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Dynamo for Advance Steel – Hands-On for Beginners

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Learning Objectives

- Learn how to use Dynamo nodes to create beams and plates
- Learn how to assign Advance Steel properties and parameters with specific nodes
- Learn how to drive the geometry by linking an Excel Sheet to Dynamo
- Learn how to speed up the modeling process with Dynamo

Description

Get your feet wet with the Dynamo extension for Advance Steel software. In this hands-on, session we'll go step by step through the specific nodes available in Dynamo to drive a steel structure in Advance Steel. It's about the basics of creating beams and plates. We'll then work with specific nodes to set up the beam type and size, material, and user attributes. We'll assign some connections in Advance Steel to understand how modifications to the Dynamo script affect the model. Furthermore, we'll walk through the benefits of using Microsoft Excel Sheets to drive a Dynamo script for similar projects like transmission towers. [Add your class description.]

Speaker

Stephanie Hoerndler joined Autodesk in 2013 with the acquisition of Advance Steel technology. She is Technical Specialist for Structural Engineering and Fabrication, but also focus on other Autodesk solutions such as Revit, Dynamo and AutoCAD. Before joining Autodesk, Stephanie worked for several years in a company for structural engineering and studied civil engineering at university HTWK Leipzig, Germany. Stephanie is based in Munich, Germany.

Use Dynamo nodes to create beams and plates

The Dynamo Extension for Advance Steel adds the functionalities of Dynamo to Advance Steel, in order to quickly generate complex structures using Advance Steel beams and plates. You can assign materials, beam sections or user attributes from Dynamo to the generated elements in order to minimize the number of steps required for modeling.
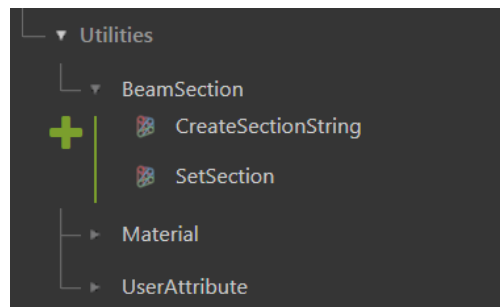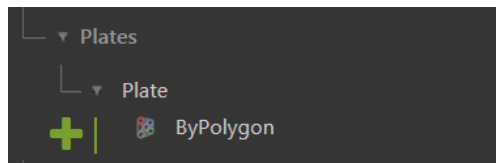
Start the Add-in
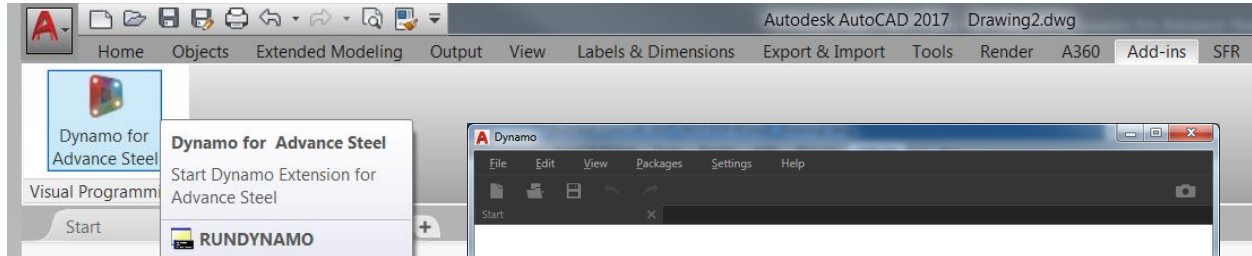
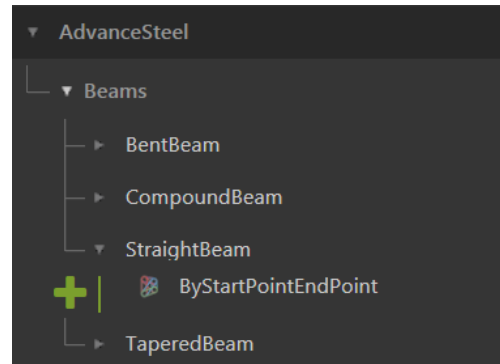The sample files for Advance Steel are located on the Dynamo start page, SAMPLES section, or start a new Project.
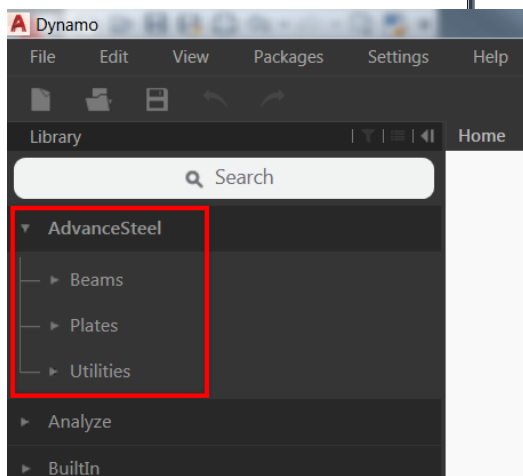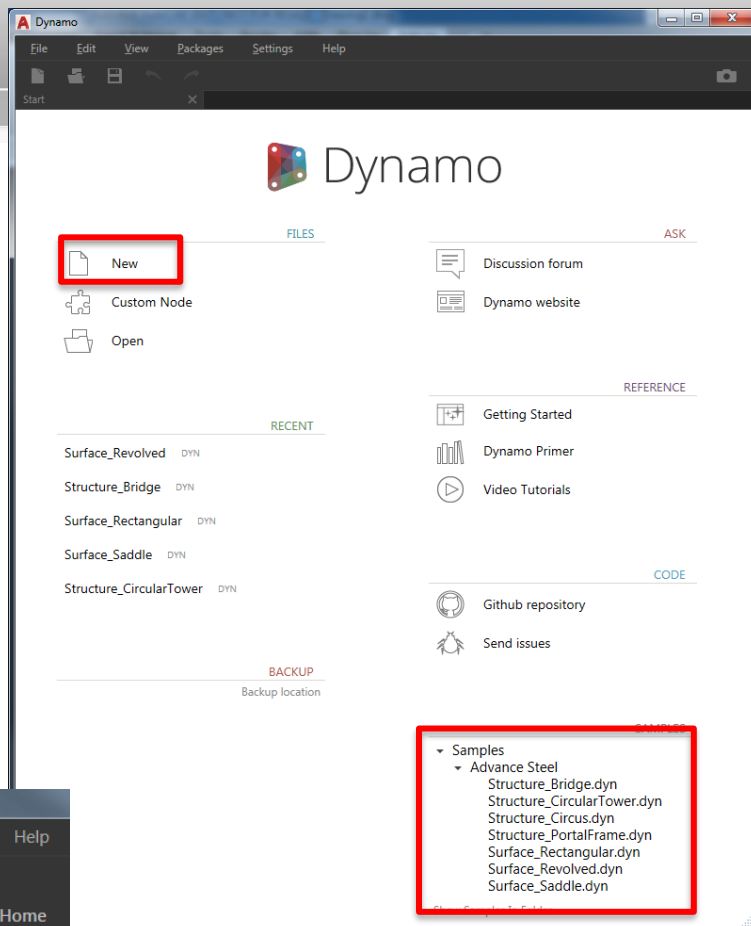
Advance Steel specific category

MEP & STRUCTURAL
FABRICATORS FORUM

Advance Steel Specific Nodes

- Beams
  - Bent Beam
  - Compound Beam
  - Straight Beam
  - Tapered Beam
- Plates
- Utilities
 - Beam Section
  - Material
  - User Attribute

▼ AdvanceSteel

└ ▼ Beams

　└ ▶ BentBeam

　└ ▶ CompoundBeam

　└ ▼ StraightBeam

　　➕ | 🎲 ByStartPointEndPoint

　└ ▶ TaperedBeam

└ ▼ Plates

　└ ▼ Plate

　　➕ | 🎲 ByPolygon

└ ▼ Utilities

　└ ▼ BeamSection

　　➕ 🎲 CreateSectionString

　　　🎲 SetSection

　└ ▶ Material

　└ ▶ UserAttribute

Create a Straight Beam

StraightBeam.ByStartPointEndPoint
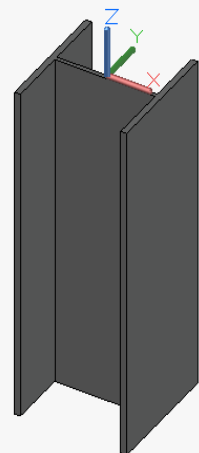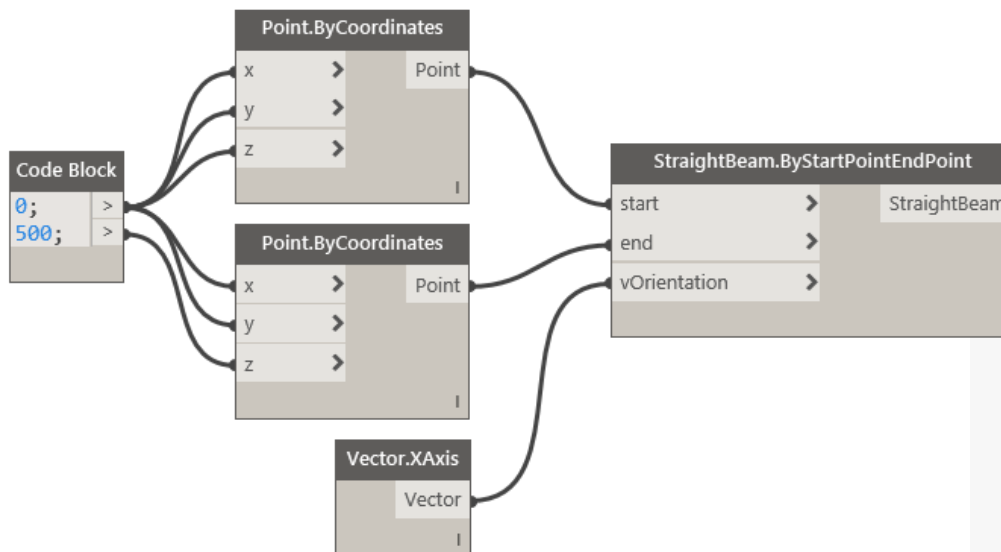
Step-by-Step

1. On the Dynamo start page, click New to create a new blank file.

2. In the tree menu on the left, expand the AdvanceSteel tab Beams StraightBeam and select ByStartPointEndPoint. This command will create an Advance Steel beam in Dynamo, using a start point and an end point.

3. Notice that the StraightBeam.ByStartPointEndPoint node appears in the Dynamo workspace:
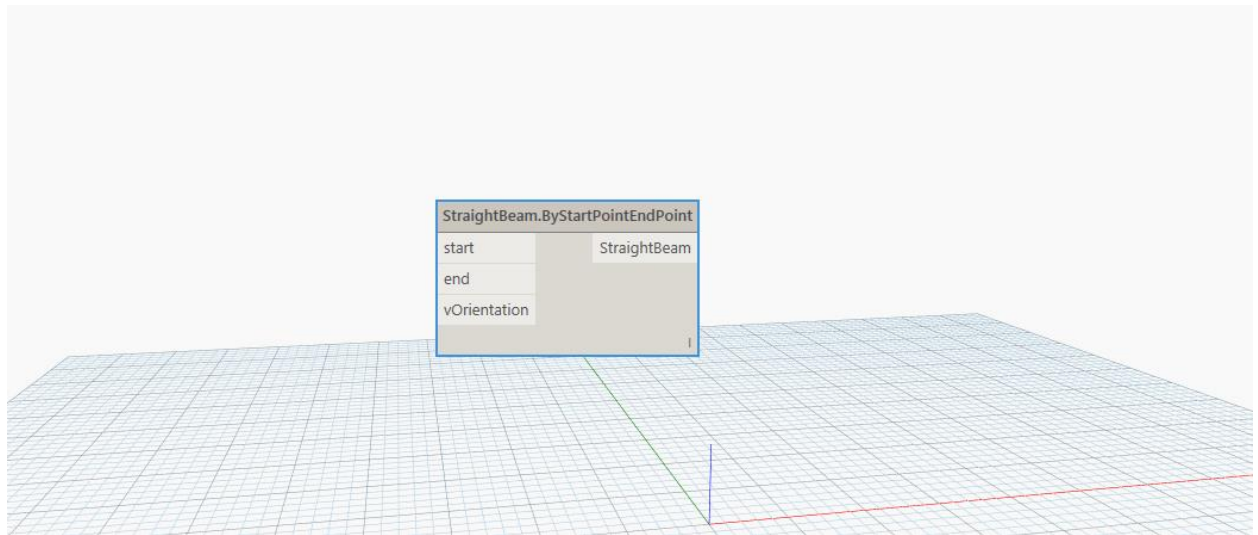

4. In order to output a straight beam, you need to provide a start point, an end point and a vector orientation used to determine the strong axis of the beam. To select the two required points, you can search the word "point" in the library, using the Library Search box on the left tree menu.

5.From the search results list, select ByCoordinates (x, y, z) to create a point using the three x, y, z coordinates:

The Point.ByCoordinates node appears in the workspace. This node requires three coordinates to generate a point. Therefore, the input is 3 numbers and the output is one point (with 3 coordinates):
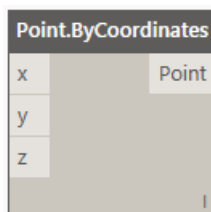

Note: If a node can accept inputs, they are shown on the left side. The output of the node is always on the right side.
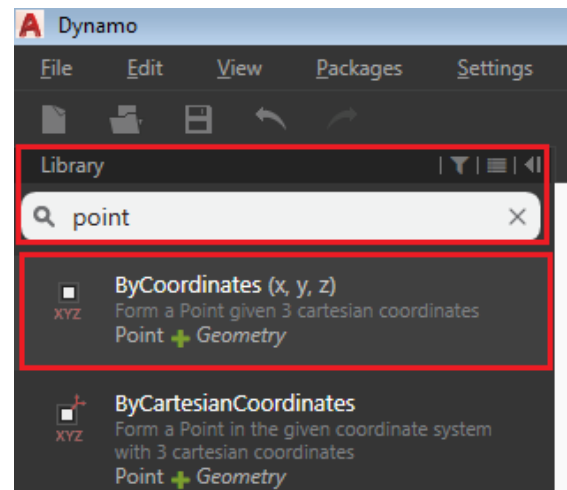
6. Repeat the previous step to create a second Point.ByCoordinates node.

7. Click and drag the nodes to arrange them like in the following image:
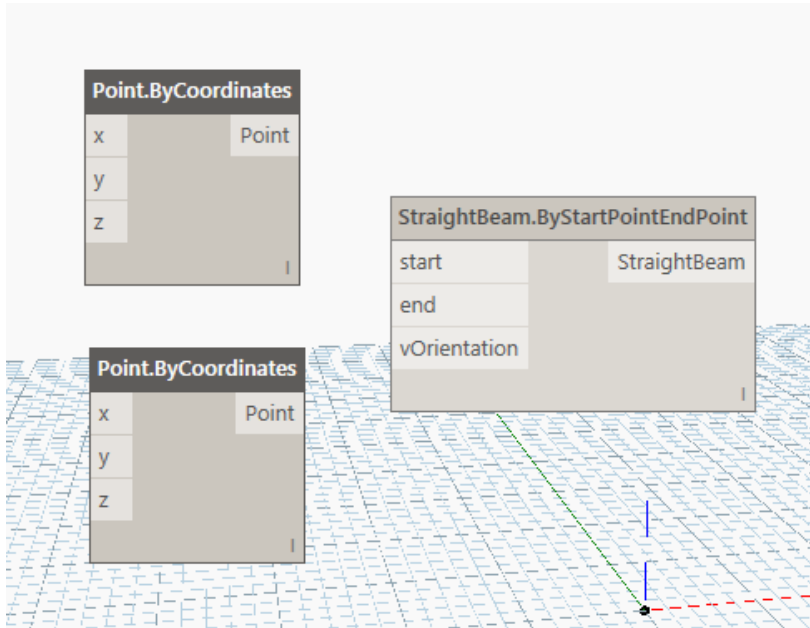
8.Search for the word "number" in the Library search box and select Number from the search results list. The Number node appears in the workspace.

9. Repeat the previous step, to create another Number node.

10. Change the value in the new Number node to 1000, by double-clicking on the value (0.000) and typing 1000. Press Enter or click outside the node to save the changes.

11.Search for "xaxis" in the Library search box and select XAxis from the search results list. The Vector.XAxis node appears in the workspace.

12. Rearrange the nodes by dragging them in the workspace, similarly to the image below:
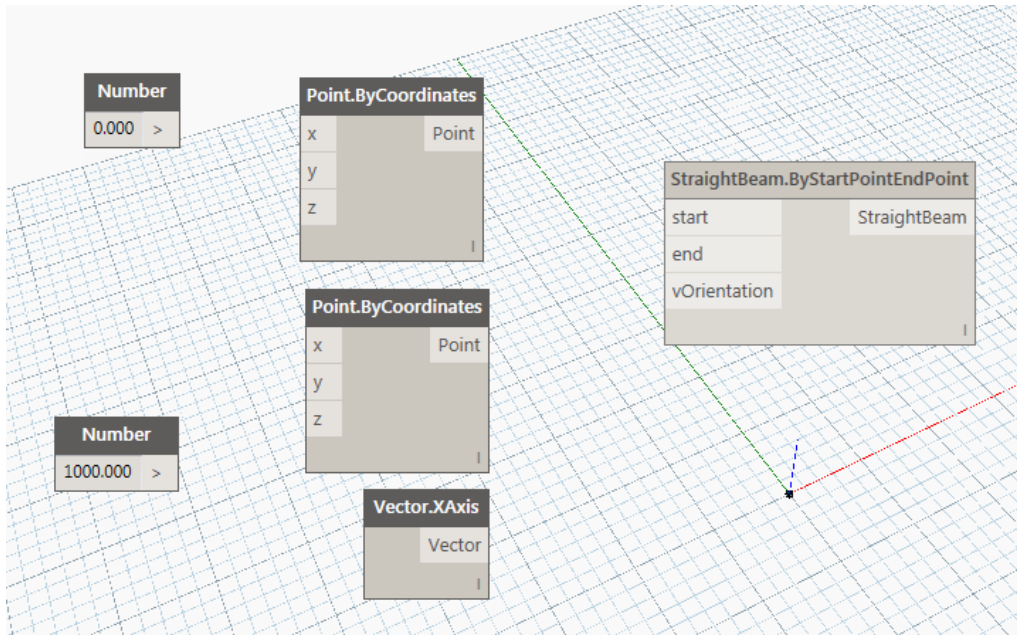
Connect the Nodes

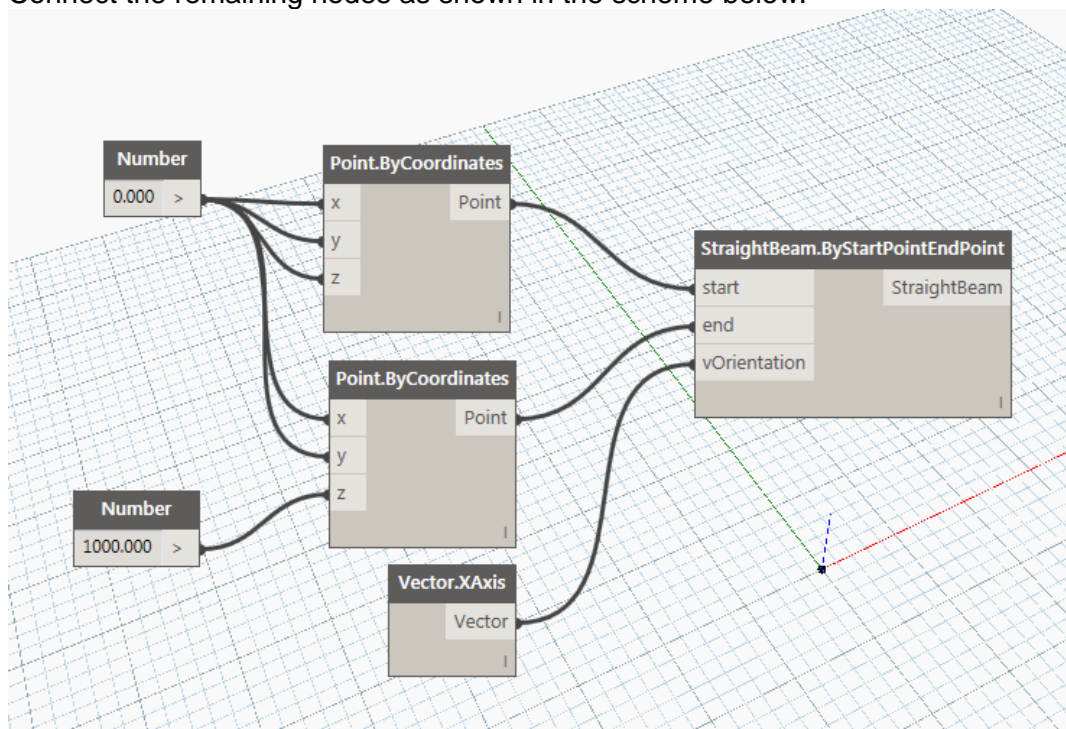Now that you have all the required nodes, you need to connect them in order to make them work together.

In order to connect the 0 value Number node to the top Point.ByCoordinates node's X coordinate, click the buttons marked in the image below (the order is not important):
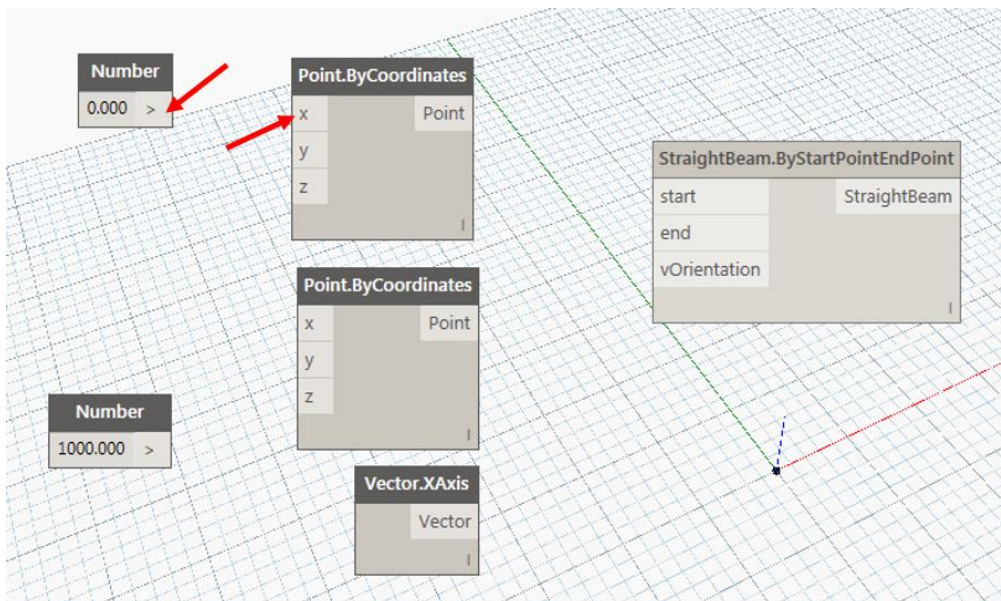
The result should be the following:
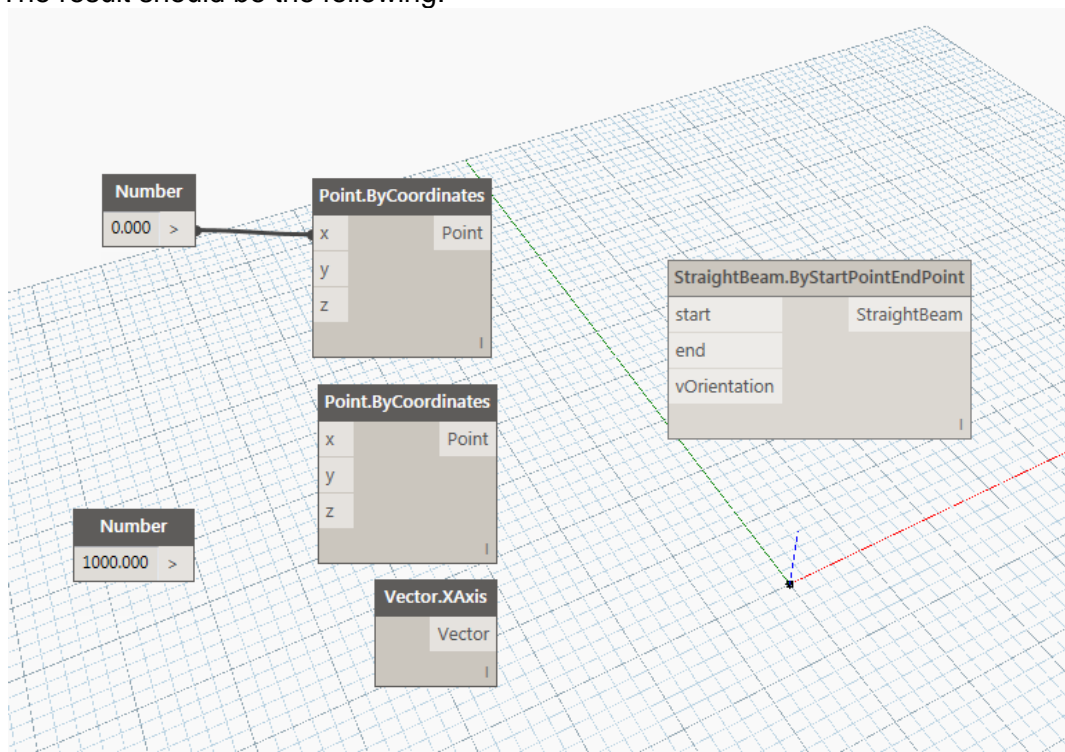
Connect the remaining nodes as shown in the scheme below:

Note: If you make a mistake, you can always delete a connection by selecting the input point for the connection (usually the one on the right) and clicking in an empty spot on the workspace.

Scheme significance

On the left side, there are two numbers, in the middle there are two points and a vector and on the right, there is the beam. The two numbers are used for the coordinates of the points. The first number (0) is used as the X,Y coordinates for both points but also for the Z coordinate of the first point. The second number (1000) is used for the Z coordinate of the second point.

Notice that a single number can output to many nodes at the same time (5 in this example). The vector orientation is required to define the direction of the beam's strong axis. Therefore, this creates a beam with the length of 1000mm, from the (0,0,0) origin to the (0,0,1000) point, with the strong axis facing the X direction.

In the bottom left corner of the Dynamo window, you will notice that the Automatic option is selected; this means that the Advance Steel model is being updated in real time, according to the changes made in Dynamo. Consequently, if you turn to Advance Steel, you will see that the beam you designed in Dynamo will appear in Advance Steel: StraightBeam.ByStartPointEndPoint
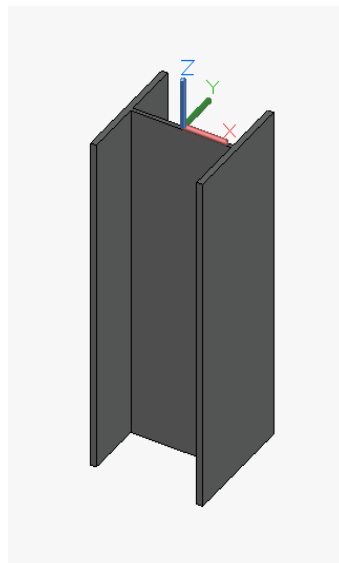
## Assign Advance Steel properties and parameters with specific nodes

Parameters such as Material, Section Size and User Attributes 1-10 can be assigned using Dynamo. To assign parameters specific nodes are used.

Assign Materials

Step-by-Step

In the tree menu on the left, expand the AdvanceSteel tab ➤ Tag ➤ Material and select SetMaterial. The Material.SetMaterial node appears in the workspace.

In order to set the material, you need to have two inputs as in the image below:
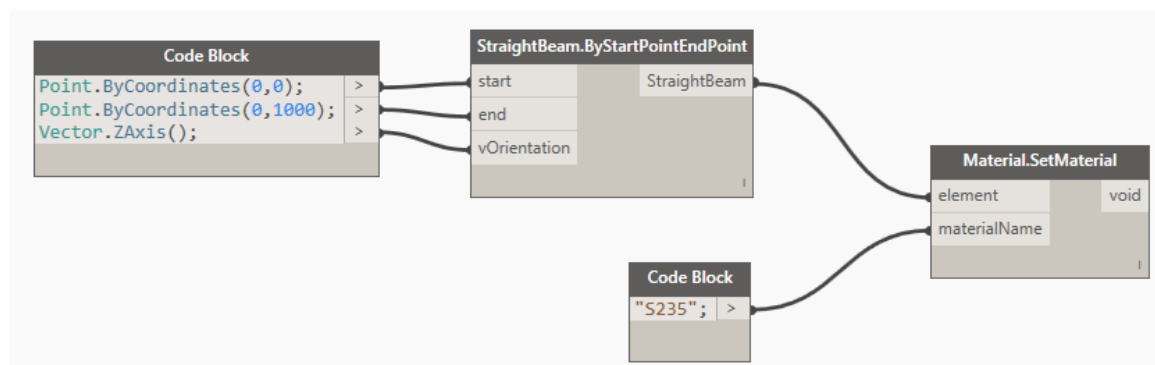
- One input goes into the element and comes from either a beam or a plate output.
- The second is a string representing the material name. For the material, you need to use the value from the Key column in the Material table of the Advance Steel AstorBase database.

Note: You can access the AstorBase database by clicking (Management Tools) in the Advance Steel Home tab ➤ Settings panel. In the Management Tools application, access the Table Editor, click the button in the top right corner (Open ODBC) to load the Advance Steel databases and use the filter in the bottom right to search for "material". Access the Material table under AstorBase to see the material keys:
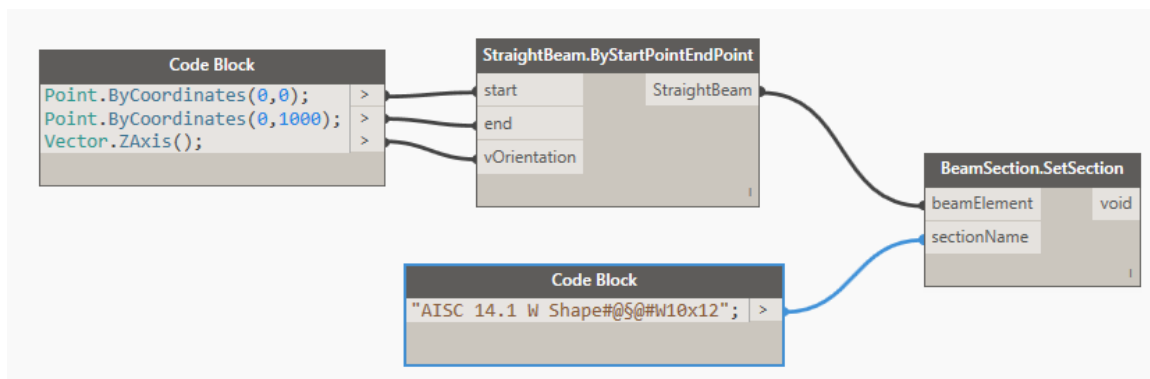
Assign Beam Sections

When creating elements or changing the profile assigned to an element, you may want to assign a specific section profile, rather than a default profile. To generate a string with the correct format, follow these steps.

Step-by-Step

In the tree menu on the left, expand the AdvanceSteel tab ➤ Tag ➤ BeamSection and select SetSection. The BeamSection.SetSection node appears in the workspace. This node works for both beams and plates.

In order to set the section, you need to have two inputs as in the image below:

- One input goes into the element and comes from either a beam or a plate output.
- The second is a string representing the section name.

The sectionName can be written as a String (picture above) or created with the BeamSection.CreateSectionString node (picture below). This node will add the "…#@$@#..." characters to the string automatically. It is a combination between sectionType and sectionSize.
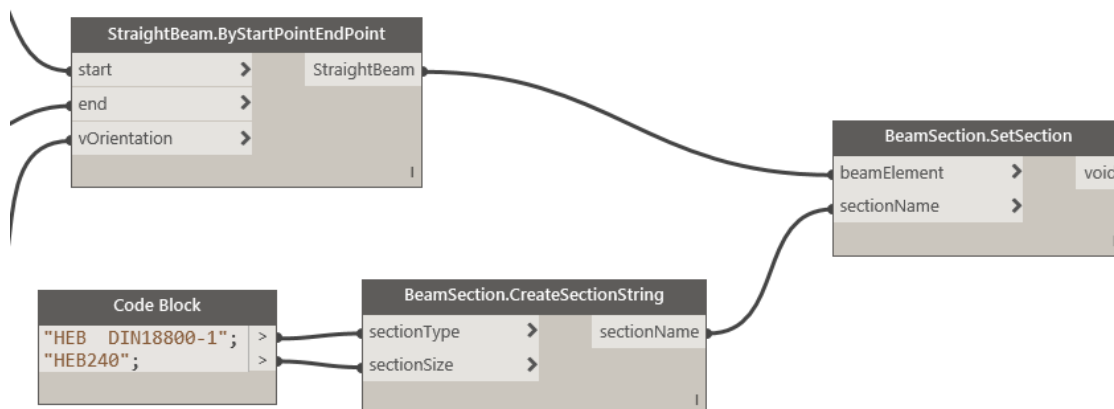
Run Name ≠ Key Name
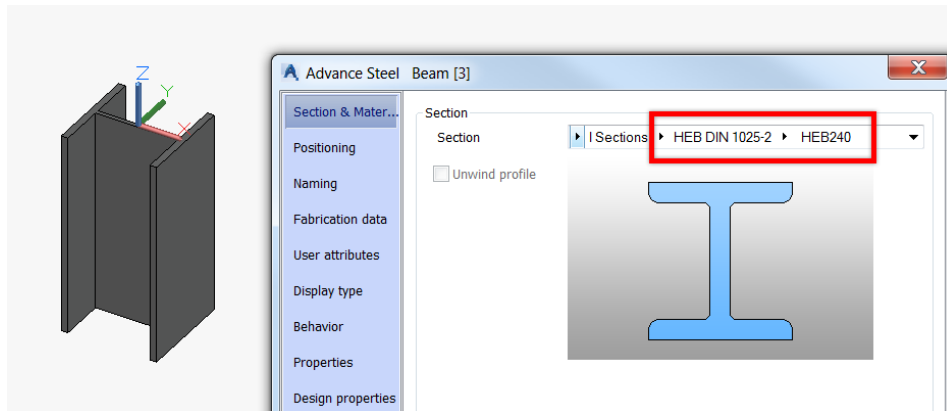
The run name is not always identical with the key name.
Run Name = visible in Advance Steel
Key Name = internal Name
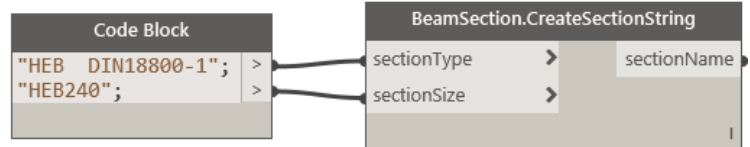
Profile Section Name String

To access the correct profile class name and section size, you will need to browse the Advance Steel profiles database. There are two ways to do this:
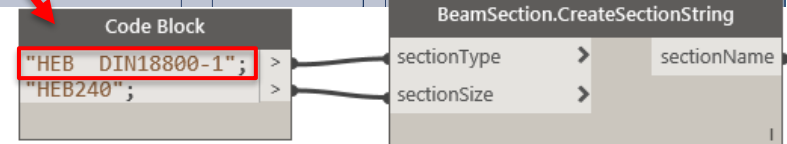
1. Start Advance Steel Management Tools (a separate application installed with Advance Steel)
   a. Select "Table editor"
   b. Click "Open ODBC"
   c. Filter "ProfileMasterTable"
   d. Browse to "Astor Profiles"
   e. Select "ProfilMasterTable"

The "ProfileMasterTable" table describes all the available profiles types and the tables in which all the sizes for each profile can be found.
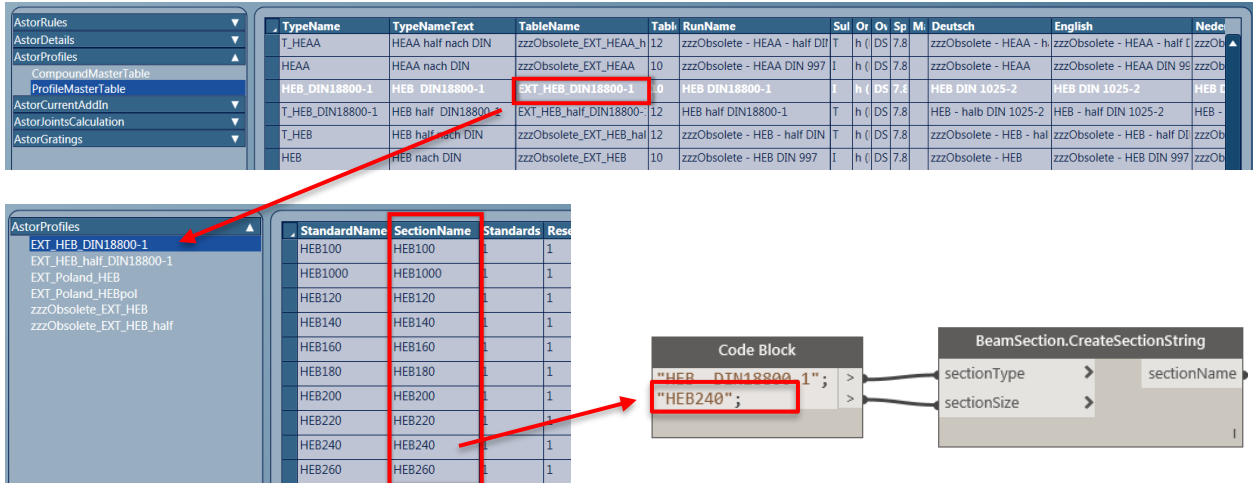
1. Look in the >*Language*< column for the profile class name (i.e. "HEB DIN 1025-2")
2. Look for the TypeNameText in the same row (i.e. "HEB DIN18800-1")

Installation Language
-> TypeNameText
= Section Type

3. Look for the TableName in the same row. (i.e. "EXT_HEB_DIN18800-1")
4. Open the table with that name
5. Look in the SectionName column for the desired section size (i.e. "HEB240")

The profile name to use when creating a new element or assigning the profile name for an existing element will be a concatenation of the profile class name (from 2) and the section size (from 4).
For example, "HEB DIN18800-1#@§@#HEB240".

Assign User Attributes

Step-by-Step
To assign user attributes to elements in Dynamo:

In the tree menu on the left, expand the AdvanceSteel tab ➤ Tag ➤ UserAttribute and select SetUserAttribute. The UserAttribute.SetUserAttribute node appears in the workspace. This node applies to both beams and plates.

A simple workflow of using the UserAttribute.SetUserAttribute node is represented in the picture below. The result is an Advance Steel beam that has the value of the user attribute as defined by the string from Dynamo:
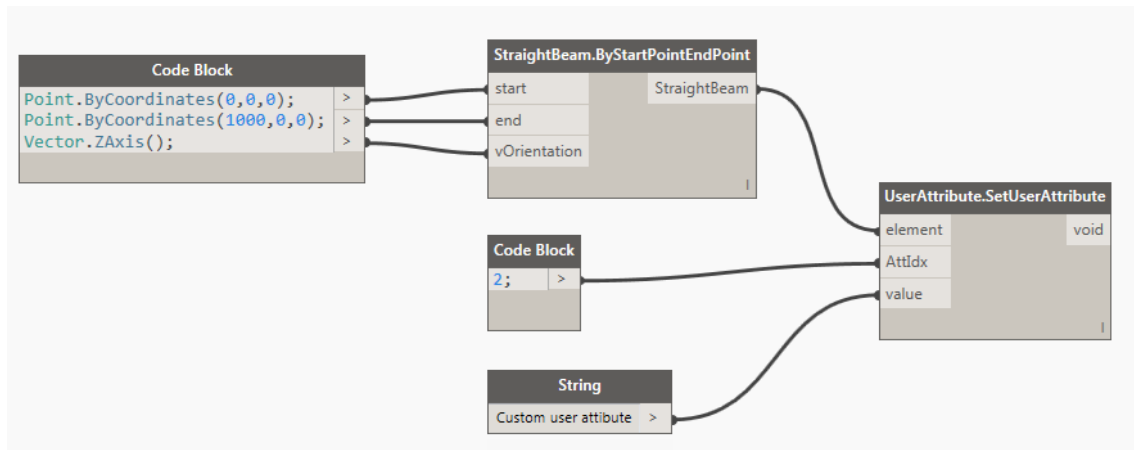
Having custom user attributes, you can apply filters in Advance Steel to select and modify the elements:
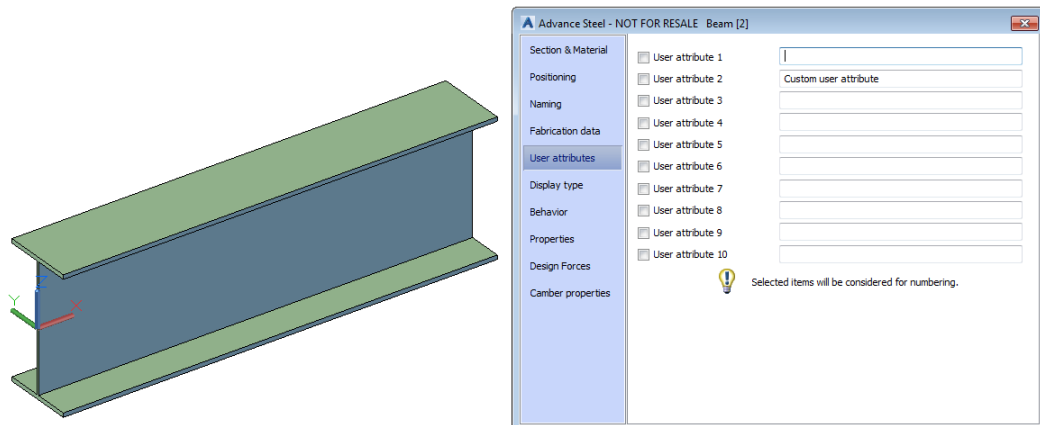
Drive the geometry by linking an Excel Sheet to Dynamo

Dynamo can handle Excel spreadsheets very well. This could be used as interface E.g. Export form an analysis tool to excel containing the start and end point of each element and the sections size and material. Dynamo can be used to import and create the elements in Advance Steel.

Link to excel

The Excel.ReadFromFile node reads data from a Microsoft Excel spreadsheet. Data is read by row and returned in a series of lists by row. Rows and columns are zer-indexed; for example, the value in cell A1 will appear in the data list at [0,0]. This node requires Microsoft Excel to be installed.
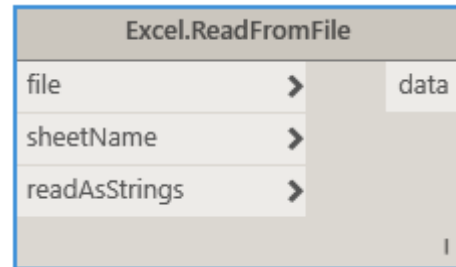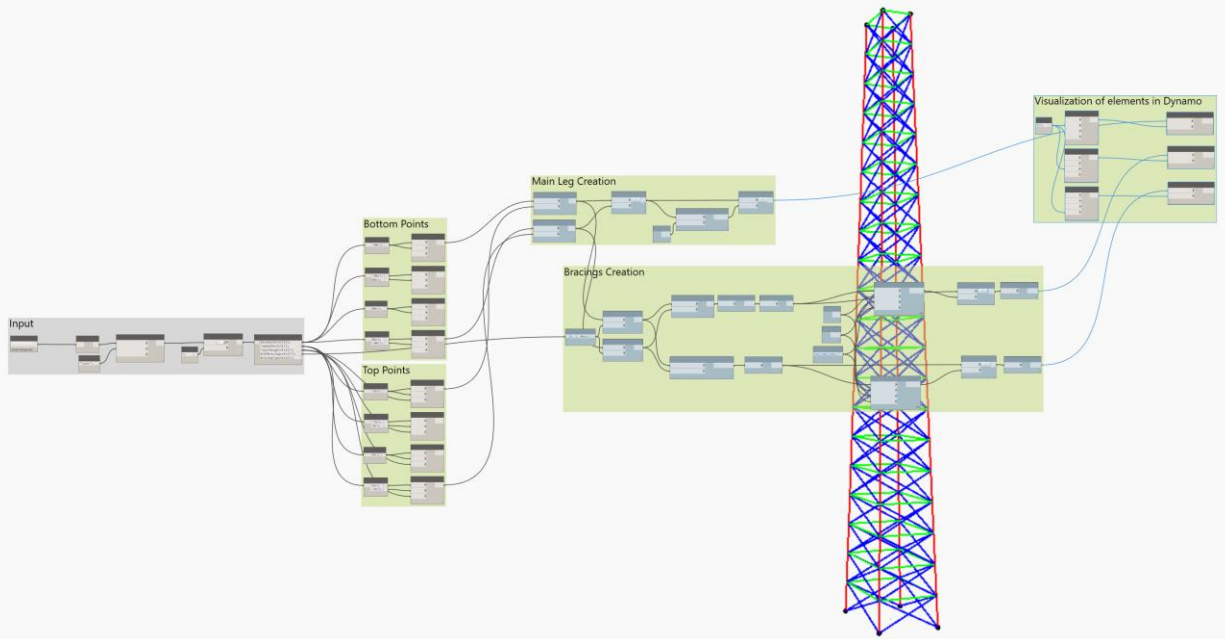

Step-by-Step

The File.FromPath and File Path node will link to the corresponding spreadsheet. With a Code Block the proper sheetName can be defined.
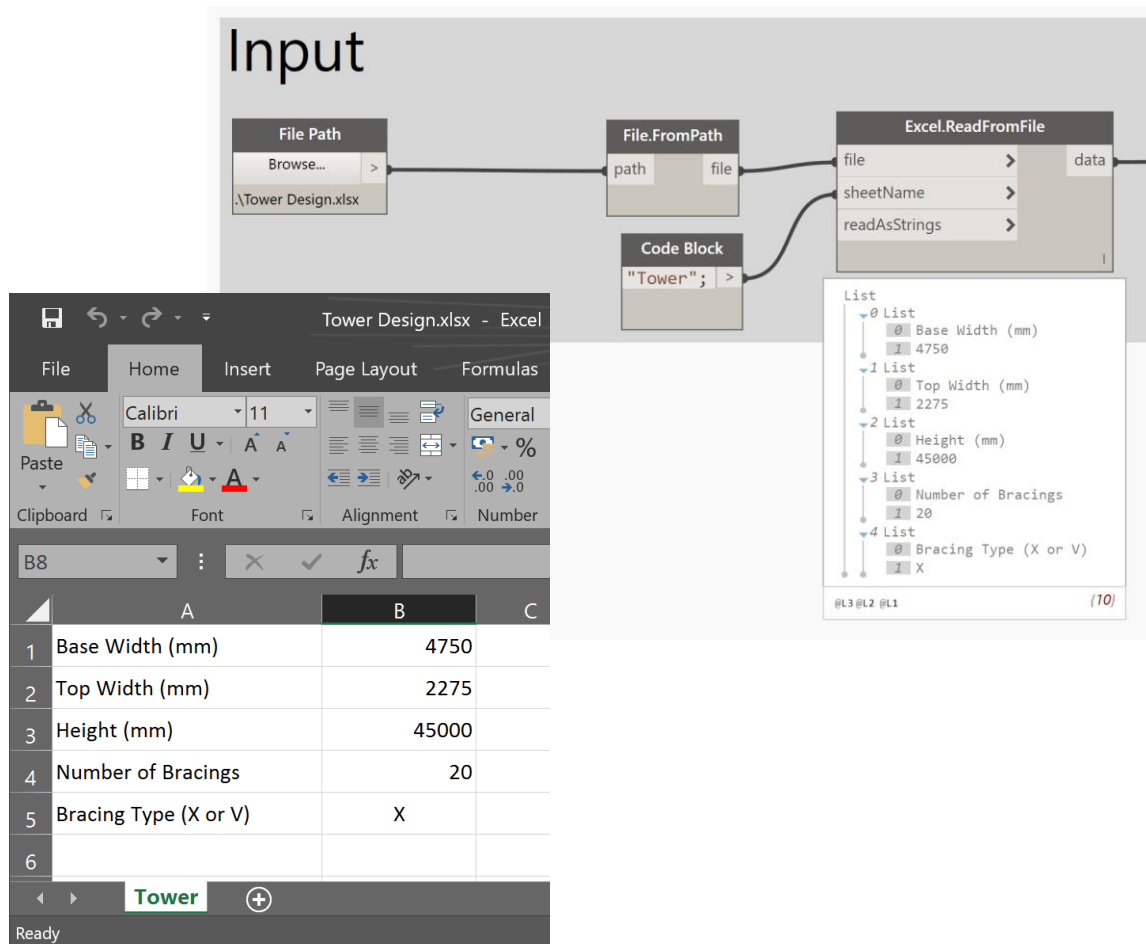
Excample Transmission Tower

For this example, the Tower Design.dyn and Tower Design.xlsx files were provided.