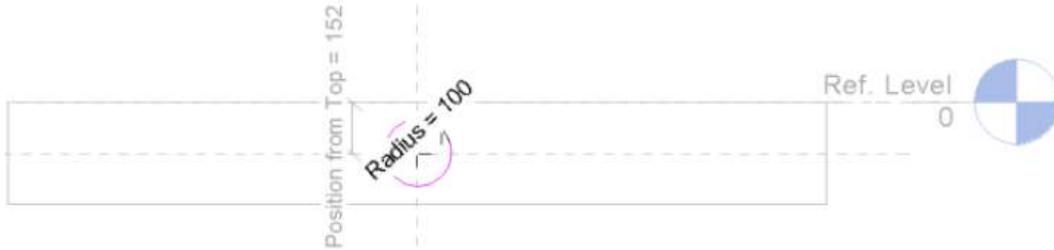
- Type 60x90: Click the “New” button, type the name and modify the parameters:



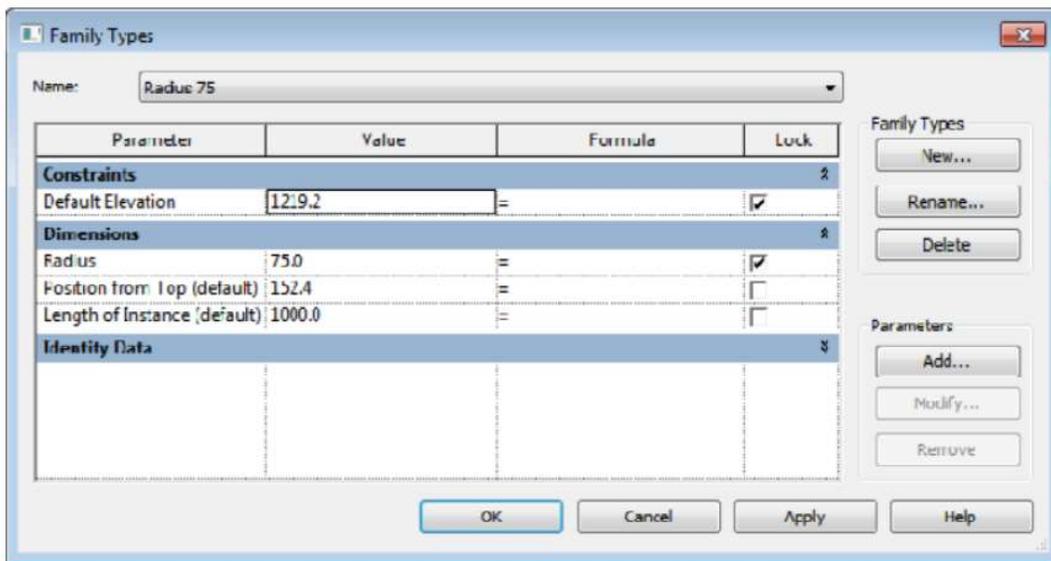
18. Close the dialog and save the file at the following location:
 C:\ProgramData\Autodesk\Structural Precast for Revit 2018\Families\[language]\Custom Slabs.

Creation of void family as copy from an existing family

1. Open an elliptic void family and save it as a new file “Round void.rfa”.
2. Switch to the Front view.
3. Select the extrusion object of the elliptic hole and modify it: Modify | Void Extrusion → Mode → Edit Extrusion.
4. Delete ellipse.
5. Create a circular sketch.
6. Create two dimension lines to move the center of the circle to the origin and close to the locks to create constraints.
7. (Optional) Create a dimension line for the radius of the circle and type parameter for the dimension line.



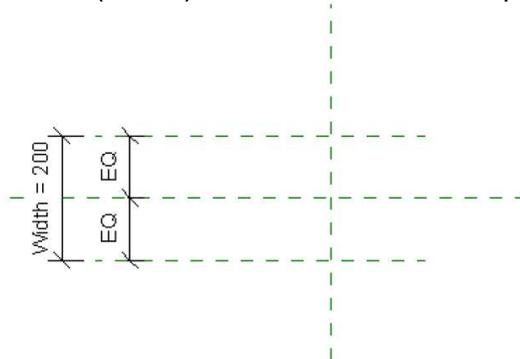
8. Finish editing the extrusion: Modify | Void Extrusion → Mode → Edit Extrusion.
9. Edit family types: Create → Properties → Family Types. Delete the “Radius_Vert” and “Radius_Horiz” parameters. Delete the “40x80” and “60x90” family types. Create new family types for the circle and modify the parameters accordingly. For example:



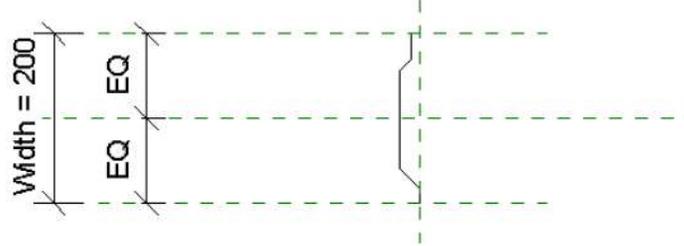
10. Close the dialog and save the file.

Hollow core slab – Creation of division profile

1. Create a new Family from the “(Metric) Division Profile.rfa” template.



2. Draw the profile: Create → Detail → Line. The profile must be defined left of the vertical reference plane, it must start from the bottom of the reference plane and end on top of the reference plane and it must be a continuous line. For example:



The vertical reference plane is the edge of the hollow core element.

3. Usually it will be necessary to create a profile for each floor thickness, since it is hard to define which part should change when the profile is used with another thickness.
4. Save the family, in the “profiles” program data folder as “Profile A.rfa”, for example.

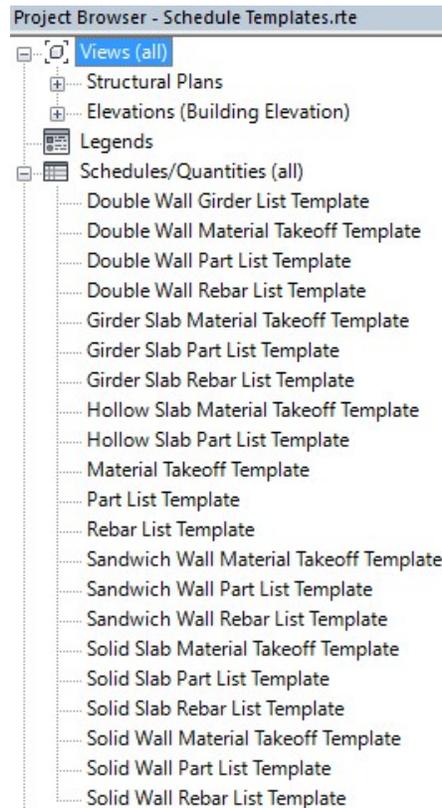
Hollow core slab – Known limitations

- Strands can have only one diameter;
- For inner openings, the free form will pass through the opening;
- The voids are not updated when the slab is modified so that the width of a hollow core slab is modified. This means that the user should re-split the floor to obtain the updated geometry.
- Strand diameters should be more than 5 mm;

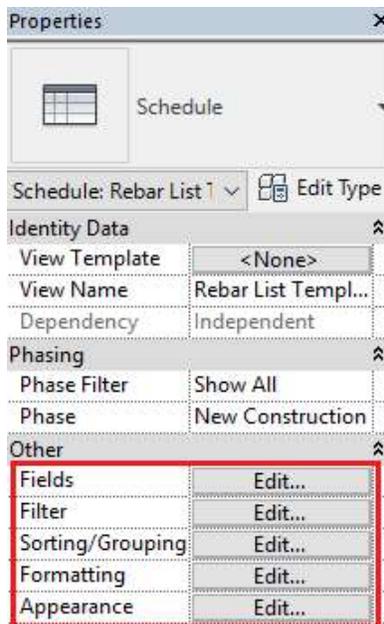
Customization of rebar schedules and part lists

To customize the rebar schedule and the part list, one may start from the “Schedule Templates.rfa” (or its corresponding translation in French or German) located in C:\ProgramData\Autodesk\Structural Precast for Revit 2018\Families\[language]\

In the project browser the list of existing templates is displayed.



Select the one that needs to be modified and then in the properties pallet click on the “Edit...” button of any section. The Schedule Properties window is opened and allows editing of fields, filters, sorting/grouping, formatting and appearance settings.



Note: Segmentation and parameters inside shop drawing are strictly related to the assignment of material to a precast element.

Dimensioning Mounting Parts

Overview

For a mounting part dimension lines are created in a view, if the following criteria are met:

1. The family of the mounting part defines special lines, which are invisible and are used as dimensioning points. (The lines can also be created in a sub-family, but only if the sub-family is “shared”).
2. The family of the mounting part defines no lines for dimensioning, but contains a solid with references at its extents. In this case the extents are dimensioned in all views. Or if
3. The family of the mounting part has neither lines nor a solid, but it creates a hole into the hosting element. In this case the mounting part is dimensioned together with the contour of the main element

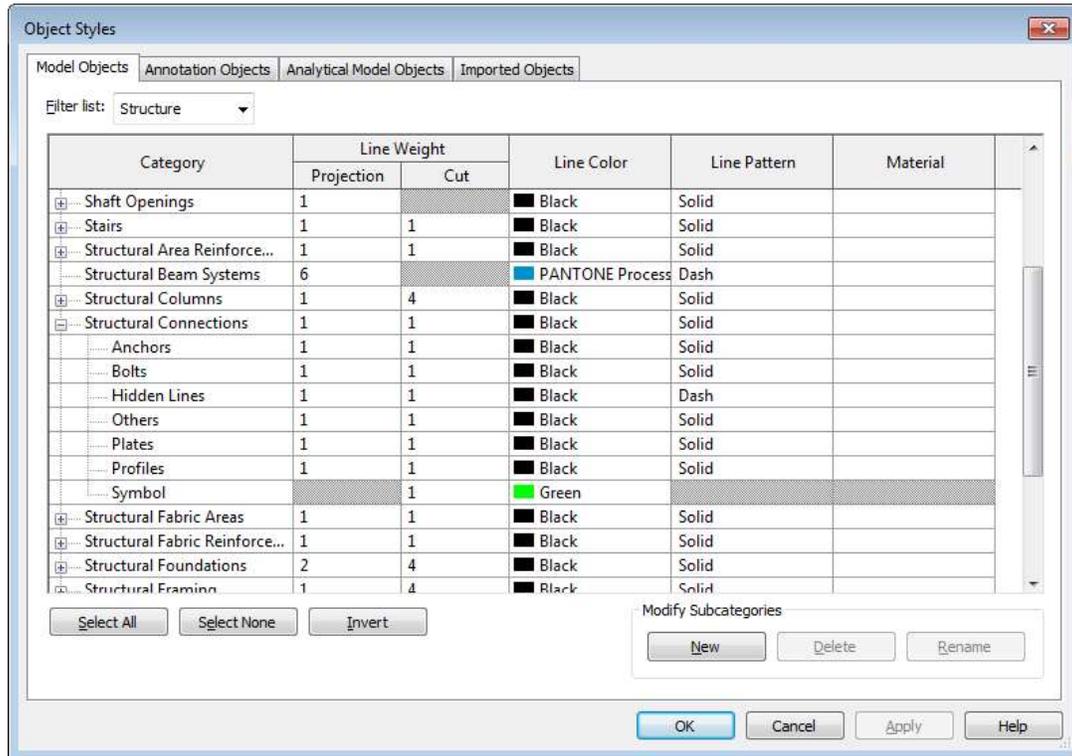
Define lines for the dimensioning

The lines used as references for the dimensioning on the shop drawing are standard model lines with a special sub-category defined for them. This subcategory or rather its name also defines in which views (seen from the mounting part) these lines are used to create dimensioning:

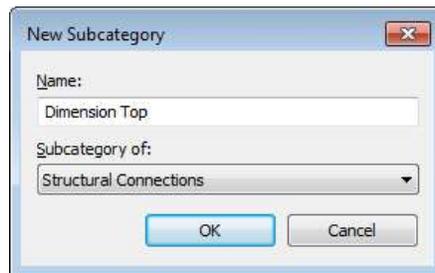
- *Dimension_Top* → View from top
- *Dimension_Front* → View from the front
- *Dimension_Side* → View from the side

Defining sub-categories

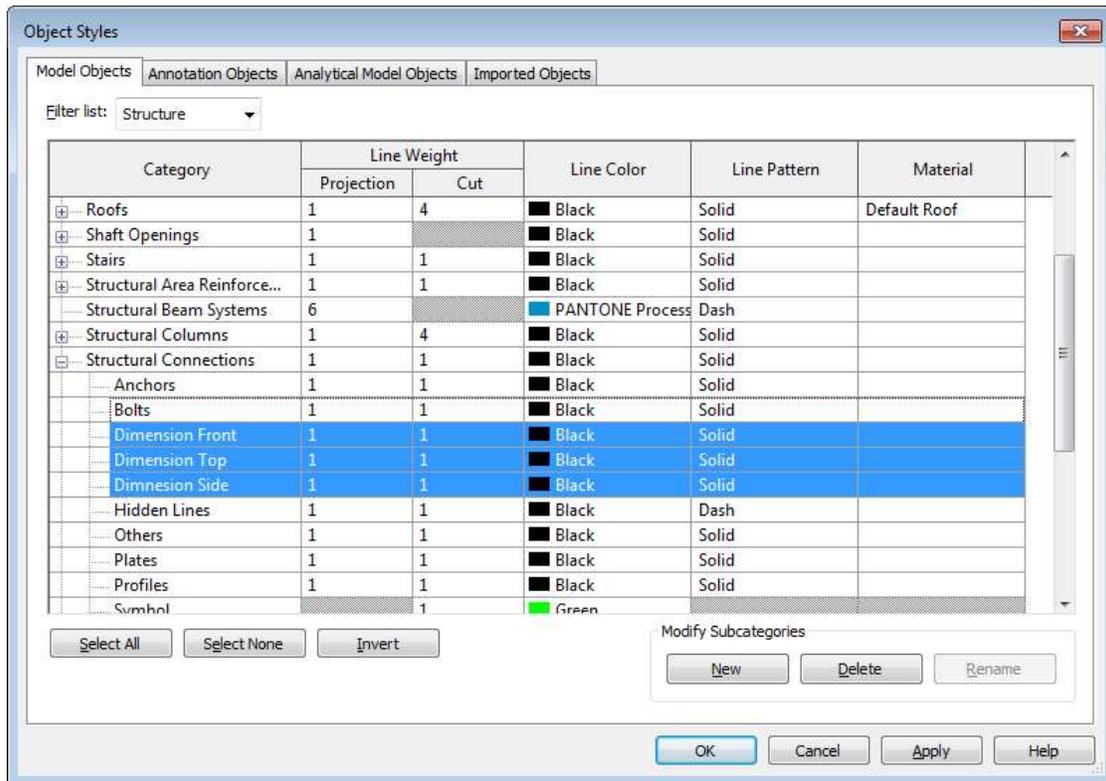
First one or more sub-categories with the desired names must be created: Manage → Object Styles:



The window contains a section “*Modify Subcategories*”. Click on “New”, and enter the desired name for the sub-category (see above for rules naming convention).



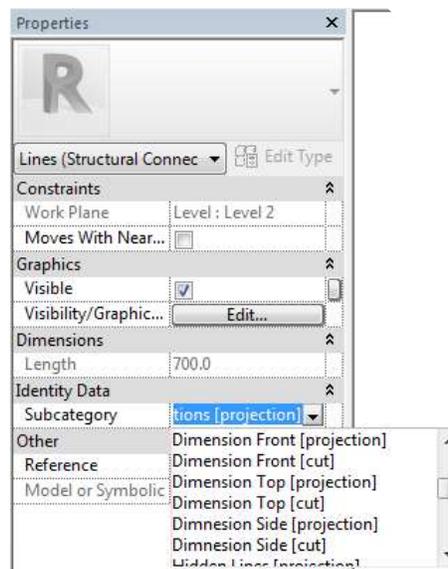
Repeat the steps in order to obtain the all necessary sub-categories.



Close Dialog *Object Styles* with OK.

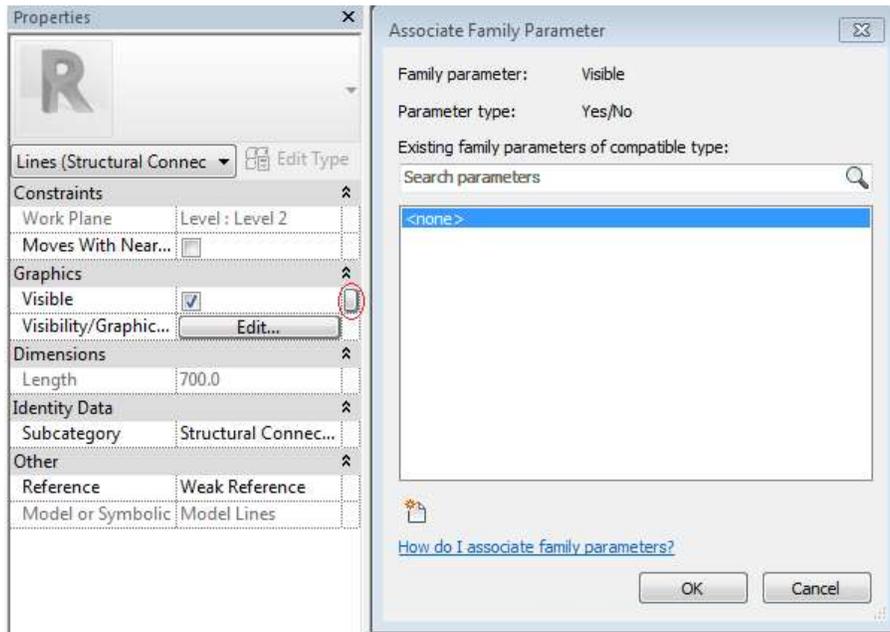
Create a family that you will later on use in your project.

Now the lines can be assigned to this new sub-categories (i.e. create a model line in a *Structural Connection* family and select it).

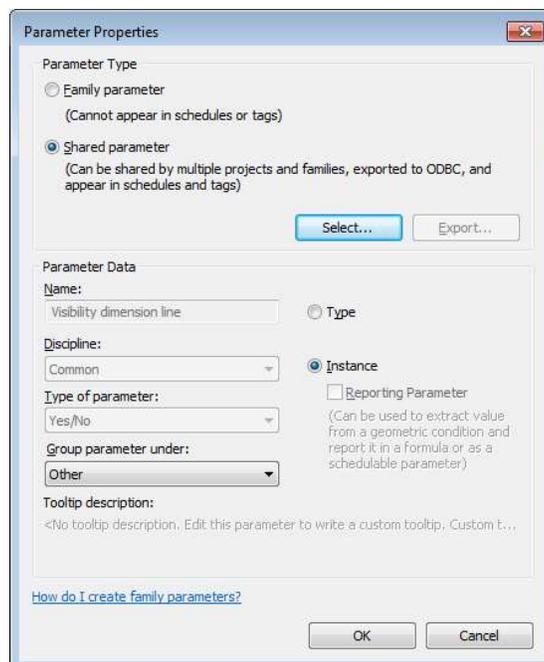


Define parameter for visibility

The line should be invisible normally so it does not change the appearance of the model. But to create the shop drawing, the line must become visible shortly (due to Revit limitation: cannot get reference of invisible line). To achieve this, the line needs a shared parameter attached to its “Visible” property. In the properties of the line click the button next to the parameter “Visible”:

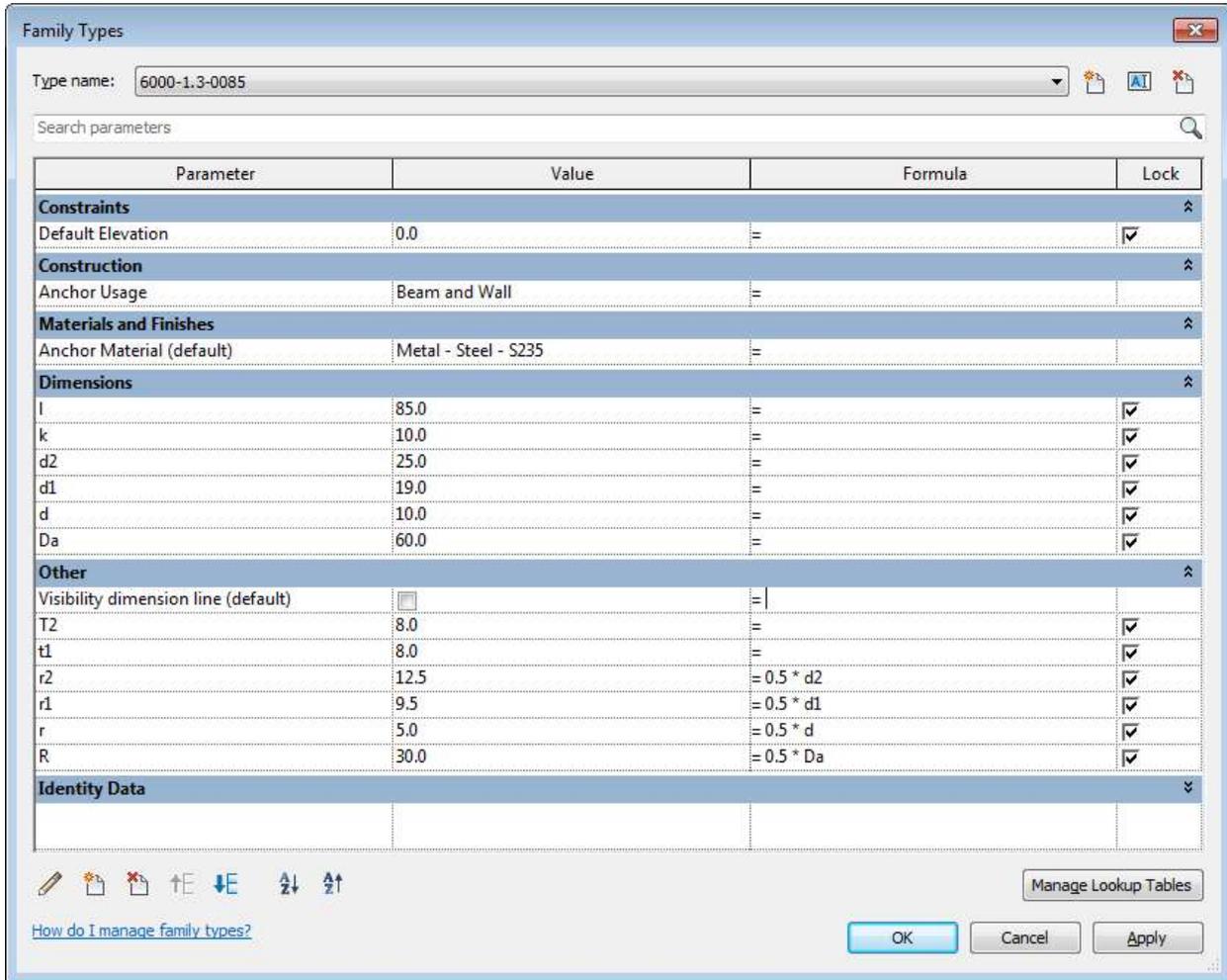


Select the parameter “Visibility dimension line” (if it is already in the list). If this parameter is missing, click on “Add Parameter” and add the parameter from the shared parameter file as an instance parameter.



Close the dialog with OK, select the parameter in the parameter selection dialog and close this one also with OK. Repeat as necessary for all dimension lines.

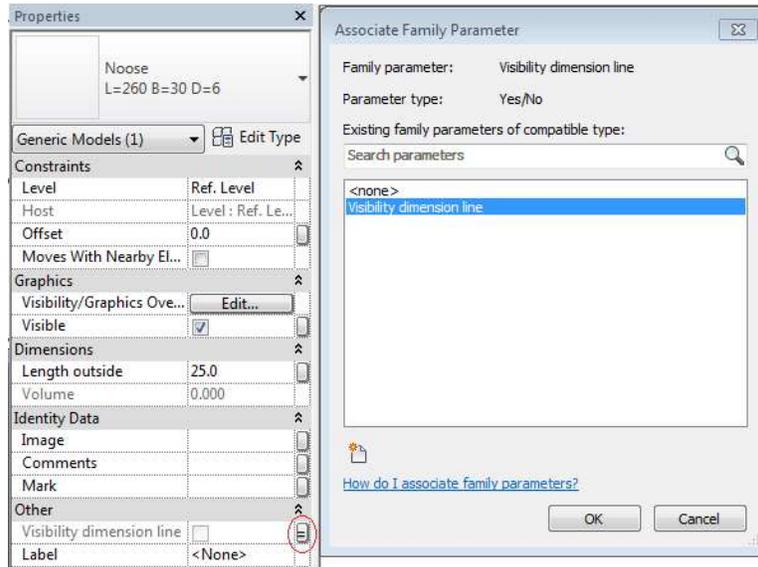
Now this parameter must be set to not visible, i.e. “false”: Modify → Properties → Family Types. Below you there is an example for the Lifter family containing all the parameters, including the one for the visibility of the dimension line.



Parameter	Value	Formula	Lock
Constraints			
Default Elevation	0.0	=	<input checked="" type="checkbox"/>
Construction			
Anchor Usage	Beam and Wall	=	
Materials and Finishes			
Anchor Material (default)	Metal - Steel - S235	=	
Dimensions			
l	85.0	=	<input checked="" type="checkbox"/>
k	10.0	=	<input checked="" type="checkbox"/>
d2	25.0	=	<input checked="" type="checkbox"/>
d1	19.0	=	<input checked="" type="checkbox"/>
d	10.0	=	<input checked="" type="checkbox"/>
Da	60.0	=	<input checked="" type="checkbox"/>
Other			
Visibility dimension line (default)	<input type="checkbox"/>	=	
T2	8.0	=	<input checked="" type="checkbox"/>
t1	8.0	=	<input checked="" type="checkbox"/>
r2	12.5	= 0.5 * d2	<input checked="" type="checkbox"/>
r1	9.5	= 0.5 * d1	<input checked="" type="checkbox"/>
r	5.0	= 0.5 * d	<input checked="" type="checkbox"/>
R	30.0	= 0.5 * Da	<input checked="" type="checkbox"/>
Identity Data			

In the family types dialog uncheck the check box of the parameter “Visibility dimension line (default)” in the column “Value”, i.e. set the default value to not visible. Close the Dialog with OK.

If the dimension line was defined in a sub-family, this parameter must be passed through up to the main family (i.e. the family that is loaded into the Revit project). In the parent family select the sub family instance and click on the button next to the Parameter “Visibility dimension line” and add the parameter the same way it was described above. Below is shown an example for the loops inside the Nooses families used for connecting walls.



A dimensioning line in a view on the shop drawing is dimensioned only if the plane of the view is parallel to the plane of the mounting part in which the dimension line should be used (based on the name of the dimension lines sub category). If that is the case, it is dimensioned as follows:

- The line is in a plane which is parallel to the plane of the mounting part in which it should be dimensioned:
This line is dimensioned in direction of the line, if the line is parallel to a main axis of the view on the shop drawing.
Every line is used no more than once and will be dimensioned either horizontal or vertical.
If the line is not parallel to one of the main axes, it is not dimensioned.
- The line is in a plane orthogonal to the plane of the mounting part in which it should be dimensioned:
This line will always be dimensioned vertically and horizontally.
This line can always be dimensioned, even if the line is not parallel to any axes of the view.

Dimensioning the extents of a mounting parts

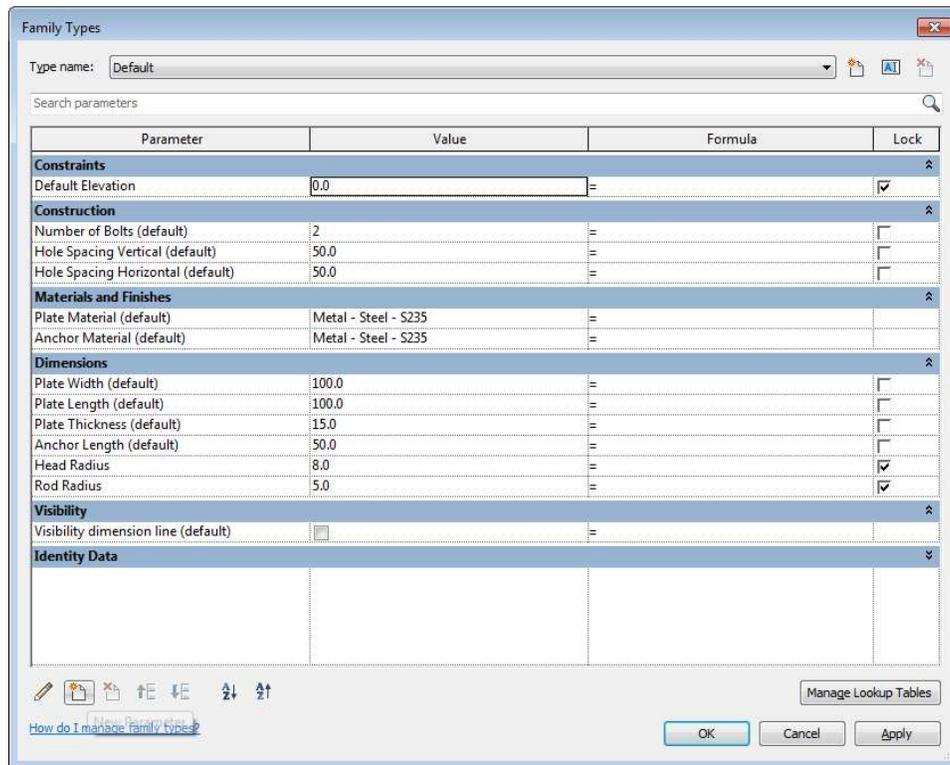
In all views of a shop drawing, the extents are dimensioned, if a mounting part does not define dimensioning lines. The dimensioning of the extents does only work if the mounting part defines a valid solid. Bodies that are defined in the family as “Void” do not define a valid solid and as such cannot get there extents dimensioned. If a valid solid is there, the extents are dimensioned in all views (this will not work reliably for round edges or non-planar faces, since there might not be a reference at the extents of the element).

But if even one dimensioning line is defined in the mounting part, the extents will not be dimensioned at all (define dimension lines at the extents of the element if those are needed). If

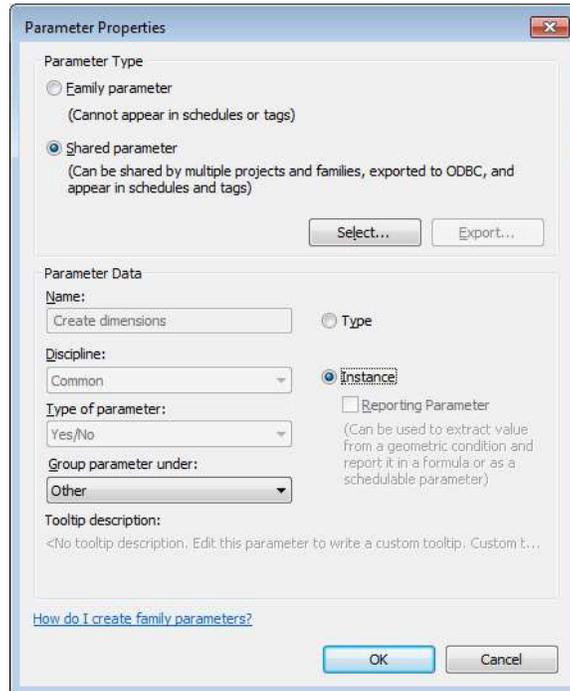
the mounting part cuts a piece out of an element, this hole is not dimensioned together with the main parts contour – unless the mounting part does not contain a valid solid at all.

As a result, mounting parts, which have dimensioning lines defined and do not contain a valid solid will be dimensioned twice: once with the dimensioning lines and once with the main elements extents. If a mounting part without dimensioning lines contains arc segments, the dimensioning can be quite wrong, since arc segments do not contain useful reference points.

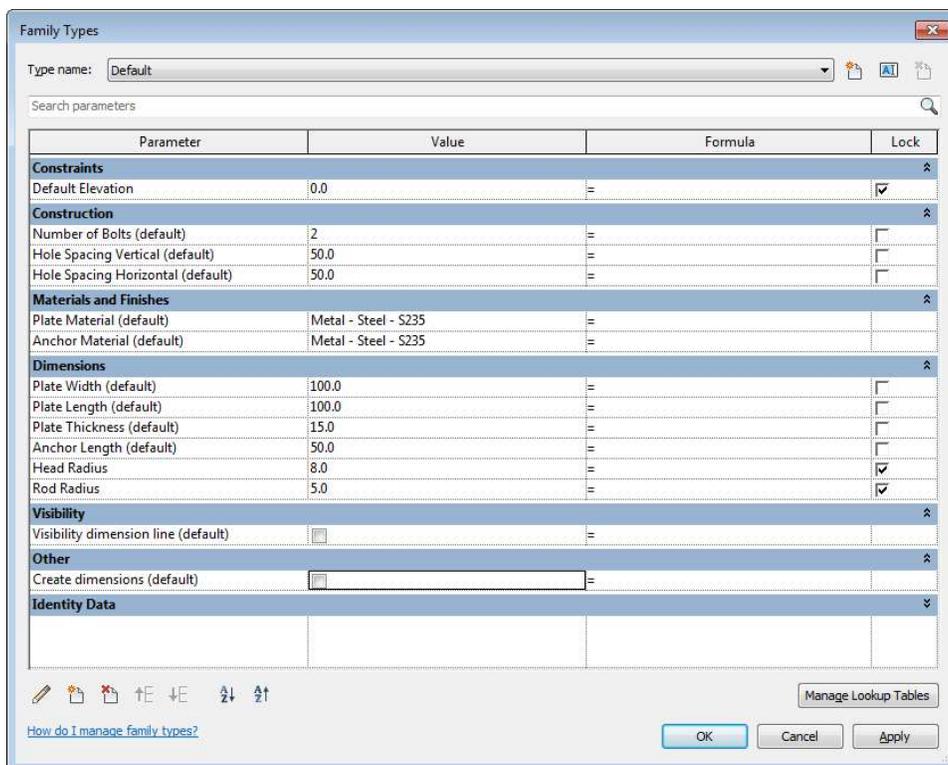
If a mounting part should not have its extents dimensioned, it can use the shared parameter “Create dimensions” as an instance parameter and set this to false. Modify Tab→ Properties Panel→ Family Types → New Parameter



Select “*Shared Parameter*”, click on “*Select*”, chose the shared parameter “*Create dimensions*”, select the option “*Instance*”, and close the dialog with OK.



Now remove the check mark for the parameter in the column “Value”:



Close the dialog with OK. The Parameter is optional and is only needed, if no dimensions should be created. If the parameter is not defined, dimension lines are created.

Dimensioning mounting parts with the host element contour

Mounting parts without dimensioning lines and solids are dimensioned with the host elements contour, if the mounting part creates a hole. This is just a makeshift solution, based on the fact that Revit does hide void geometry from the API. All corner points of the resulting host elements contour are dimensioned. Exception: Recesses which are not going through the element and are placed at the edge of the element are not dimensioned.

Dimensioning equal mounting parts on one dimension line

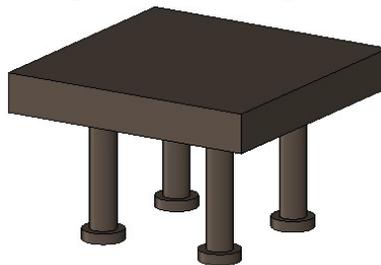
The dimensions of all mounting parts of the same family are dimensioned on one line, if they are placed on the same side of the host. Controlling for this is the center of the element. All mounting parts with the same family name on top of the center of the host are dimensioned on top of the element. Mounting parts below the center are dimensioned below the element. The same goes for the vertical dimension lines. Dimension points on the extents of the host are added to the dimension line, additionally to the dimension points of the mounting parts (one point left & right or top & bottom)

Workflow example

The objective is to have the center of anchor plates dimensioned in the view from top in both directions.

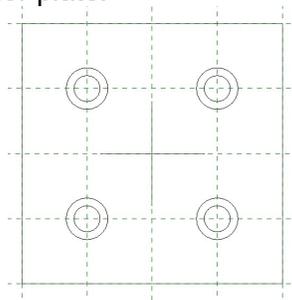
1. Open/Crete your mounting part family

Open the anchor plate family, which can be found at the following location: Libraries\US Metric\Structural Connections\Mounting Parts\Fastening Plates\M_Plate with Anchors.rfa:



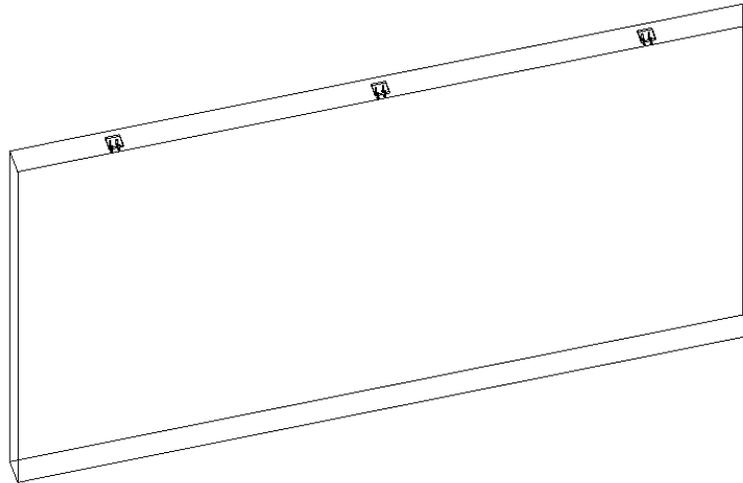
2. Dimensioning using model lines

Switch to the Floor plans Ref. Level and create one horizontal and one vertical model line, intersecting in the center of the anchor plate:

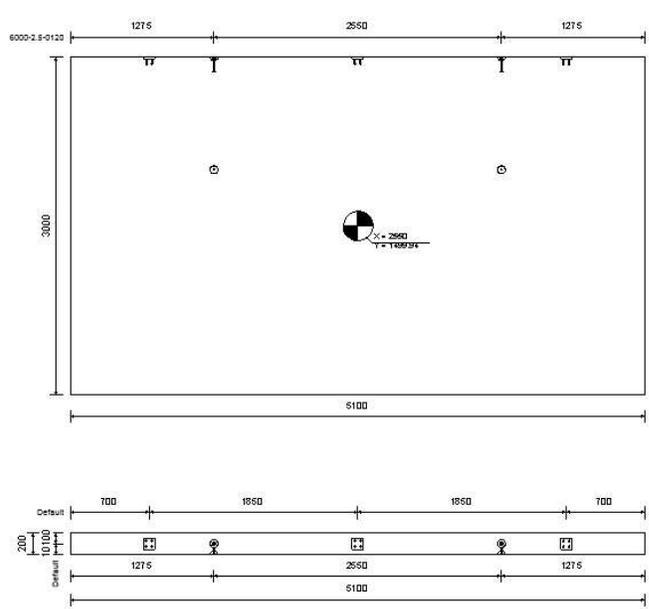


Based on the name of the sub category, the dimension lines should be created only when we are looking from the top (as seen in the family) at the anchor plates. For this wall that's only in the frontal view of the wall.

If now the plates are added to the top face of the wall:



Follow the same procedures as above. The families are now dimensioned only in the top view of the drawing:



Material Take off		
Material	Volume	Category
Concrete, Cast In Situ	3.06 m³	Parts

Part List	
Type	#
M_Plate with Anchors: Default	3
Solid Wall - Bushing: 50-0120	2
Solid Wall - Lifter: 6000-2.5-0 120	2

Rebar List			
No	#	Ø	L

Count: 1
ProdNos: 1
Weight: 7362.70 kg



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No.	Description	Date

Owner _____

Project Name _____

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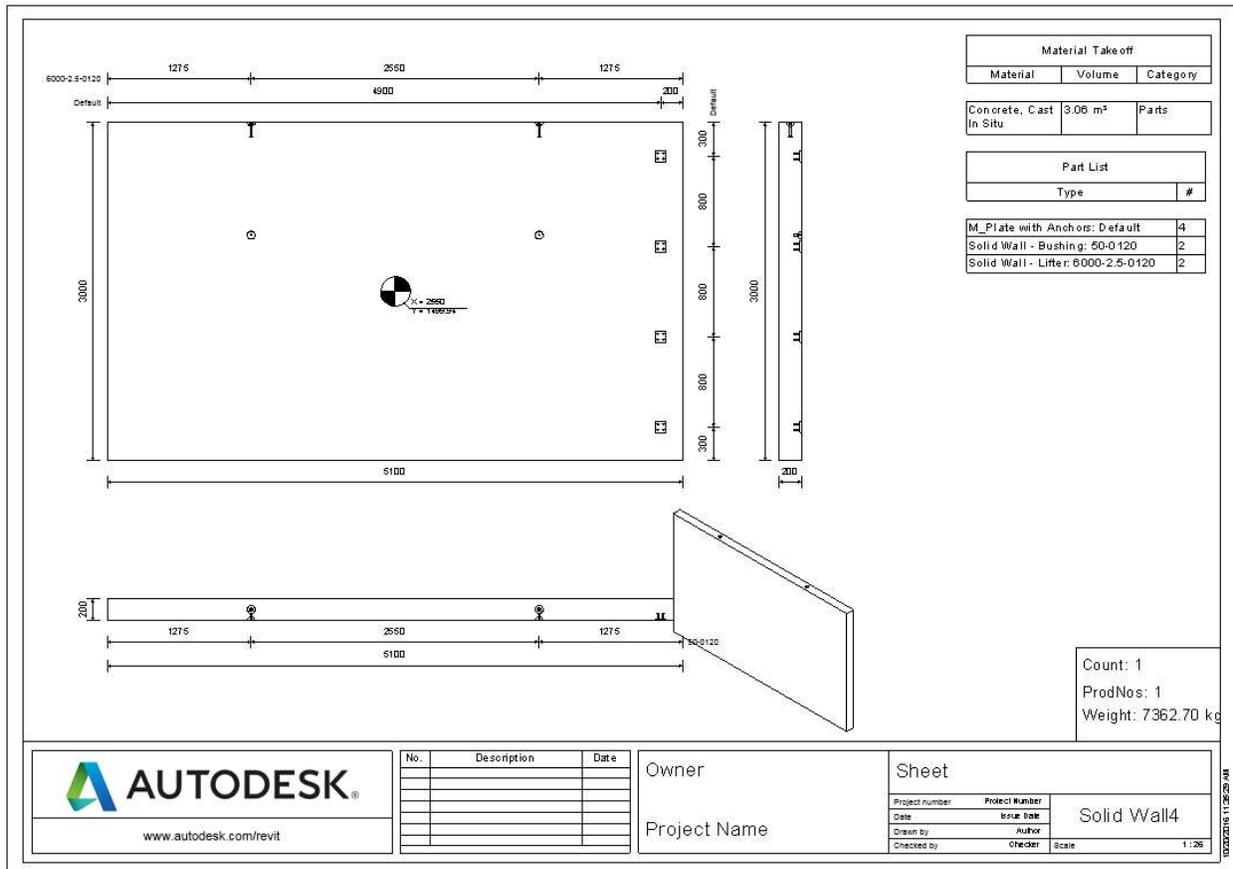
Solid Wall3

4. Dimensioning using only one dimensioning line

Instead of two dimensioning lines intersecting in the center, we now create just one line, which is orthogonal to the plane of the anchor plate and is placed in the center of the family:

As before we need to set the sub category (see chapter 1) and the visibility parameter (see chapter **Error! Reference source not found.**).

When this family is used as before, it is dimensioned the same way as in the first example:



The drawing shows a wall family with dimensions: 5100 (width), 3000 (height), and 4800 (inner width). It includes a material takeoff table, a part list, and a count table.

Material Take off		
Material	Volume	Category
Concrete, Cast In Situ	3.06 m³	Parts

Part List	
Type	#
M_Plate with Anchors: Default	4
Solid Wall - Bushing: 50-0-120	2
Solid Wall - Lifter: 6000-2.5-0120	2

Count: 1
ProdNos: 1
Weight: 7362.70 kg

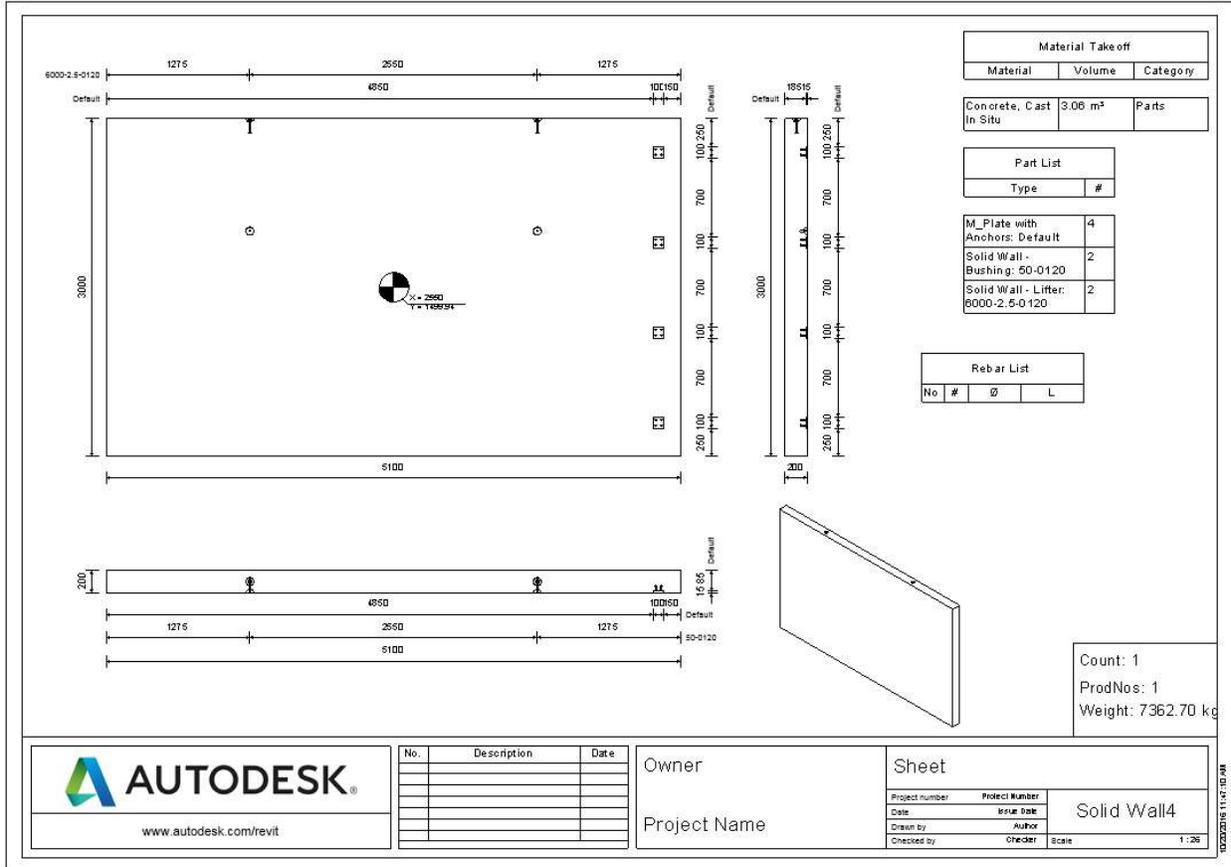
 www.autodesk.com/revit	<table border="1"> <thead> <tr> <th>No.</th> <th>Description</th> <th>Date</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> </tbody> </table>	No.	Description	Date													Owner: _____ Project Name: _____	<table border="1"> <thead> <tr> <th colspan="2">Sheet</th> </tr> <tr> <th>Project Number</th> <th>Project Number</th> </tr> </thead> <tbody> <tr> <td> </td> <td> </td> </tr> <tr> <td>Date</td> <td>Issue Date</td> </tr> <tr> <td>Drawn by</td> <td>Author</td> </tr> <tr> <td>Checked by</td> <td>Checker</td> </tr> <tr> <td> </td> <td>Scale: 1:25</td> </tr> </tbody> </table>	Sheet		Project Number	Project Number			Date	Issue Date	Drawn by	Author	Checked by	Checker		Scale: 1:25
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But there are two important differences:

- In the first example it would have been possible to create only one line, getting dimensions only vertical or only horizontal; in the second example always both directions are dimensioned.
- If the anchor plate is added rotated in the first example, it cannot be dimensioned at all; in the second example the center of the plate is always dimensioned.

5. Dimensioning using the contour of the family

Remove the dimension lines and load the family into the same project, and create new shop drawings. Now the extents of the anchor plates are dimensioned in all views (using one dimension, since it's always the same family).



The drawing shows a rectangular anchor plate with a total width of 5100 and a height of 3000. The top view shows a central hole with a diameter of 2500. The front view shows the plate's thickness and the vertical spacing of the anchor bolts. The side view shows the plate's depth and the horizontal spacing of the anchor bolts.

Material Take off		
Material	Volume	Category
Concrete, Cast In Situ	3.06 m ³	Parts

Part List	
Type	#
M_Plate with Anchors: Default	4
Solid Wall - Bushing: 50-0120	2
Solid Wall - Lifter: 6000-2.5-0120	2

Rebar List			
No	#	Ø	L

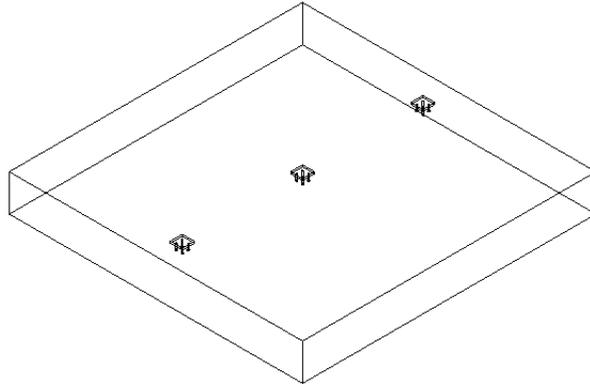
Count: 1
ProdNos: 1
Weight: 7362.70 kg

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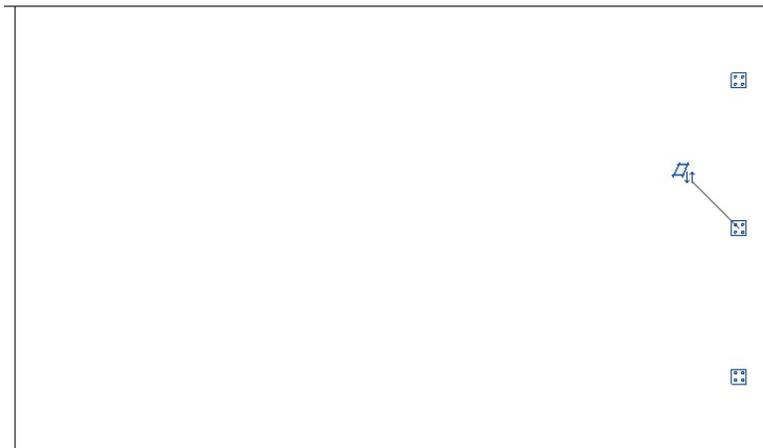
In top and front view only the plate without the anchors is dimensioned, because in these views there are only round faces of the anchors visible thus giving no references to dimension.

6. Dimensioning using sub-families

Create new Family → “Metric Generic Model face based” (C:\ProgramData\Autodesk\RVT 2017\Family Templates\English). Load the anchor plates with dimensioning lines into the family and place it three times on the top face of the families’ body:



The visibility parameter must be passed through into the new family (see chapter **Error! Reference source not found.**). Now the new family is placed in the wall.



Split the wall and create a shop drawing. The anchor plates are only dimensioned in the front view:

The drawing shows a wall panel with a top view of 5100x3000mm and a side view of 200mm thickness. The top view is divided into sections of 1275, 2550, and 1275mm. A circular hole is located in the center. A north arrow is present with coordinates X=2550 and Y=1188.75. A 3D perspective view shows the panel's profile.

Material Takeoff		
Material	Volume	Category
Concrete, Cast In Situ	3.06 m ³	Parts

Part List	
Type	#
Family1: Family1	1
M_Plate with Anchors: Default	3
Solid Wall - Bushing: 50-0120	2
Solid Wall - Lifter: 6000-2.5-0120	2

Count: 1
ProdNos: 1
Weight: 7362.70 kg

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No.	Description	Date

Owner
Project Name

Sheet	
Project Number	Sheet Number
Date	Issue Date
Drawn by	Author
Checked by	Checker
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Solid Wall5