CES500113

Multibridge Cable-Stay Intelligent Models in Infraworks, Inventor, Civil 3D and Revit

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Learning Objectives

- Learn about how to transition from traditional, 2D bridge workflows to modeling in InfraWorks using parametric Inventor parts
- Learn about using InfraWorks, Civil 3D, Inventor, and Revit to create a parametric, adaptable, multibridge intelligent model
- Learn about the automation power and flexibility of using Excel- and iLogic-driven Inventor models within InfraWorks
- Learn about the value that Hatch gained using the InfraWorks bridge workflow with some quantitative numbers on time spent

Description

A colleague says, “We've got a project with a 1227m bridge structure including 578m cable stay bridge, 6 approach/exit ramps, 2 overpasses, 5 pedestrian overpasses and numerous walls. Can you create an intelligent model in Revit?” You've used Revit software off and on for the past 10 years, and you remember how painful it was to do a bridge or tunnel that followed complex Civil 3D alignments. Then there are the inevitable design changes that occur while you’re trying to model these bridges.

In this class, we’ll discuss how we utilized the InfraWorks bridge workflows to develop a fully parametric intelligent model of a multibridge cable-stay structure in a lot less time when compared to traditional 2D AutoCAD, Civil 3D, or even Revit workflows! We'll demonstrate the adaptability of the parametric InfraWorks bridge model and its ability to adapt to design changes. We'll demonstrate the breadth of information created, and finish it off with stunning screenshots and fly-through renders.

Speakers

Scott Cameron

Scott has 26+ years of experience within a variety of industries including ship building, pulp and paper, oil and gas, highways and bridges, light rail rapid transit, material handling, and ports and terminal on sites in British Columbia, Canada, Central America, South America, Australia, and other countries around the world.

For the past 12 years Scott has worked at Hatch as a BIM Specialist and Senior Designer in the Ports & Terminals practice group in Hatch Infrastructure Transport & Logistics. He is also the Hatch Global Revit Application Development Lead responsible for the management and implementation of Revit at Hatch globally.

The past 5 years he has been filling the role of BIM Manager on large Infrastructure projects ($500 million to $1.5 billion). His true work passion is utilizing any modeling software package such as InfraWorks, Inventor, Revit, Civil 3D / AutoCAD, and Navisworks but he especially loves parametric modeling. Scott's non-work passion is motorcycles. Not only riding them but building them and racing them at racetracks around the pacific northwest.

Danny Lewis

Danny is a 14+ years of experience in Mechanical engineering with experiences ranging from machine design (mining machines, mobile equipment, conveyors, 1000ºC roasters/furnaces, chutes and launders, machining (using Inventor HSM) and fabrication (general welding techniques and detailed design), slurry pumping analysis and piping design, along with multiple pre-feasibility/feasibility studies for new mining facilities.

Throughout this time, Danny has worked, in-depth, with a number of Autodesk products (PLM360, Inventor HSM, VRED, Fusion360, ACAD {Mechanical, Plant3D, P&ID}, Recap, Navisworks) but most notably the Inventor/Vault tools.

Danny is now the Global Application Development Lead for Inventor/Vault at Hatch and has spent the last 7-months additionally engaging in the Infraworks workflow and participating as much as possible to push that development along.

What is in this Handout

There is a 0% chance that all the ins and outs of Infraworks, Inventor, iLogic, Excel, Revit and Civil 3D related to this workflow can be tought within a single white paper… it would be an epic novel of around 1000 pages; or a good round of googling to be able to gather all the necessary tid bits.

Learn about how to transition from traditional, 2D bridge workflows to modeling in InfraWorks using parametric Inventor parts

Traditionally at Hatch since 2009 and the $2.5 billion Port Mann Highway 1 project in Vancouver BC, we have been using Civil 3D to design our bridges and create 2D plans and profiles. Back then we thought there was a big improvement over Autodesk LDD that we used on the $600 million Sea to Sky project. That was nothing thought………things really changed in the past couple of years with Infraworks! Now we can truly work in a 3D environment to build our bridge models.

Before

Traditionally, the structural bridge team would take the alignment and lay out a plan view of the bridge locating piers, abutments, girders and bearings. We would take the alignment profile and offset the profile line for deck thicknesses, barriers, railings, parapets and add some piers with bearings and foundations. And we all know what happens when the alignment and profile changed – redo almost all of the plan and profile from scratch!

Now

Civil3D is still part of the mix, but now we will use a few new programs in the workflow. Civil3D, Inventor, Infraworks, and Revit are all used but its not as complicated as one might fear.

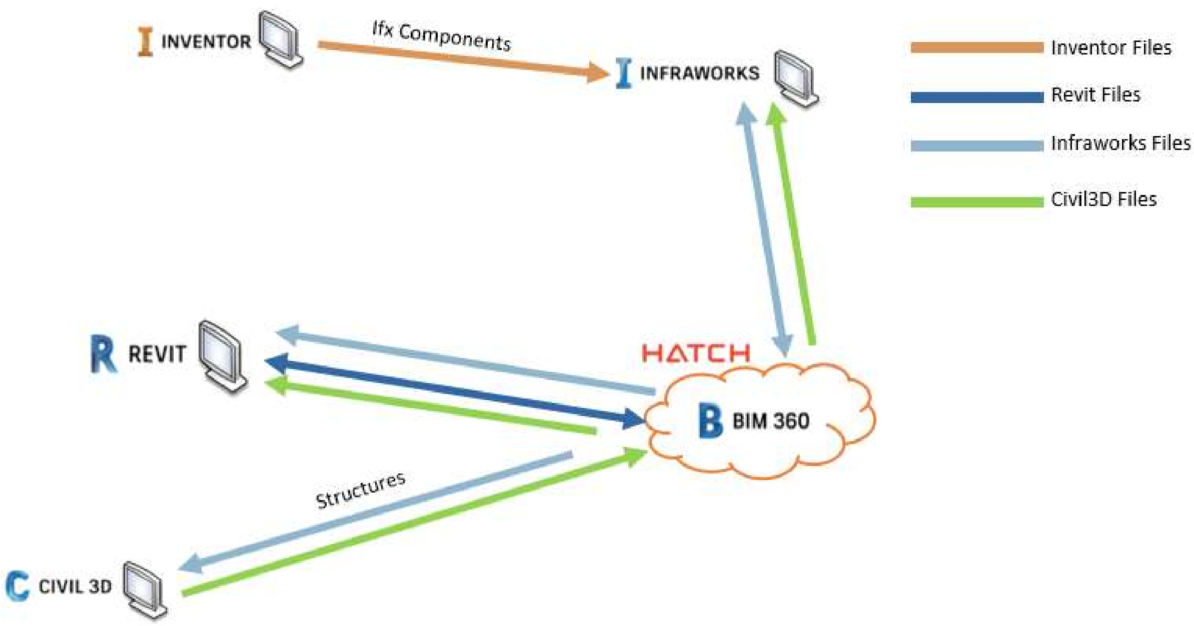
Civil3D – To create the road alignments, profiles and corridors just like we have been doing for the past 17 years. Then push them into Infraworks. The Infraworks bridge model is pushed pack into Civil3D to present the bridge profile (until Revit can create profile views – potentially coming soon).

Inventor – To create the structural components of the bridge model.

Infraworks – To assemble the structural Inventor components along, and constrained to, the corridor.

Revit – To further detail the model and present the model on drawing sheets.

Workflow diagram



Initial Bridge creation

1. Create your road corridors at your bridge and bring them into Infraworks
   - Presentation - *Video Example #1 – Adding Corridors in Infraworks.*

   Tip – corridor must have a flawless surface. Any imperfections are transferred to the bridge deck and girders below in Infraworks.
2. Create the bridge along the corridor in Infraworks between desired stations
   - [BIMbc Vancouver: Infrastructure Workflows - YouTube]
     Ara Ashikian presents at BIMbc – great video
3. Apply main parameter values such as number of piers and girders along with some spacing and sizes.
4. Chose styles of structural objects from styles pallet. If the one you need is not already included with Infraworks you will need to use Inventor to create the part
5. Create the parts in Inventor
   - Presentation - *Video Example #3 – Creating the Inventor Parts*
6. Import the Inventor parts into the Infraworks component library
   - Presentation - *Video Example #4 – Importing Inventor Parts into Infraworks*.
7. Chose the new components from the style pallet to swap out the original bridge components for your custome parametric Inventor components
8. Import the Infraworks model into Revit for detailing and or drawing production
   - Presentation – *Video Example #5 – Importing Infraworks Bridge Into Revit and Updating*

Learn about using InfraWorks, Civil 3D, Inventor, and Revit to create a parametric, adaptable, multibridge intelligent model

The workflow for this and steps involved are pretty thoroughly described throughout the entire presentation and it would be redundant to try and duplicate everything inside the handout.

In a quick summary, the workflow is always:
1. Use the Infraworks model builder to create the area model for your site (not shown in the presentation)
2. Bring a Civil3D corridor into Infraworks or create a corridor in Infraworks using imported Civil 3D alignment and profile geometry.
3. Create a bridge on the corridor (default components will come in on the bridge)
4. Adjust the default bridge components to suit your project requirements
5. Create custom bridge components in Inventor and add them to the bridge as required
6. Export bridge as IMX file
7. Import IMX file into Civil3D and Revit
a. Once initial import is completed, Civil3D and Revit notify users when the IMX file is updated by Infraworks users.
8. Complete drawings for bridge in Civil3D and Revit

Notable Video References from Presentation
Video Example #2 – Updating Corridors in Infraworks
Video Example #6 – Importing Infraworks Bridge Into Revit and Updating

Learn about the automation power and flexibility of using Excel- and iLogic-driven Inventor models within InfraWorks

There is a 0% chance that all the ins and outs of Inventor, iLogic, and Excel can be tought within a single white paper… it would be an epic novel of around 1000 pages. However, this handout will describe some of the major elements that we used on the Pattullo Bridge project and provide you with good information of what IS possible to be done, so that you can start off with a good plan. Autodesk University classes (Past and Present) as well as the Inventor forums and YouTube are all chalk full of very helpful How-To lessons to help users navigate the Inventor software; but they're only helpful if you start with the right approaches.

In Summary: **Learn what CAN be done with Inventor iLogic and Excel to create bridge components… but not necessarily HOW**

What can be done in Inventor

Inventor is an incredibly powerful modeling software even without iLogic and Excel. The tool is primarily designed for manufacturing environments, but can also be used for larger scale assemblies. Everything in the model can be controlled in multiple different ways and the overall focus of the software is to just help users describe (in excruciating detail) every aspect of the 'thing' that is being modeled… and almost all of this information it then shares freely with other downstream software. At Hatch, we use Inventor as a core software for making mechanical components of all shapes and sizes and then take the components into analysis software for FEA/CFD/DEM analysis as well create drawings of the parts. I would say that we produce detailed drawings with the software (we could) but typically we often put all the fabrication details directly into the models and then just hand the detailed models off to the fabricators (who are also using Inventor!).

Below is just a small sampling of the functionality of Inventor that we used for the Infraworks modeling. Understanding and mastery of all the items below would be good starting point to succeeding with Infraworks.

Parameters

The primary method that Inventor interoperates with Infraworks is via parameters. They're just a named value for anything you want in the model and can be a Boolean (true/false), Text, Units (including a 'Unitless' unit). There's three different types of parameters, but all the types can be referenced in to Infraworks if the 'key' column is checked. Parameters can be named almost anything, BUT need to conform to certain naming rules with prevent the use of spaces in the words and special characters. The parameter name ARE case sensitive. So abc123 is different from Abc123.

Parameters are properties of the specific model that is open, so if that model is then placed into an assembly, the assembly file itself will have it's own parameters different from the models placed in it. To connect assembly parameters to the parameters of the parts within it requires iLogic coding.

Model Parameters – any sketch dimension in the model, can be renamed

User Parameters – custom parameters created in the model, can be tied to a sketch dimension (or multiple sketch dimensions) or left independent
*Multi-Value Parameters are just a parameter that has been tagged to be able to take values from a set of values predefined to it. Typically this is used to create toggles in Infraworks where the value changes between 0/1
*Boolean Parameters – can only be TRUE/FALSE (because that's the definition of Boolean)
*Text Parameters – can be whatever you want, including numbers… but you can't change from a text or Boolean parameter to a unit parameter after it's been created.

Reference Parameters – Dimensions that are redundantly put onto the model (eg. A total dimension for a defined set of lines). The value in the reference parameter cannot be manually edited because it is driven BY the other parameter dimensions in the model.

Work Planes/Axis/Points

This functionality is probably more familiar to Revit users, but in Inventor you can define any number of work planes, axis, and points, and have the location of them defined by sketches. These workplanes can be used to define the surfaces of sketches as well the start/stop point of extrusion, sweeps, and other modeling functions.

Without getting too far into the weeds, you can also do surface modeling in Inventor and model everything as surfaces instead of solids; any of these surfaces can be referenced into the solid models… its just a whole other thing.

You can also do freeform modeling and do the whole clay push the surface around and sub-divide surfaces… not sure how well that translates into Infraworks, but I'd be surprised if it didn't work.

Reference Geometry / Sketches

Inventor is linear in how it calculates it's operations and as you progress the model, you can reference all the geometry and sketches that are already available in the model. This includes projecting geometry from previous sketches as well as the location of any of the work features described above. If the original sketches/work features change, the subsequent geometry that reference them also adapt to suit the new conditions. This is an incredibly powerful tool when used correctly.

Note: Creating very complex sketches in Inventor with 100s of lines will likely result in sketch failures. A better approach is to setup layers of sketches where the previous sketches are referenced in as needed… instead of trying to do it all in one.

Multi-Body Parts to Drive Assemblies of Parts

Without getting too technical, one of the features of Inventor is to create models that are a collection of bodies within a single 'part'. The benefits of this are varied but within Infraworks context the benefits are that you can perform operations to a single body out of the collection and *Important* can save the multi-body part out as an assembly that is controlled by the geometry of the original multi-body part. This functionality is currently necessary create components that will be seen as 'independent' parts by the time the Infraworks component lands in Revit. There's many ways to do this type of component, but best is to use the integrated button in Inventor to save multi-body part to assembly.
*to have the components keep their flexibility in Infraworks, currently the only method is to map the assembly parameters to the original multi-body part parameters.

Suppressions

Within the model, you can toggle certain features to be suppressed (or conversely… NOT suppressed) if a certain criteria is met. For simple criteria such as a parameter being 1 or 0, it can be done directly in the feature by Right-Clicking the feature and editing the feature Properties. For more complex things, iLogic coding would be required.

What can be done in iLogic

iLogic is an integrated programming software that allows users to pull out almost any property, parameter, features, 'stuff' about any of the Inventor models and then perform programming operations on them. This tool is incredibly functional and provides a whole host of automation benefits to Inventor

For the sake of Infraworks, this means that users can build a lot of functionality into the components and tie them to parameters as toggles. An example would be to have a cross-frame and by using iLogic to toggle whether certain cross-members are included or to change the way the cross-member is sized if it reaches a certain parameter threshold (eg. Width apart).

The limits of what you can do in iLogic is really only limited by your ability to perform VBA type coding (think Excel Macros), however some of the typical setups for doing the VBA coding will not work once it lands in Infraworks. For that sake, it's best to keep it simple and use very basic coding in the iLogic. This means forgoing creating a Main() function and declaring variables and the such.

Note: if for some reason iLogic isn't sufficient, you can also create VBA macros in Inventor that sit above iLogic coding but can still interact with it.

What can be done in Excel (and Inventor)

Inventor can connect to an Excel file through three different methods and all of the three methods have their place where they make sense.

Excel Referenced Parameters

From within the parameter screen in Inventor, there is an option to reference in an excel file directly to the parameters. This method creates new parameters and assigns them the names, units, and values as described in the Excel table. If the Excel table changes, the parameter values change to suit (And the model changes to suit the new parameter values).

This is helpful when you have an excel table that has all the values you need and want to just pull in a list of parameters from the table.

Note: The excel file needs to be formatted in a certain manner for Inventor read the values correctly. Essentially, have the parameters listed in A1-A###, units listed in B1-B###, Values listed in C1-C###. If you have a break in the rows… Inventor will assume that's the end of the list from Excel.

Excel LookUp Via iLogic

iLogic has the capability to directly connect with an external Excel file (that you give it the path of) and then look up cell values from that Excel file and return them. An example of this would be sending Excel a value of "FIELD1" and it can then look in the excel file for a specific tab, column, row that matches and you can then point it to a corresponding tab/column/row to get the value back and put that value into another parameter.

Write Parameters from Excel per given parameter

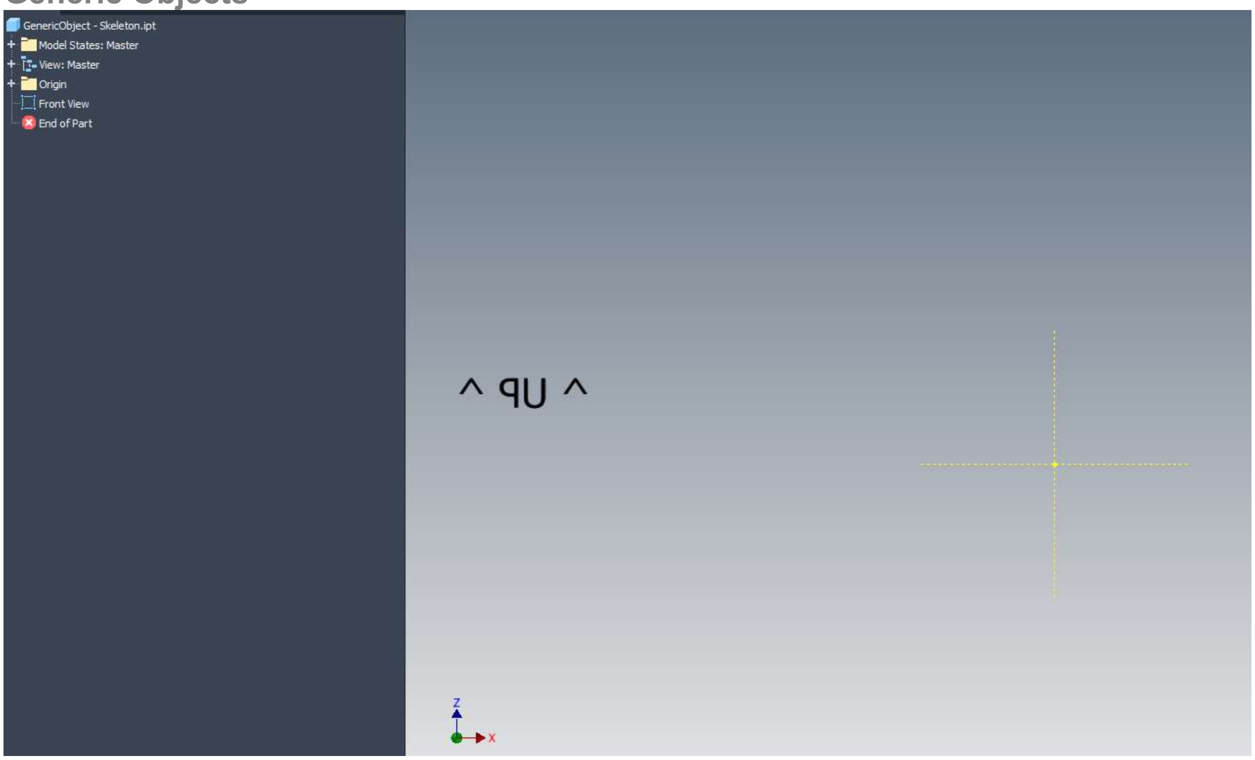
One variation of using the Excel LookUp Via iLogic is to have a single parameter passed to excel and then have it find the corresponding Row that matches… and then grab all the parameter values that match that row of values.

This is helpful if your table has a set of sizes and each of the sizes lists out multiple variables that define that size. By using this method, you can just toggle between the specific table sizes and all the values for that size will pull in via the excel table.

As described in the presentation, below is a quick summary of the ‘magic words’ that each of the different components use in Infraworks HOWEVER… by the time you’re reading this, the information is probably already stale. Infraworks Bridge Workflow is rapidly improving and I believe one of the ‘plans’ on their horizon is to make mapping to the specific parameter names more flexible… once they do that; this information is obsolete.

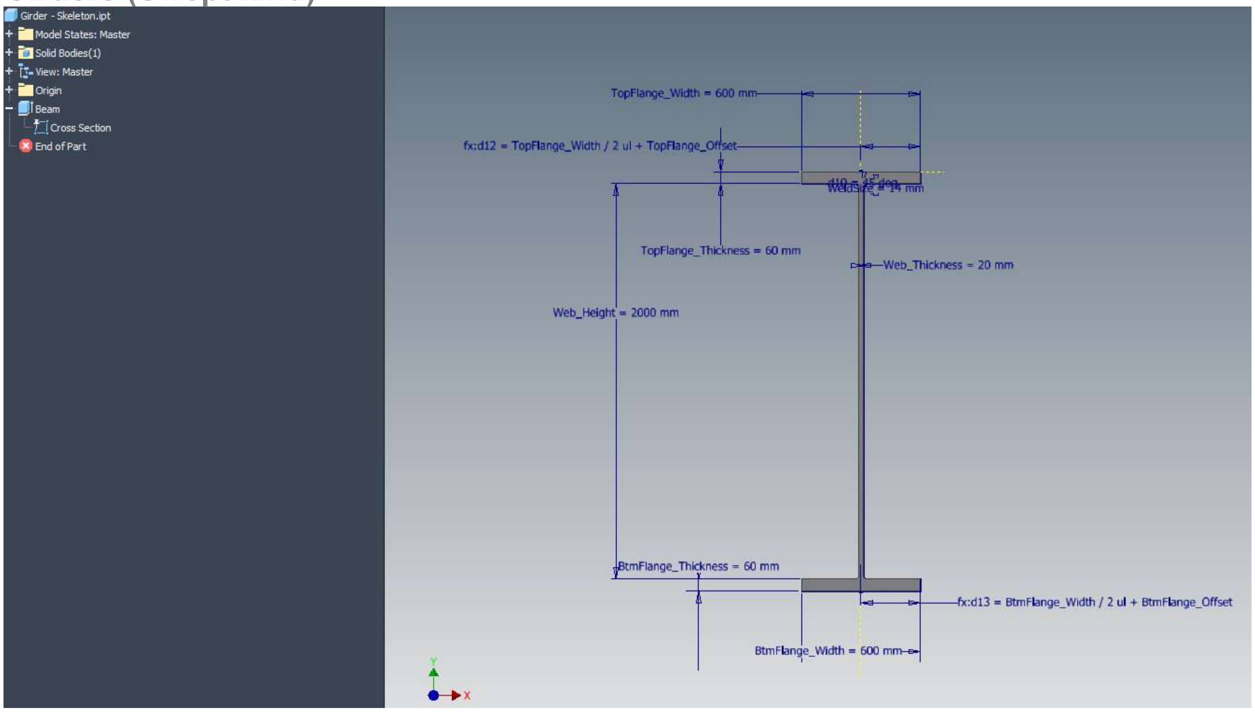
Regardless… here ya go:

Generic Objects



As far as I know… no ‘magic words’ for generic objects, but the only thing worth mentioning is that whatever you model should be done with Z in the up direction and X being perpendicular to the alignment. Once in the model you can skew the model and can also toggle that Y is up (which is default in Inventor)… but might as well draw it correct in the first place. The origin of the model will be origin of the model and Infraworks will put Z=0 right on the alignment. So if you want your component to be above the alignment, then draw it above the x-y plane.

Girders (Swept kind)



Girders are pretty straight forward, but there's some automated functions in Infraworks that will force the absolute highest point of the girder to be at the bottom of the deck. This is usually fine, but can cause some pain if you want to have the girder drop down from the deck for an area.

The slope/rotation of the girder will be forced to be perpendicular to the underside of the deck; again normally this is fine… but isn't when that's not what the design requires.

Other things to keep in mind is that EVERY parameter that you define in the girder will be prepended with the LeftGirder and RightGirder as mentioned in presentation; not a bad thing… just something to keep in mind.

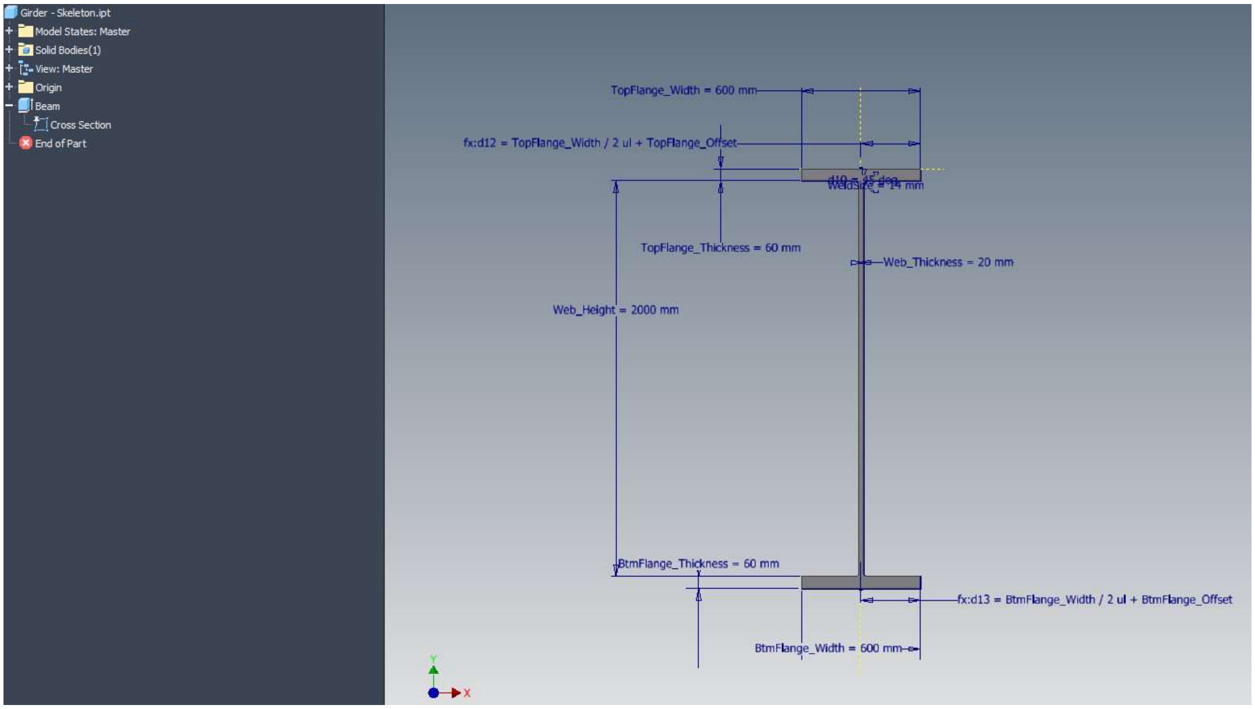
Last thing to note for girders, you'll draw them with Y-axis in the up direction.

Magic Words:

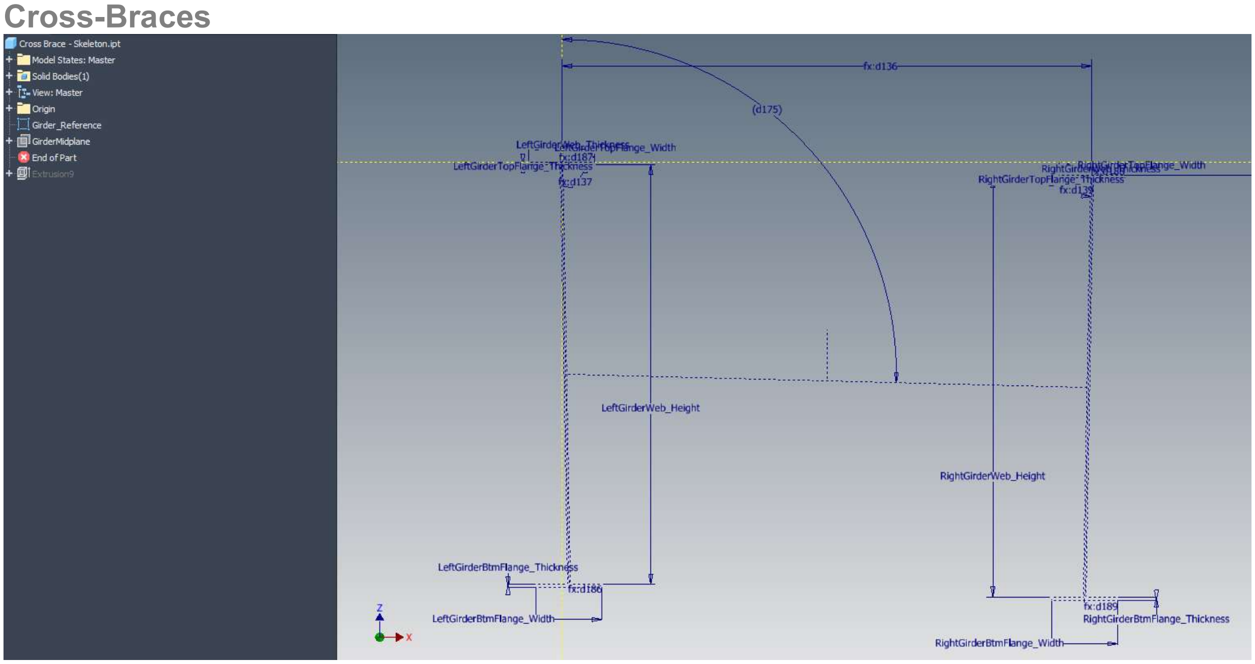
MatchGirderTopSlopesToDeckSlopes		True/False	True

This parameter, when added to the girder (as a boolean parameter) toggles whether Infraworks allows the girder to sit above the deck for the areas outside of the deck. Eg. If the deck is 5ft wide and I have U-shape that has a 6ft area in the bottom and the sides go above the deck, then this toggle will allow those sides to go above the deck level.

Girders (3D Girders)



Cross-Braces



Cross-Braces are a very versatile tool because of the prepending capabilities in Infraworks. The Z-axis will be up and when looking at the zx plane, the left girder is on the left, right on the right. The top-center of the left girder should be at the origin of the model. Anything modeled in the y-direction (into the page as shown) will go along the alignment (and there's an option in Infraworks to enable it to match the bridge slope).

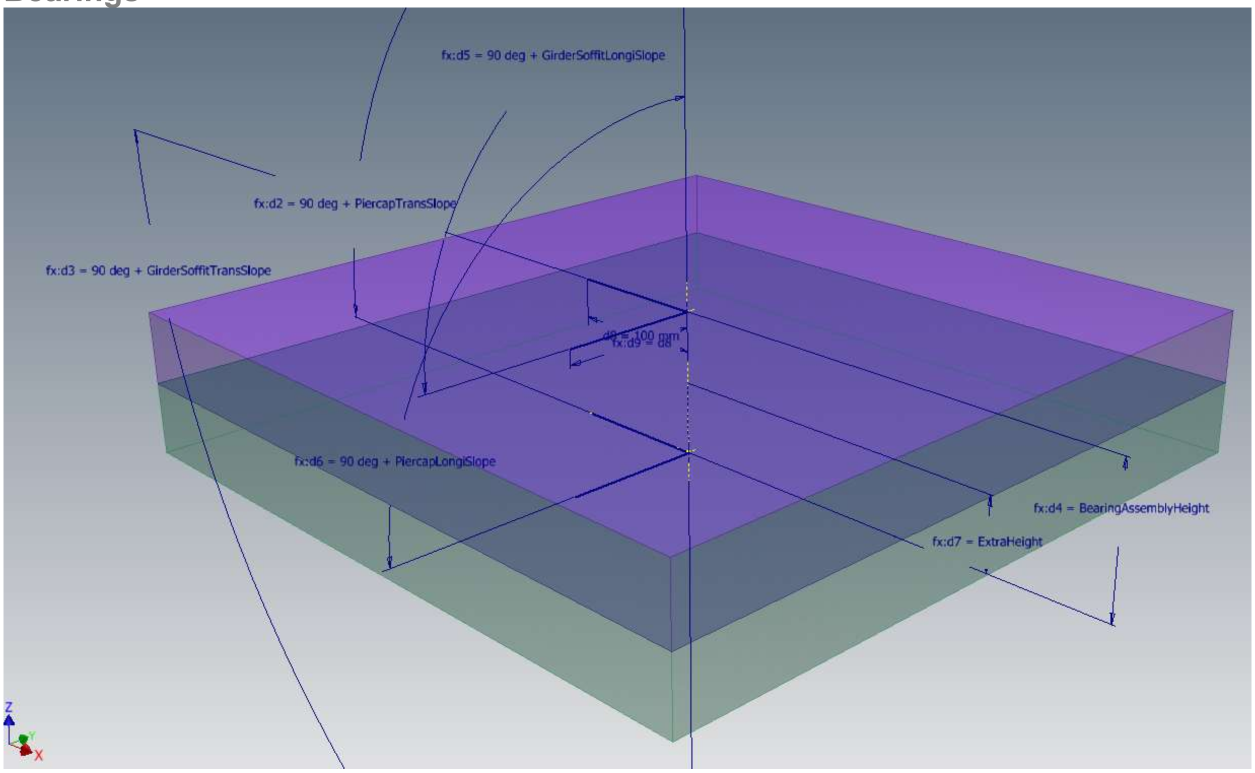
ProTip: Model the lines at an angle and then define them to be straight; Inventor will sometimes try to put in constraints when you aren't looking. Testing that your model will be able to flex for the girder slopes is very important. If you hold CTRL while placing your sketch lines; it will omit putting any constraints on them.

Magic Words:

VerticalOffsetBetweenWebs	d142	mm	-100 mm
DistanceBetweenWebsAtTop	d136	mm	4000 mm
LeftGirderWebSlope	d137	deg	1 deg
RightGirderWebSlope	d139	deg	1 deg

These are all pretty self explanatory except for the fact that the Left/Right WebSlopes are actually web angles (so they'll be in degree). Regardless… if you include these 4 parameters, they'll work correctly.
Protip: Put the slope/angles on as a 90+{parameter} dimension so that a dimension of 0 deg or -# deg doesn't cause issues for the sketches.

Bearings



Bearings are actually a really simple feature once you've figured out how to add the appropriate slopes to the top and bottom of the bearing model that you create.

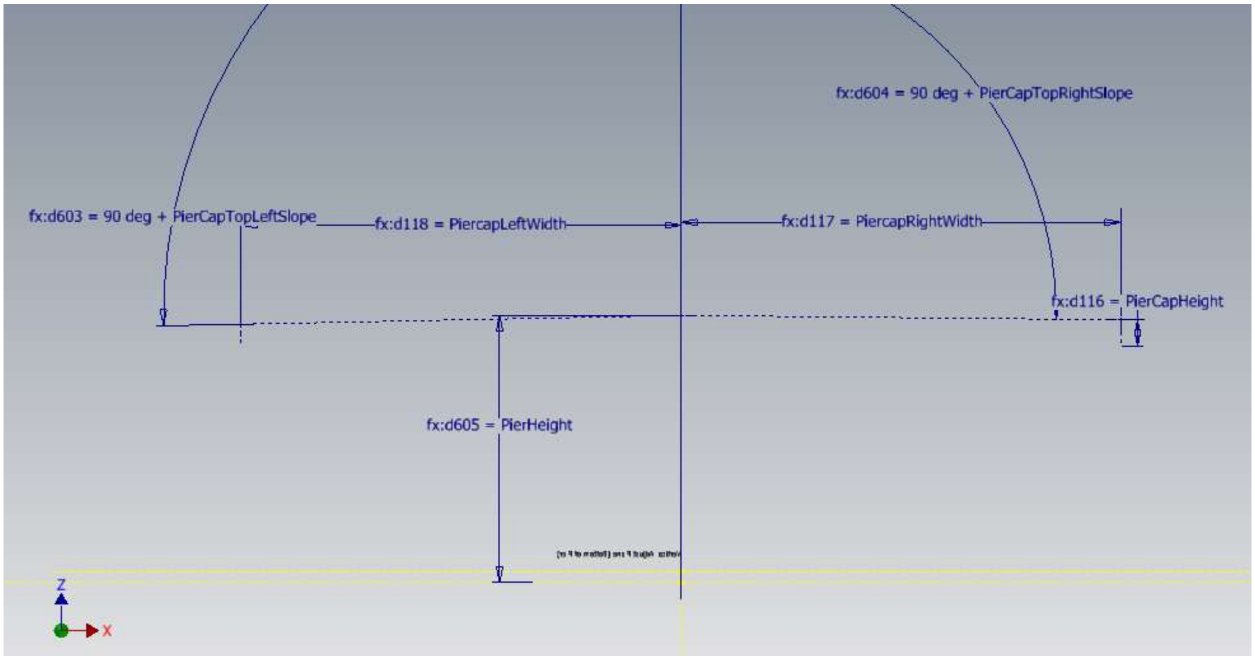
Magic Words:

GirderSoffitTransSlope	d3	deg	0 deg
GirderSoffitLongiSlope	d5	deg	0 deg
PiercapTransSlope	d2	deg	0 deg
PiercapLongiSlope	d6	deg	0 deg
BearingHeight	BearingAssemblyHeight	mm	50 mm
ExtraHeight	d7, BearingAssemblyH...	mm	50 mm
BearingAssemblyHeight	d4	mm	BearingHeight + ExtraHeight

The difficult parameters are the top and bottom slope parameters, but the remainder of the ones that come in are 'bearing height' and 'extra height'. The extra height is the height required to make the up the distance between the top of pier to the bearing when it is not suitable for the bearing to be the same height on the pier. An example would be when the pier is sloped but the deck and girders are flat. The 'extra height' would show up on the bearings at the lower points to make up the difference; the bearing height would however remain the same for all the bearings (unless you override a specific bearing in the group).

Aside from the top/bottom slopes, the only other parameters would be the bearing height and the exra height and then the complete bearing assembly height. Note: If you have other things to add to the full bearing assembly height, then add them to the equation that creates the total value.

Piers



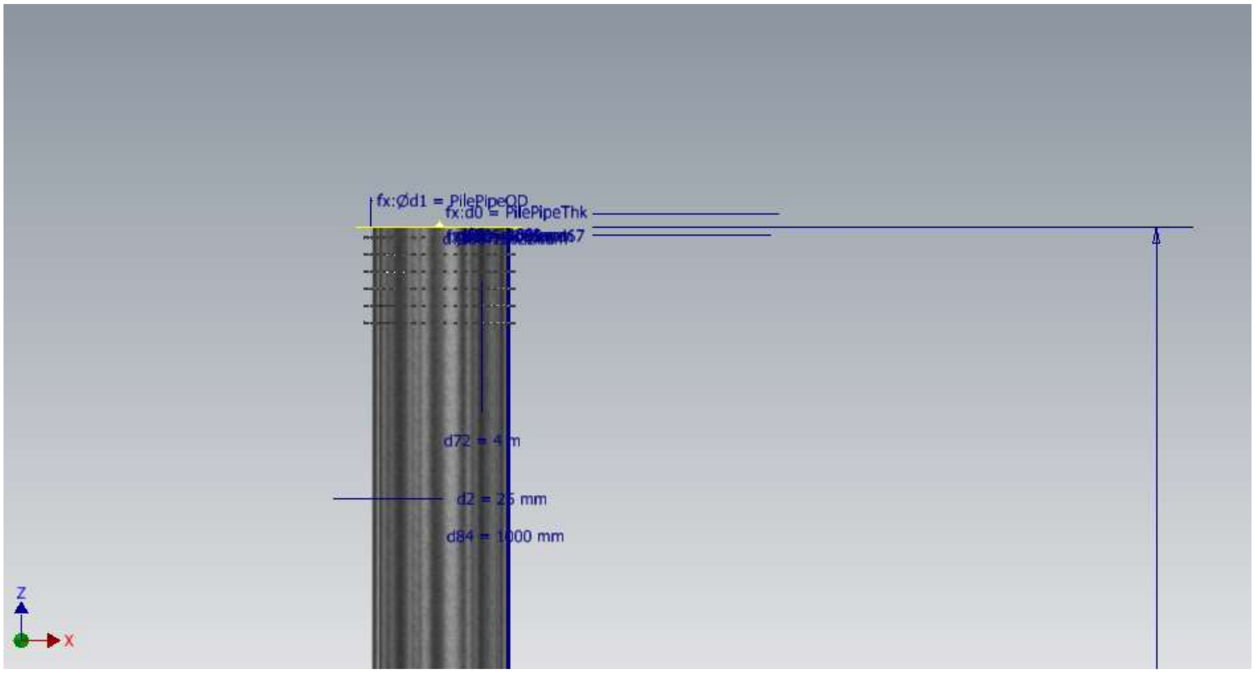
Piers are one hand very simple… but quickly become complex to model if you build a lot of toggles onto them. The core things that the pier needs to adjust for is the location of the top dead center of the pier (center = center of the alignment) and then the width and slope of the road to the left and right of the alignment, and then the overall height that the pier should be above ground. Once these parameters are established, the rest of the model is just how much variation you want to build onto the pier so that you can accommodate a variety of different styles without having to have multiple different family.

It should be noted that the left and right width of the piers will be automatically adjusted to the bridge corridor information, so if there's specific values you need to obtain or if you want to have more or less pier supports beyond those values, then your model will need to have an override value assigned to those parameters to accomdate this. And example would be to have a dimension that lists 'LeftWidth + LeftWidth_OR' on it… to allow room for you to add or subtract values to it.

Magic Words:

PierCapHeight	d116	mm	2400 mm
PierHeight	d605	mm	24252 mm
PiercapLeftWidth	d118	mm	40000 mm
PiercapRightWidth	d117	mm	40000 mm
PierCapTopLeftSlope	d603	deg	atan(PierCapTopLeftSlopeInPercentage / 100 ul)
PierCapTopRightSlope	d604	deg	atan(PierCapTopRightSlopeInPercentage / 100 ul)
PierCapTopLeftSlopeInPercentage	PierCapTopLeftSlope	ul	2 ul
PierCapTopRightSlopeInPercentage	PierCapTopRightSlope	ul	1 ul
PierCapDepth		mm	2200 mm
PierVerticalAdjustment	d170	mm	1000 mm
IsIntegralPierThatDoesNotRequireBearings		ul	0 ul

Foundations

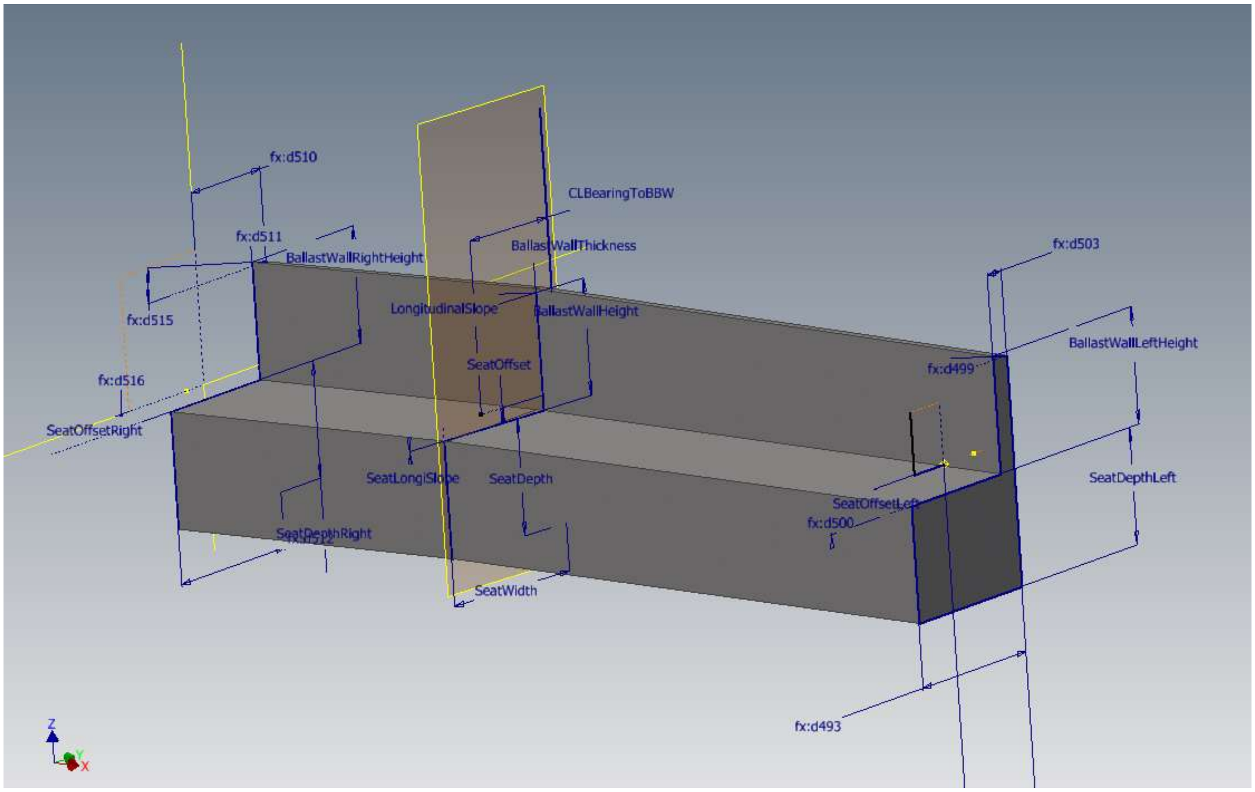


Foundations have function in them where the top of the foundation (drawn at z=0) will be put into the Infraworks model at ground level. If you change the parameter in Infraworks called 'height above ground' then it will raise the foundation vertically up (the whole foundation; including piles) but it will also adjust the bottom location of the piers. This is important to note because if you want the bottom of the piers to raise up… you should actually be adjusting the foundations.

Magic Words:
None (that I'm aware of)

Protip: Just include the foundations (if they're a pile below a column) into the pier that uses it. It's not an absolute necessary thing to do, but can be useful at times.

Abutments



Abutments were the first bridge feature that the Infraworks developed, but as such… it's also the least intuitive. I've heard from the Infraworks team that they plan on potentially reworking the entire workflow of abutments, so the data listed below is very likely out of date as you're reading this. I would recommend first looking on the Autodesk Knowledge portal to see if there are updated information about Abutments…and if there's nothing better there; then refer to the information below.

The gyst of the the abutement is modeled is that the Left and Right are determined as if you are driving across the bridge and therefor you'd see the back of the abutment first. So if you're looking at the abutment face-on, then Right is Left and Left is Right. The other weirdness of the existing abutment model is that rather than the left and right slopes that the piers have, the values are actually SeatOffsetRight and SeatOffsetLeft (and you'd have to figure out what the slopes are from those offsets and widths from the centerline.

The bearings are located on the ZX plane (at least at the cneterline) and the skews of the abutment has to be modeled in Inventor for them to function in Infraworks. Again; I would recommend opening up one of the existing reference abutments and review (in detail) how that model flexes with the parameters and then design yours to match.

Magic Words:

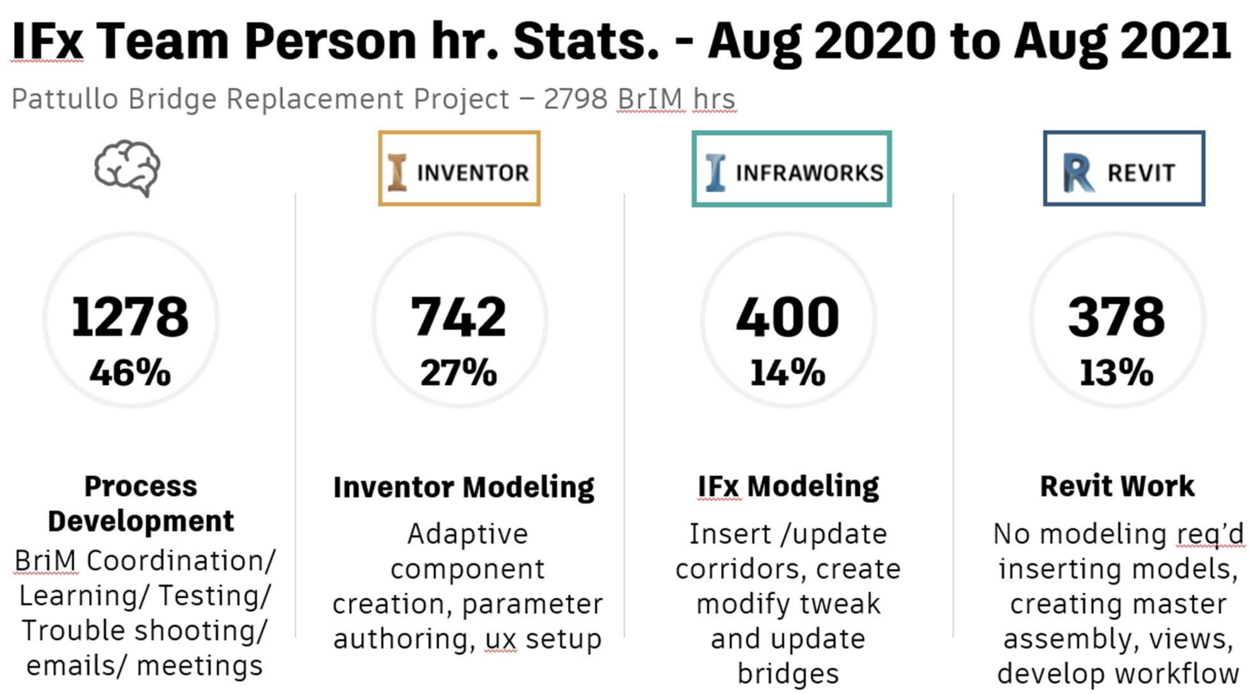
CLBearingToBBW	d448, Sketch1	mm	Centerline of Bearings to Back of Ballast Wall
LongitudinalSlope	d453, Sketch1	deg	Longitudinal Slope
SeatDepth	d449, Sketch1	mm	Seat Depth in Middle
SeatLongiSlope	d452, Sketch1	deg	Seat Longitudinal Slope
SeatOffset	d450, Sketch1	mm	Seat Vertical Offset in Middle
BallastWallHeight	d471, Sketch1	mm	Ballast Wall Height Above Seat
BallastWallThickness	d447, Sketch1	mm	Ballast Wall Thickness
SeatWidth	d451, Sketch1	mm	Seat Width
Skew	d509, d455, d451, d44...	deg	Skew
LeftWidth	Work Plane28	mm	Left Width
SeatOffsetLeft	LeftEdgeSketch	mm	Seat Vertical Offset on Left Edge
SeatDepthLeft	LeftEdgeSketch	mm	Seat Depth at Left Edge
BallastWallLeftHeight	LeftEdgeSketch	mm	Ballast Wall Height Above Seat at Left Edge
RightWidth	Work Plane30	mm	Right Width
SeatOffsetRight	RightEdgeSketch	mm	Seat Vertical Offset on Right Edge
BallastWallRightHeight	RightEdgeSketch	mm	Ballast Wall Height Above Seat at Right Edge
SeatDepthRight	RightEdgeSketch	mm	Seat Depth at Right Edge

Learn about the value that Hatch gained using the InfraWorks bridge workflow with some quantitative numbers on time spent

It was evident early on that we were not going to be able to model the main cable stay bridge, along with the approaches, off ramps, over passes, multi-user paths, and walls in Revit. As soon as I was asked if I wanted to model the structures in Revit that it would be very difficult, if at all possible. If it was possible, how would the model be updated and adapt to the road corridor changes during development. How long would it take? And how many people would we need? From my past experience, on much smaller Revit models, I tried to scale up my experience and envisioned at least 20 to 30 Revit modelers over a year… at least!

Very Possible Using The Infraworks Bridge Workflow

Once we learned of the Infraworks Bridge Workflow from Ara Ashikian at Autodesk, we began to see a path forward for this project. Not only was it possible, but the bridge models became a reality much quicker than we thought they would. It wasn't all roses (or dandelions) during the process, the bridge workflow is still a very new function. There are several areas that we still need to work out how to model for some of the nuaces of this bridge, but the time spent and the number of people we used to get to where we are today is shockingly low.



We had around 8 people over the span of a year work a total of 2800 hours. And 46% of that was process development, learning, coordinating, testing, trouble shooting, banging our heads against the desk time! That means we only spent 1520 hours creating what you see today. That's only 5 weeks for the team of 8x to work full time to create something like this. As the team learns the workflow and tools, the process development time will obviously be cut back significantly. We feel the modeling portion will only get faster, especially as we develop the structural component library in each project. As the library of components improves, the Inventor part development portion of the workflow decreases on a typical project; freeing up those resources to work on more complex, new, project types. Based on the efforts above, that means that a project of this scale would take around half the time as listed above to get the same quality…. That's incredible.

A VERY valuable tool

The value that Hatch received is in not only the obvious time and money saved for the client but the fact we are now able to:

- Save time and money for us and the clients
- Execute the work faster, at a higher quality product, and with less errors
- Create high quality imagery and equisite detail of each and every component in a bridge
- Create accurate proposals and bid models and obtain high class estimates throughout all phases of the project.
- Make changes throughout the project without creating massive delays and huge change orders
- Track status of components directly in the model parameters and then relay those onto other programs to make a ‘heat map’ of the design completion level of the whole project
- Allow the client to view the status of the bridge model via BIM360 and the ‘large model viewer’ throughout the project
- Provide higher quality and richer drawings to the construction teams and a better overall model product to the client.

Very Special thanks to the IFx Team For Their Hard Work

Danny and Scott would like to thank the hard working persevering Pattullo IFx team. Its your ideas and problem solving abilities that make these sort of dreams a reality.

- Kristen Barrie
- Amelie Croteau
- Daniel Jeffrey
- Glenn Ferridge
- Millie Jamieson (not shown below)
- Ruth Chang (not shown below)
- Matthew Murray

- Ara Ashikian (Autodesk)
- Kris Landry (Autodesk)