Session 7

Concrete Modeling Using Revit Structure
Shruti Harve, LEED AP, Ideate, Inc

Concrete Modeling using Revit Structure

In this class will focus on tips and tricks and best practices to model concrete structures using Revit Structure. We will go over tips for modeling concrete and precast concrete components, schedules and tags, modeling waffle slabs, slab edges, expansion joints & concrete control joints, and more.

Key Learning Objectives:

- Introduction to Modeling Precast Concrete Components
- Documentation: Schedules and Tags
- Tips and Tricks to Model Concrete Structures

About the Speaker:

Shruti holds a Master of Science degree in Architectural Computing from University of Strathclyde, United Kingdom and is LEED accredited. Her experience includes working in Architecture and Construction firms in India and the United Kingdom as well as Structural Engineering firms in the Bay Area providing design, 3D modeling and drafting services. At Ideate, Shruti provides training and support for Revit Architecture, Revit Structure, 3ds Max, and AutoCAD Architecture.
Introduction

This handout addresses the many questions and challenges that I have come across whilst modelling and documenting Concrete structures using Revit Structure. This presentation also incorporates the excellent feedback and great questions I received from presenting on this subject at Ideate’s Revit User Group Meeting in San Francisco. I hope you find the information presented below valuable.

The learning objectives for this presentation are:

- Introduction to Modeling Precast Concrete Components
- Documentation: Schedules and Tags
- Tips and Tricks to Model Concrete Structures

Modeling Precast Concrete Components in Revit

I always have had to create several custom precast concrete families when modelling a structure built of precast concrete using Revit Structure, mainly due to the design involving non standard shapes.

Let’s take a look at the procedure to create a custom double tee Precast Concrete Beam Family in Revit Structure.

We need to start with creating the Double Tee Profile that would be referenced in the ‘Sweep’ modeling tool when modelling the beam in the Family Editor.

Steps to Create the Parametric Double Tee Profile:

- From the ‘R’ pull down in Revit Structure, Click on ‘New’ and Select ‘Family’
• Select ‘Profile.rft’ file from the list of templates

• Using the Reference Plane tool on the Create Tab, Sketch the reference planes as shown in the illustrations below. (Reference Planes form the basis/backbone of a parametric Revit family, you need to add these before you can sketch any shape or model any geometry)
- Dimension the reference planes and label the dimensions with parameters as shown in the illustration below. Also make sure that you establish an equality constraint between certain dimensions as shown in the illustration.

(To associate a parameter to a dimension, you need to select the dimension and click on 'Add Parameter'. In the 'Add Parameter' dialog box, you need to type in the appropriate details of the parameter).

![Image of parameter creation in Revit Structure]
For the Double Tee Profile to ‘Flex’ correctly, the appropriate dimensions need to be locked. Lock the dimensions that will not change by selecting them and clicking on the ‘Lock’ symbol, as shown in screen shot below:
• Click on ‘Family Type’ and change the values of all the parameters to make sure the ‘reference planes’ are moving and flexing correctly. It is better and easier to troubleshoot flexing problems early on in the process.

• Now using the Line tool on the ‘Create’ tab, sketch the lines that form the double tee shape/profile. Make sure you snap to the reference plane intersections when you do so.
Flex and make sure everything is working correctly
Save this file with the appropriate name ‘Double Tee Profile....’

Creating the Custom Double Tee Precast Concrete Beam Family:

Instead of Creating the Precast Concrete Beam Family from scratch, what we will do here is simply open the out of the box Double Tee Precast beam family and swap it with the sweep profile we made.
Open the out of the box Precast double Tee family
Select the Precast component and click on Edit Sweep
- Select the Double Tee Profile and click Load Profile
• Select the Double Tee Profile you made earlier, (I named the one I create ‘Double Tee Profile1’ to avoid overriding the existing one)

• Click on ‘Select Profile’ and Select the appropriate Profile

• Click Finish Edit Mode

• Delete the unused Profile again to avoid discrepancies
- In the Project Browser, double click on the ‘Double Tee Profile Family’ to access its Type Properties

- Using the grey boxes next to the parameter names, associate the parameters in the Profile to the appropriate ones in the Double Tee Precast Concrete Beam Family
• Flex the Family, change all the parameter values, and test to make sure everything is working as expected.

The procedure illustrated above is the method that I have used to model Precast Beam families, (double and single tees) and it has worked well for me. But there are definitely other ways to accomplish this which might cut down the time needed. Every method has its own pros and cons that should be thought through before adopting the final approach. I will go ahead and list some that come to mind:

• Using a ‘Non Parametric Profile’ in the Sweep
• Using a Combination of Sweep and Extrusion to model the Beam
• Sketching the Profiles when creating the Sweep to model the Beam
Documentation: Schedules and Tags

There have been so many instances when working with Revit, that I have hit a road block trying to access the data I need from the model. The data is there, but there is no way to extract and use in the desired manner; for example displaying certain information in a tag, or extracting it into a schedule.

One such example is: In construction the columns will pour to the bottom of the structural member that it attaches to. The column height can be obtained pretty easily but Revit does not allow you to access the elevation which is the information that people in the field would rather be working with. This is where Ideate BIMLink works like a charm!
Ideate BIMLink

Ideate BIMLink is a software programme developed by Ideate,Inc that runs on top of Revit and lets you pull data from an Autodesk Revit file into user friendly Microsoft Excel and push Excel data back into Revit with equal ease. This indispensable tool also gives you access to the data that Revit hides. It addresses and resolves the workflow gaps such as the one I mentioned above regarding displaying Top Elevations of Columns in a tag.

Ideate BIMLink can be downloaded from: www.ideatebimlink.com
Once downloaded and installed, the programme can be launched from the ‘Add-Ins’ tab of the Revit Ribbon

Ideate BIMLink lets you create an Excel link for every Revit Object Category, by simply clicking on the ‘New’ button
As you can see, Top Elevation is one of the parameters that Ideate BIMLink exposes.

This information can be exported to Microsoft Excel, where a formula can be added (to take into account the top offset) to a ‘shared parameter’ (example: Top Elevation: Tag Display) that can then be displayed in a tag.
Concrete Beam Schedules and Rebar Schedules

It is common practice to display rebar information in Concrete Beam/Column Schedules and Column/Beam information in rebar schedules. In Revit Structure these two types of data are listed in separate tables—Host element table and Structural Rebar table. The two do have relational parameters; however they cannot be combined into a single table.

The workaround I had been using was to create several shared parameters and add the data manually into them in a Revit Schedule, but not anymore. Because Ideate BIMLink not only eliminates the manual data entry by allowing for data editing in Microsoft Excel but now from Ideate BIMLink 2013 version, it also...
exposes the ‘Rebar Host’ information and lets you consolidate both the rebar as well its host geometry information into a joined table.

**Rebar Host Data in Ideate BIMLink 2013**

Tips and Tricks to model Concrete Structures

Outlined below are some tips and tricks to help with modeling concrete structures

- Joining multiple elements at once such as all girders on a floor to the slab:
  
  Use the ‘Multiple Join’ option (in the options bar) of the Join Geometry tool
• **Concrete Expansion Joints:**
  There is no way of preventing the Concrete Beams from Auto Joining. However, if you change their ‘material for model behaviour’ property in the family editor to Precast concrete, they do not autojoin. This could be used as a workaround to display concrete joints in beams when needed to.

• **Modeling Concrete Waffle Slabs:**
  Model a floor that is the top thickness and then model either rectangular or Pan Joist beams depending on the construction of the waffle.

• **Flat Slab with Sloped Soffit:**
  In the Type Properties>Edit Assembly dialog box of the Slab, Check ‘Variable’ for the structure layer.
• Thickened Slab Edge:
  Use the Slab Edge tool under the Floor tool; To change the shape of the slab edge, you need to create a slab edge profile that can be created from the ‘Profile.rft’ family template

Summary:
Revit Structure is very good at modeling concrete structures. With a good understanding of the Family Editor and the Modeling tools, you can model almost anything in concrete.