AUTODESK UNIVERSITY

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

CES500113

Scott Cameron &

Hatch - BIM Specialist - Transport & Logistics
YouTube – Cliffman's Projects
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Our Partners:

AECON

FRASER CROSSING
CONSTRUCTORS GP

(Scott and Danny)

HATCH

exp.

GNEC
GREAT NORTHERN ENGINEERING CONSULTANTS

Leonhardt, Andrä und Partner

VIA

Special Thanks To Team Autodesk

Couldn't have done it without you! Well, we could have but it wouldn’t have been as fun!!

Ara Ashekian, P. Eng.

Product Manager – Bridges and Civil Infrastructures

- Knows Infraworks like the back of his hand
- Will find the answer
- Will fix the issue
- Made himself available to us
- Was “Part of the Team”
- …listened to Danny complain for hours on end :P

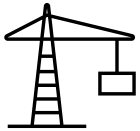
Kristopher M. Landry

Technical Solutions Executive- Civil Design & Construction

- Always interested in our success
- Helped troubleshoot Civil3D issues
- Very helpful at finding the right Autodesk people to help Hatch out if Ara doesn’t have the answers

Project Disclaimer

...we ain't done yet!



The project is still IN-PROGRESS and as a result the video we show at the end is where the model was at as of mid-August 2021.

So if things don't look perfect.... **WE KNOW**.... We're still working on it!

(Blame Autodesk for short-changing the recording timeline)

BrIM (Bridge Information Modeling)

Pattullo Bridge Replacement Project – 25 km East of Vancouver, British Columbia, Canada

IFx Team Person hr. Stats. - Aug 2020 to Aug 2021

Pattullo Bridge Replacement Project – 2798 BrIM hrs

1278

46%

Process Development

BriM Coordination/ Learning/ Testing/ Trouble shooting/ emails/ meetings

INVENTOR

742

27%

Inventor Modeling

Adaptive component creation, parameter authoring, ux setup

INFRAWORKS

400

14%

IFx Modeling

Insert /update corridors, create modify tweak and update bridges

REVIT

378

13%

Revit Work

No modeling req'd inserting models, creating master assembly, views, develop workflow

Software and Versions

The software we used; handy references for later.

Civil 3D 2021.2 (Design files can be in 2020 but C3D 2021.2 must be installed on machine)

Infraworks 2022.0.0.37 (Hotfix….??) (Always use the latest you can – min 2021)

- IWExportToRevit 2021.5.msi (Match with Revit version – always use latest update)

Inventor 2022.0 (Can use 2018 or newer – does not need to match C3D, IFx, or Revit)

- With Hatch custom in house tool (in lieu of ShapeModeler 2022)

Revit 2021.1.3 (Can use 2020/21 - make sure IWExportToRevit matches this version)

Navisworks 2022 (Use 2022 to solve some issues with colour and transparency overrides)

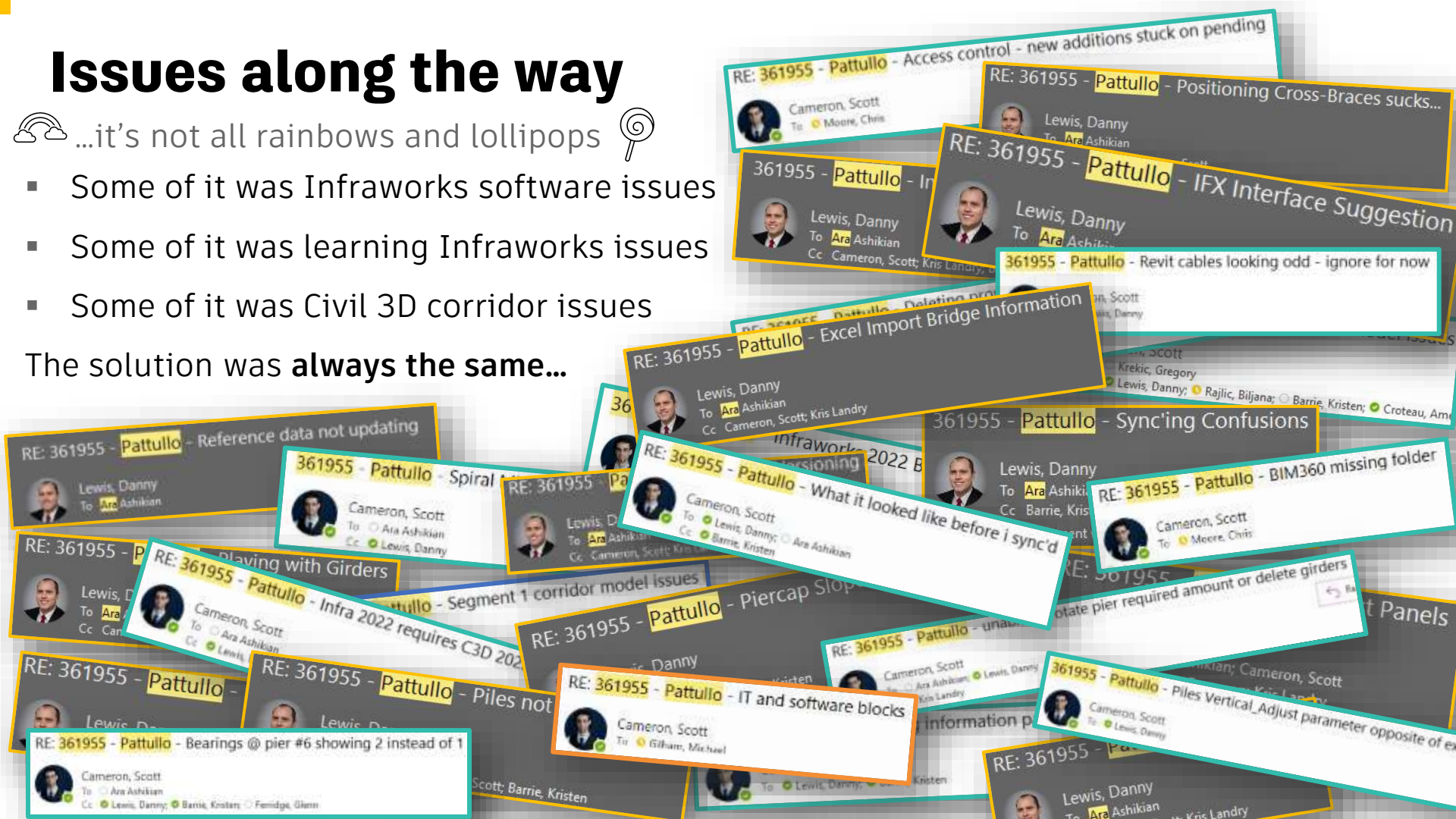
BIM360 Desktop Connector 14.7.0.1306 & ProjectWise

Issues along the way

…it's not all rainbows and lollipops

- Some of it was Infraworks software issues
- Some of it was learning Infraworks issues
- Some of it was Civil 3D corridor issues

The solution was **always the same…**



"I don’t think we accounted for this scenario!"

Civil 3D to Infraworks

Civil 3D Into Infraworks

Getting the alignments, corridors, surfaces, data out of Civil 3D

- Ideally, you want **C3D corridors from your roads team**.
- But you can start with C3D Alignment & Profile data, build your own corridors in Infraworks and switch when the roads team have the corridors ready which is what we did
- Civil 3D Data is stored in BIM360 so that a data connection to the original files from Infraworks can be maintained thru the BIM360 Desktop connector.
- If you are working in multiple common data environments like we are all you need to do is copy the source model for the C3D data over top of the copy in BIM360.
- Civil 3D source file must remain the same file name and unique ID number and the elements in the file must remain the same name/id# in order keep updating structure
- Only updates when you reload the data in Infraworks (does not update on refresh)

Importing Civil 3D Corridors into Infraworks

The Infraworks bridges will be constrained to the Civil 3D corridor, alignment, & profile

In Infraworks

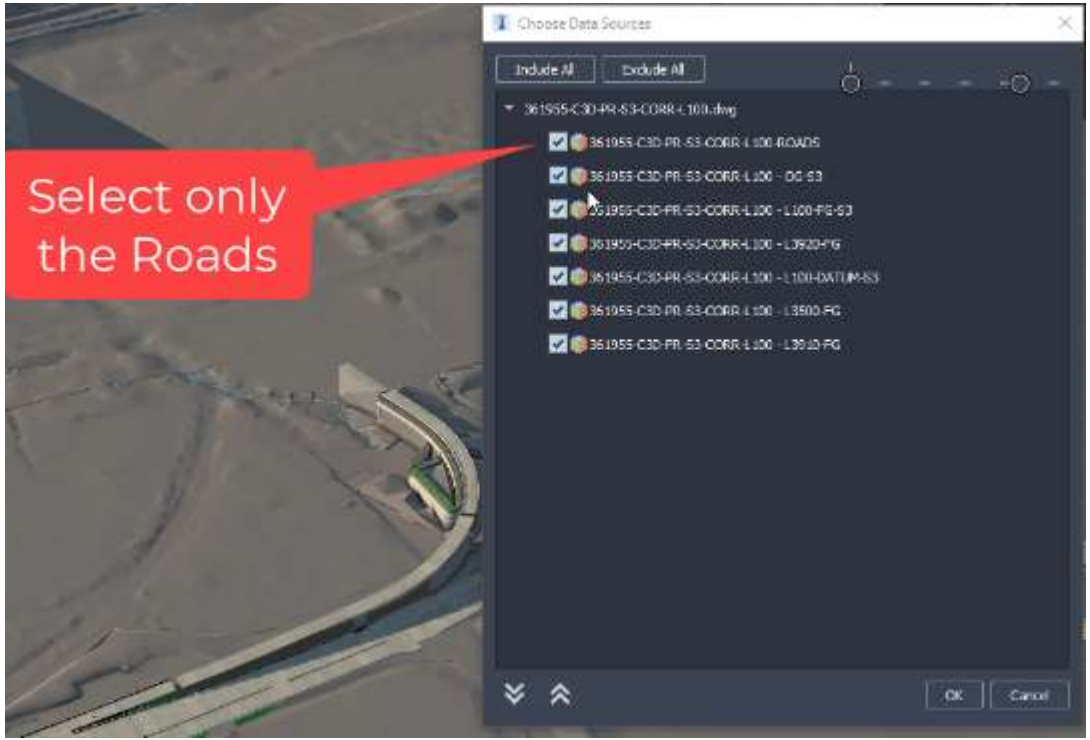
- Simple but time consuming
- 29 corridors took almost 16 hours
- Manage/Data Souce/Autodesk Civil 3D
- Browse BIM360 for corridor model
- ***Must have min C3D2021 on machine
  - Ifx used latest C3D in background
- Project C3D files can be older then 2021

Importing Civil 3D Corridors into Infraworks

The Infraworks bridges will be constrained to the Civil 3D corridor, alignment, & profile

In Infraworks

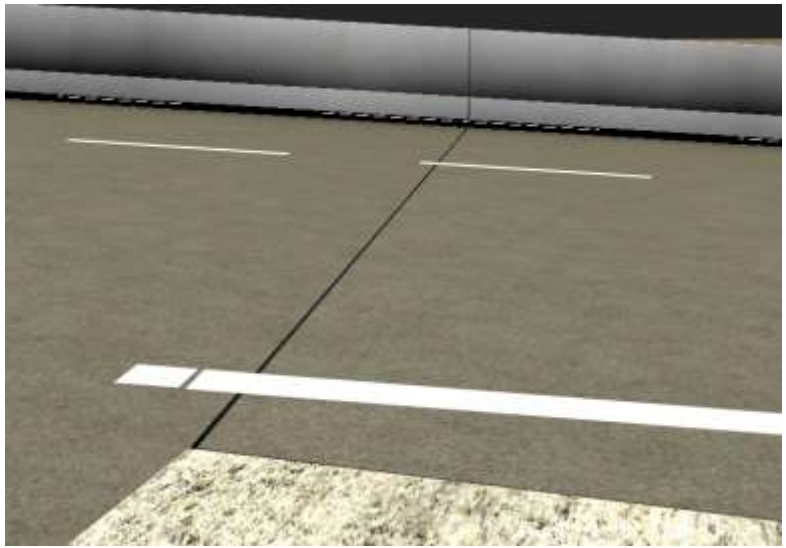
- Select only Roads
- Configure (Yes, I know it says configured but it isn't)
- Choose only the corridor related to this host model.
- Do not select other corridors referenced from other files. Use those host files for the source of those corridors.
- Close & Refresh

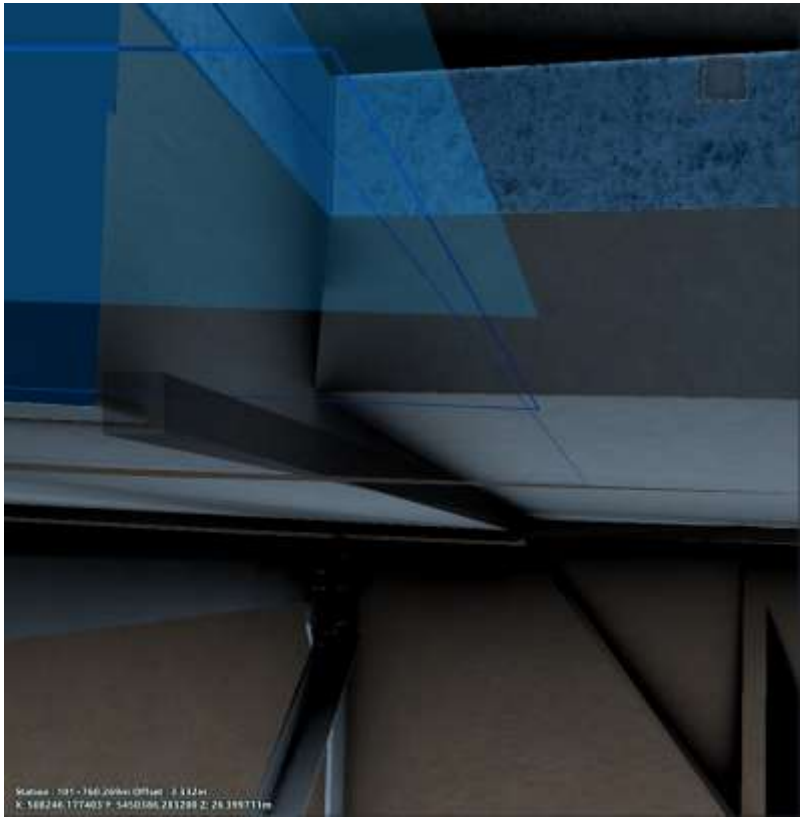


Civil 3D Corridors Into Infraworks

Getting the alignments, corridors, surfaces, data out of Civil 3D

- The smallest corridor error on top (shown below) can lead to deck and girder issues under (shown right)



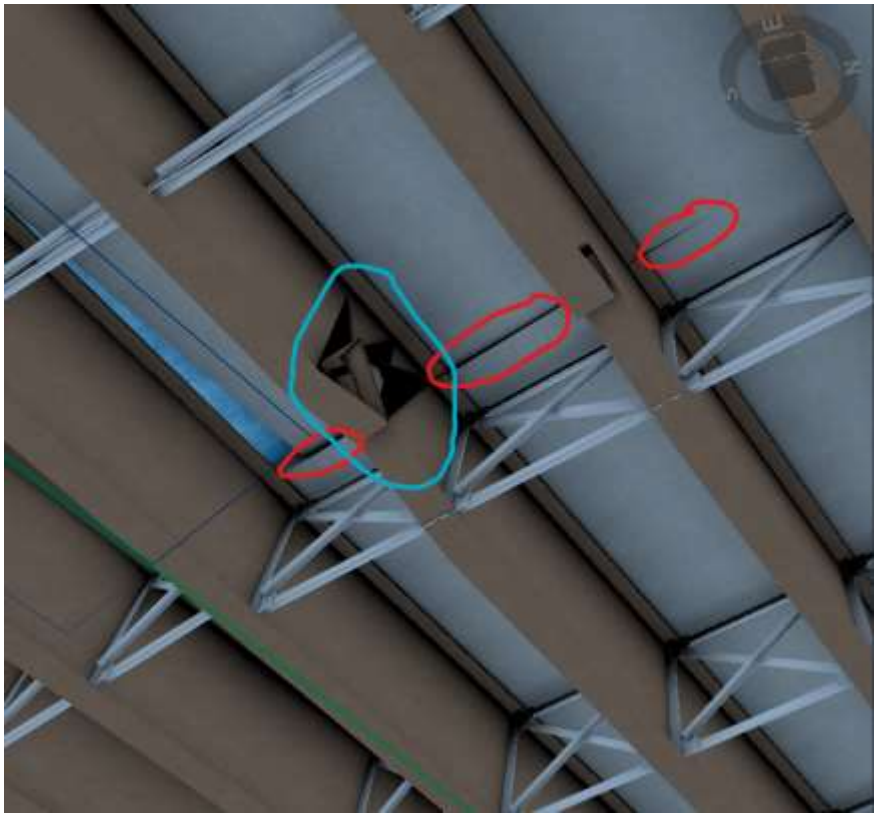


Related Links:

Civil 3D Corridors Into Infraworks

Getting the alignments, corridors, surfaces, data out of Civil 3D

- You need **really good quality** corridors
- “Garbage in = garbage out”



Related Links:


Video Example #1
Adding Corridors
in Infraworks

Updating Civil 3D Corridors in Infraworks

YES! Corridor changes in Civil 3D can be transferred to Infraworks and the structure!

In Infraworks

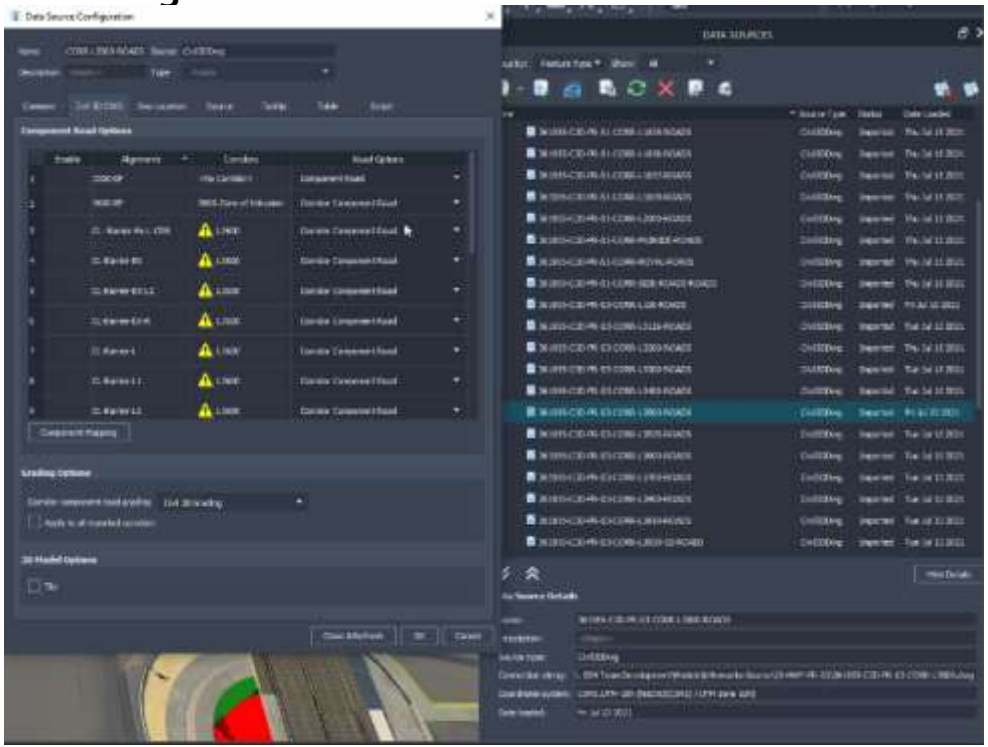
- Find datasource that hosts corridor
- Right click
  - Reimport
- “Failure gathering references” warnings
  - The data sources have links that are not in BIM360
- They can be ignored if the source data you need is lives in the file you are reloading and is not linked in.

INFRAWORKS

Updating Civil 3D Corridors in Infraworks

Updating corridors Infraworks can be very time consuming

- The **more links** your datasource have the **longer** it will take to **reimport** the file.
- “Configure” after reimport
- Check for errors and new corridors
- Close & Refresh



INFRAWORKS


Video Example #2
Updating Corridors in Infraworks

Inventor to Infraworks

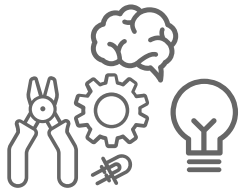
Inventor Into Infraworks

Import the bridge components and sub-components into Infraworks

INVENTOR - *NOUN (ɪnˈventə(r))*

- Extremely powerful and common Autodesk software to everyone except AEC users 😂
- The core of the Infraworks component authoring and necessary to create project specific and customizable bridge components
- Ideally would be stored in **BIM360 Docs**, however currently best practices is to store within **Autodesk Vault** (or equivalent) or **SharePoint** (or equivalent).
- Inventor components are able to leverage
  - Custom programming integrations (via Inventor iLogic)
  - Custom databases (via Excel spreadsheets)

=



Incredibly Versatile and Powerful

SharePoint INVENTOR

Related Links: https://knowledge.autodesk.com/support/inventor/learn-explore/caas/auonline/autodesk-university/forge-content/au-class-urn-adsk-content-content-cbb4e745-f8d2-4453-bdef-df856aba59a7.html?us_oa=akn-us&us_si=e39645e5-bb9b-47e5-8df7-fd4c0b209517&us_st=infraworks%20bridge

Important Tidbits

Each part type you import has different ‘twists’ that you need to learn

- Part of the challenge of publishing into Infraworks is knowing all the ‘magic words’ that need to be ~~incantated~~ listed as parameters for the model to work correctly
- Some components (e.g. Cross Braces) work of a list a prependings to a parent component (e.g. Girders)
- Other (e.g. Piers) just have a list that you need to name correctly.

Example of Prepending:

Girder Parameter	→	Cross Brace Parameters
ABC_123		LeftGirderABC_123 RightGirderABC_123

*I.e The value of **ABC_123** on the Left Girder {looking down the bridge} will override the parameter of **LeftGirderABC_123** on the cross-brace at a given location.*

SharePoint INVENTOR

Related Links: https://knowledge.autodesk.com/support/infraworks/learn-explore/caas/video/youtube/watch-v--ni-UE2w32A.html?us_oa=akn-us&us_si=b679fd88-af6f-49fd-979b-e76ac474d3cd&us_st=infraworks%20bridge


Video Example #3
Creating the Inventor Parts

Publishing to Infraworks

Then the fun begins…

- Next step is to publish the part for importing into Infraworks
  - Infraworks requires the .ipt/.iam to be published for the software to accept it into the program
- The publish tool has limitations… so we built our own:

  - You could too… so long as you have a few weeks and you're good at iLogic, VBA, and Python
- Once published, there will be 2x JPEGs and an .XML file named similarly to the original Inventor file (that you published).
  - Infraworks needs to SEE these files, so if you move your Inventor file or rename it (or add parameters) you'll need to re-run the publishing tool.

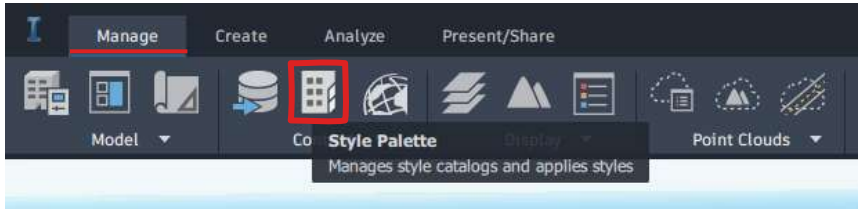
SharePoint INVENTOR

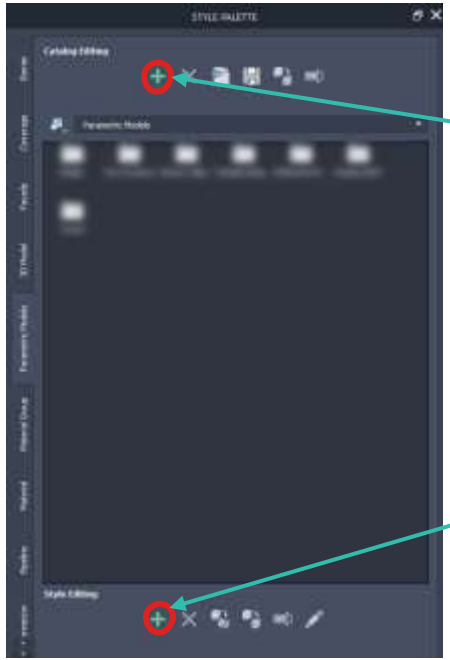
Related Links: https://knowledge.autodesk.com/support/infraworks/learn-explore/caas/video/youtube/watch-v--ni-UE2w32A.html?us_oa=akn-us&us_si=b679fd88-af6f-49fd-979b-e76ac474d3cd&us_st=infraworks%20bridge

Bringing the model into Infraworks

Probably won't work the first time…

- The parts are brought in through the Style Palette
- Be sure to click the correct plus button
    - It's not very intuitive →
- Doesn't matter where you put it, but there's no way to move it once it's put in
    - You can copy it to a new location, but then you'd have to delete the original
- If you delete a component that is in the model, it **WILL** cause issues





This adds a new FOLDER

This adds a new COMPONENT

BIM 360 INFRAWORKS

Related Links:

Setup the New Component

Find out if you screwed up in Inventor…

- Once you've hit 'new component', this screen pops up.

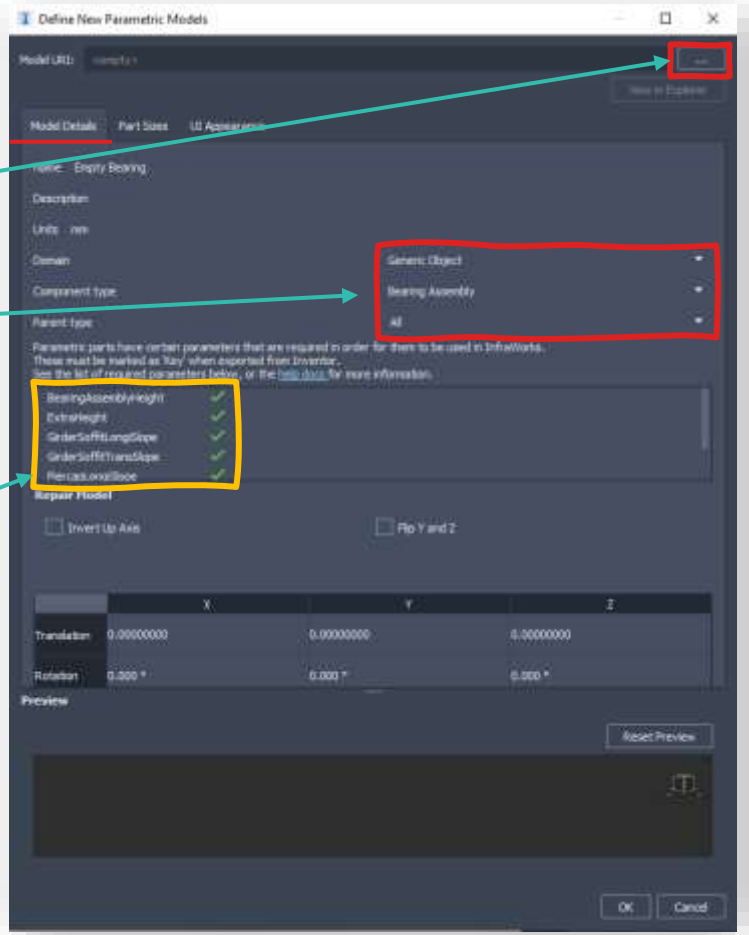
This is where you search for the PART TO ADD

Then you need to PUT IN THE PART TYPE

If you put in the wrong info… delete and try again

This is the list of (some) of the MAGIC WORDS that specific type of part is looking for.

If you are missing some… Then back to Inventor… (and republish)



BIM 360 INFRAWORKS

Related Links:

Setup the UI and Sizes Tabs

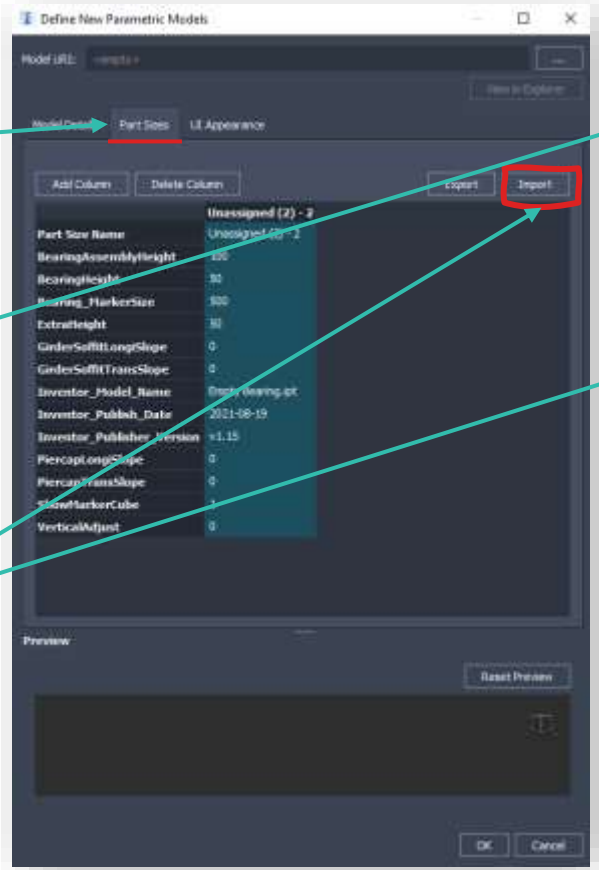
Or import the JSON file with all the information

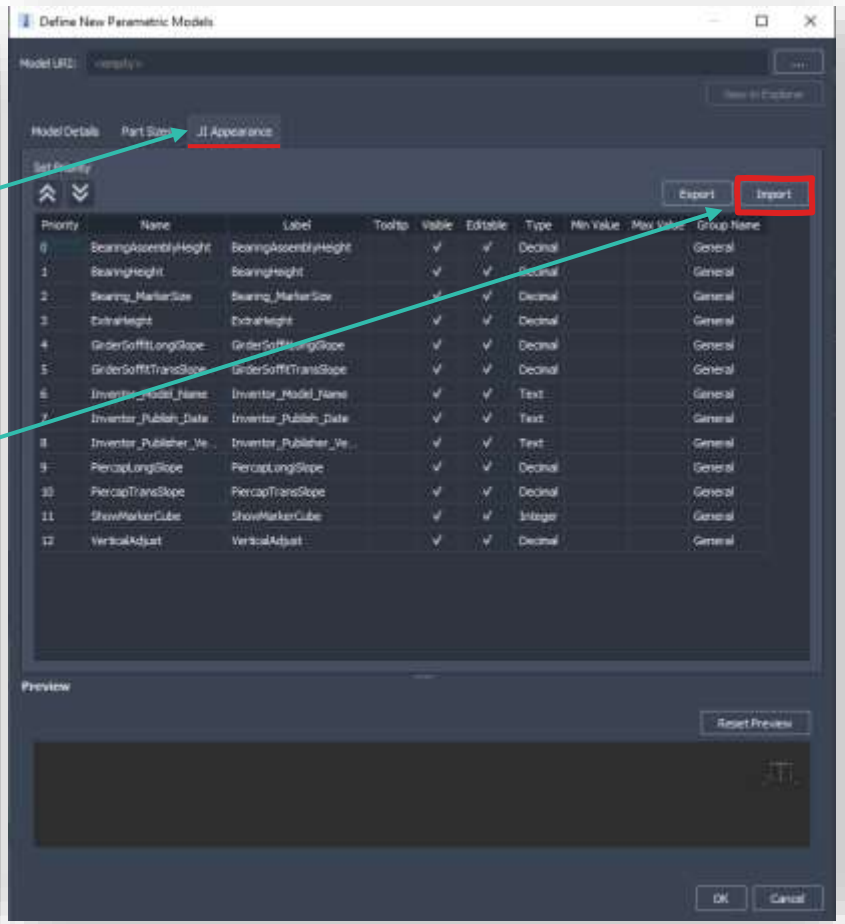
Add sizes/variations for the created component

Setup how the UI (user interface) looks in Infraworks

Or Import the Sizes and UI setups

(you'll have to import the UI, then the size… same JSON though)





BIM 360 INFRAWORKS


Video Example #4
Importing Inventor Parts
into Infraworks

Modify in Infraworks

Export Bridge Structure to Spreadsheet - Modify

Quickly edit many different bridge features in Excel

Send to Spreadsheet –Create New

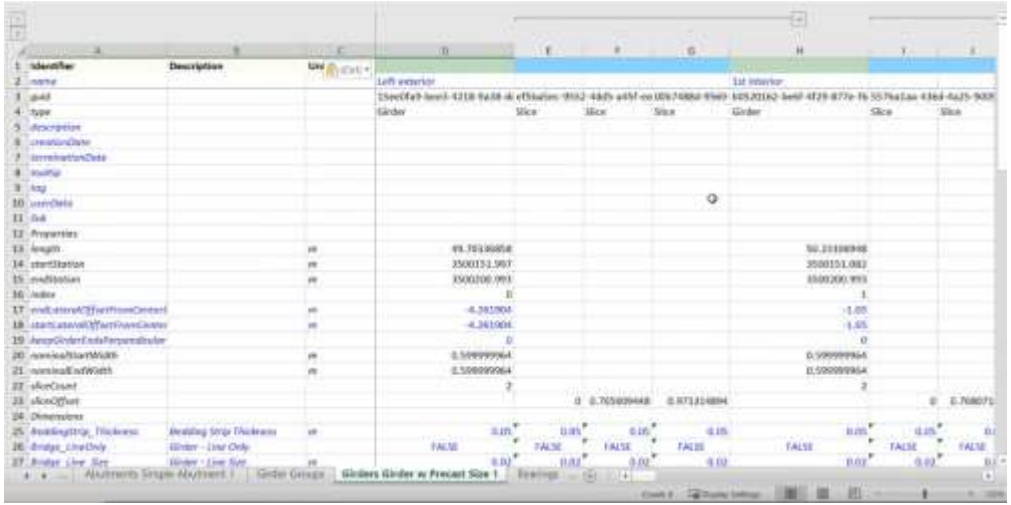
- In Infraworks Select a bridge
- Right click
  - Send to Spreadsheet
  - Create New
- Name .xlsx logically (set up a convention)
- Chose location and save

Creating Girder Slices For Varying Depths and Splice Connections

Yes, that can be done too!

Excel editing team members can be editing the girder slice locations in a spreadsheet copy while others are modeling in IFx

- Insert new slice columns between first & last slice
- Delete GUIDs at top of added column (they will repopulate on next spreadsheet export)
- Set each slice start as a percentage of length
- Enter Girder height
- Save spreadsheet



What?! Did he just say "**Others Are Modeling**" as in **plural people**?

YES, more than one person can be modeling in the **same** Infraworks model at the same time
(IF!! they are on different alignments!!)

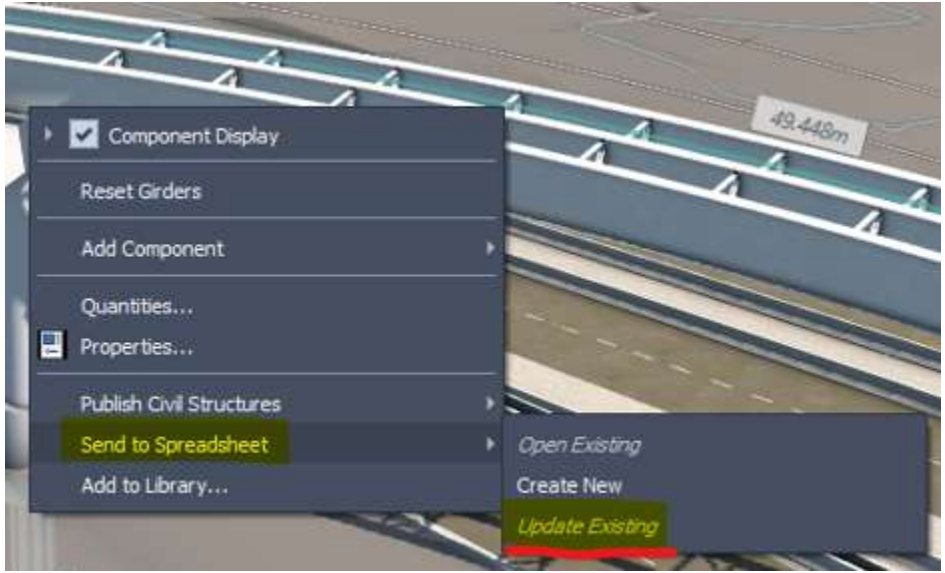
This isn't science fiction, and the future is now!

Importing Girder Slices to Infraworks

Slice and dice those girders!

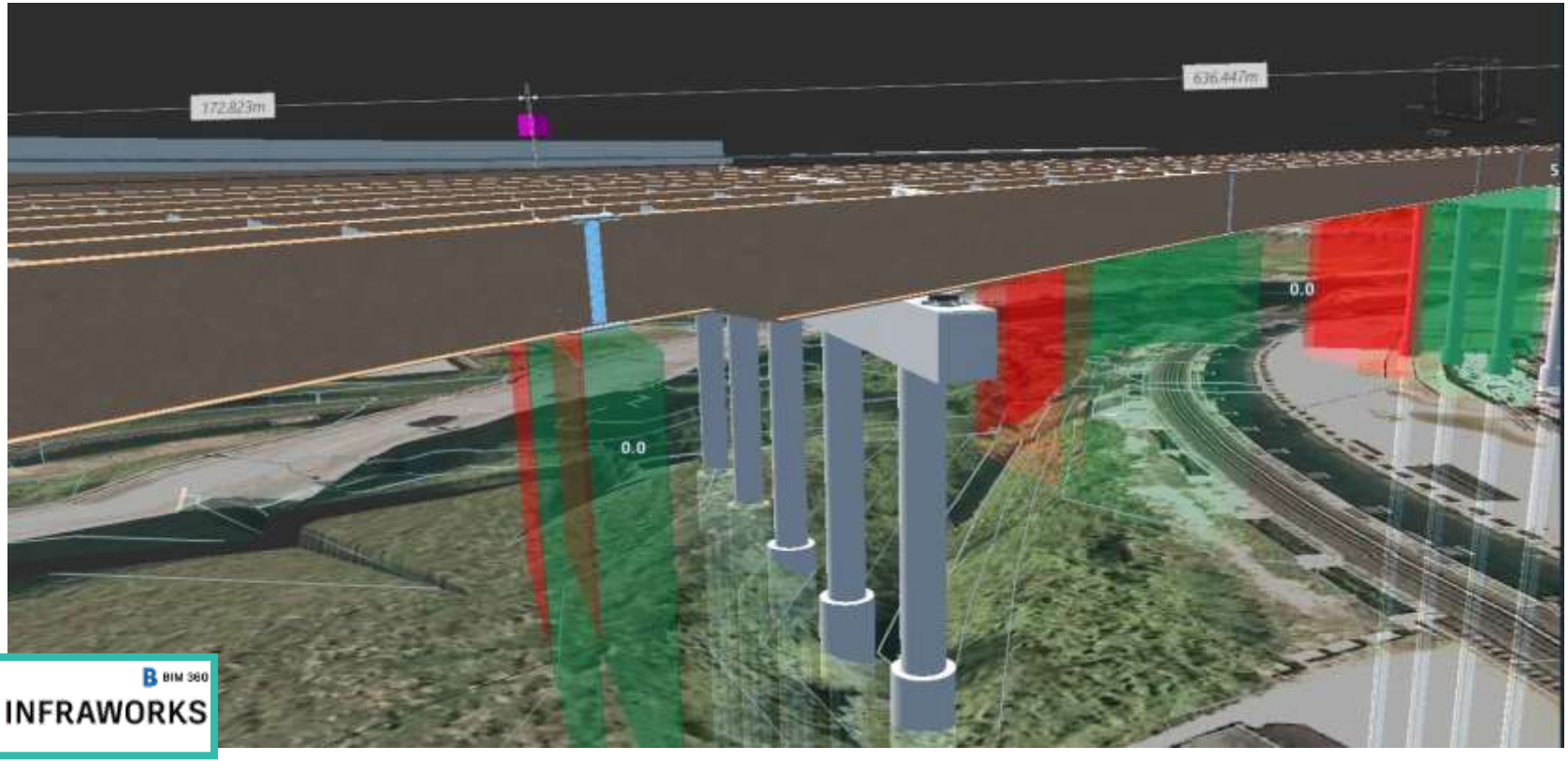
Import spreadsheet to Infraworks

- In Infraworks Select a bridge
- Right click
  - Send to Spreadsheet (Yes it sounds backwards, and we've complained to Autodesk about the confusing terminologies here)
  - Update Existing



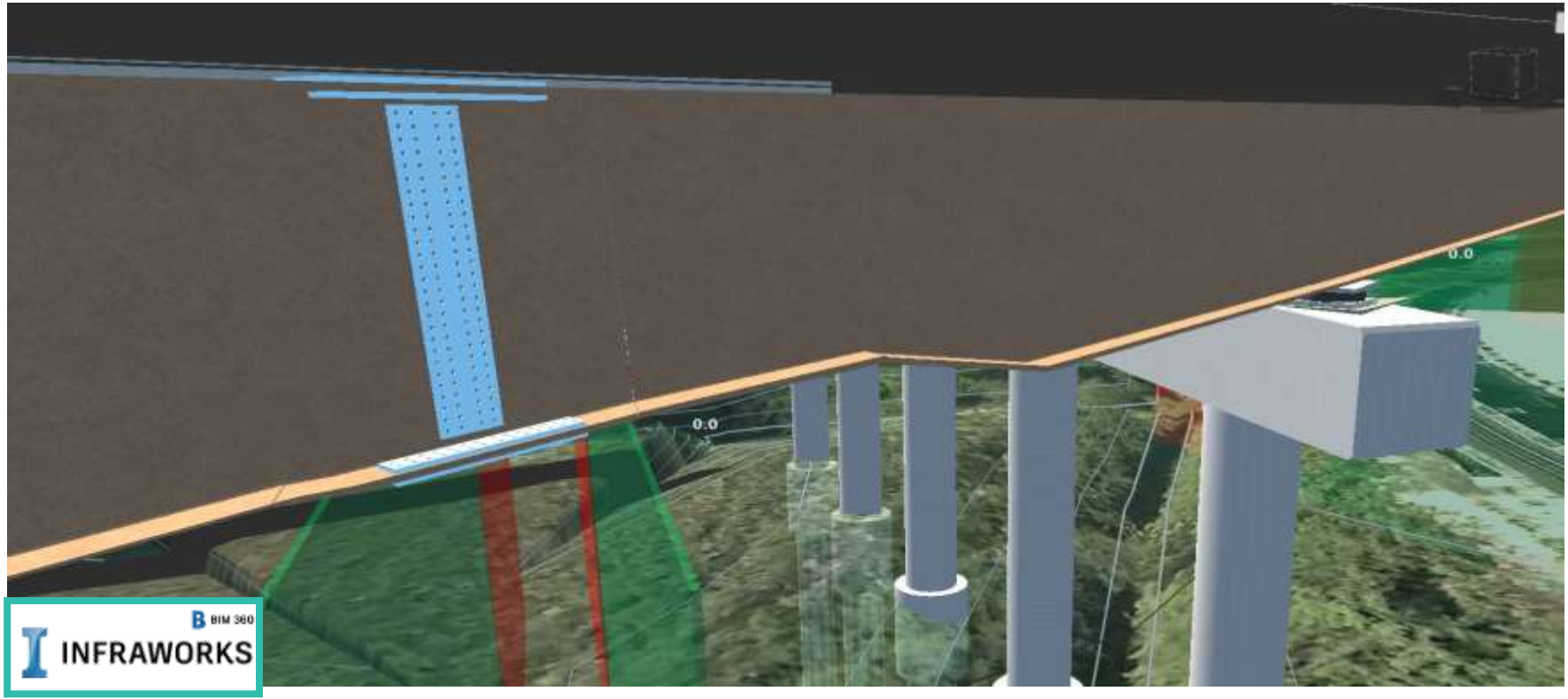
Pattullo Bridge Replacement Project

Sample Infraworks Image – Girder Depth Change and Splice Connections



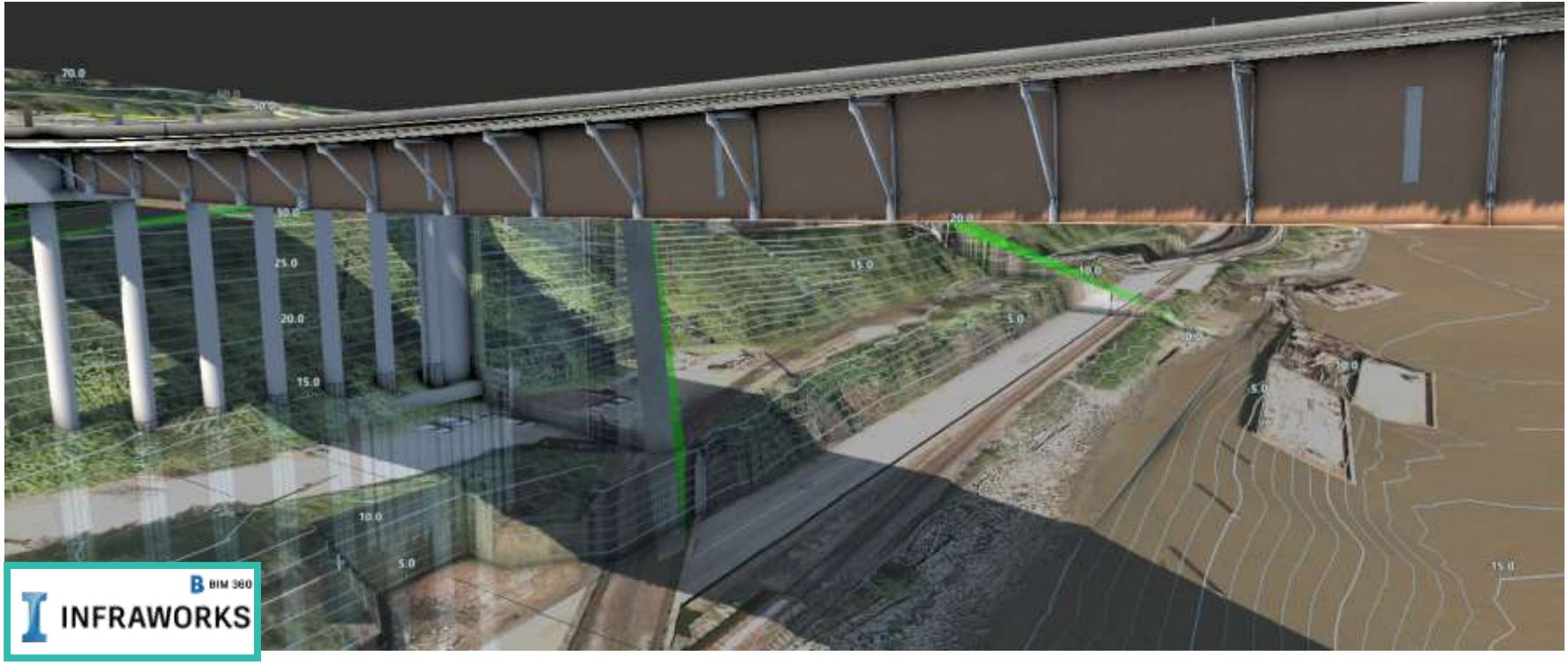
Pattullo Bridge Replacement Project

Sample Infraworks Image – Girder Depth Change and Splice Connections



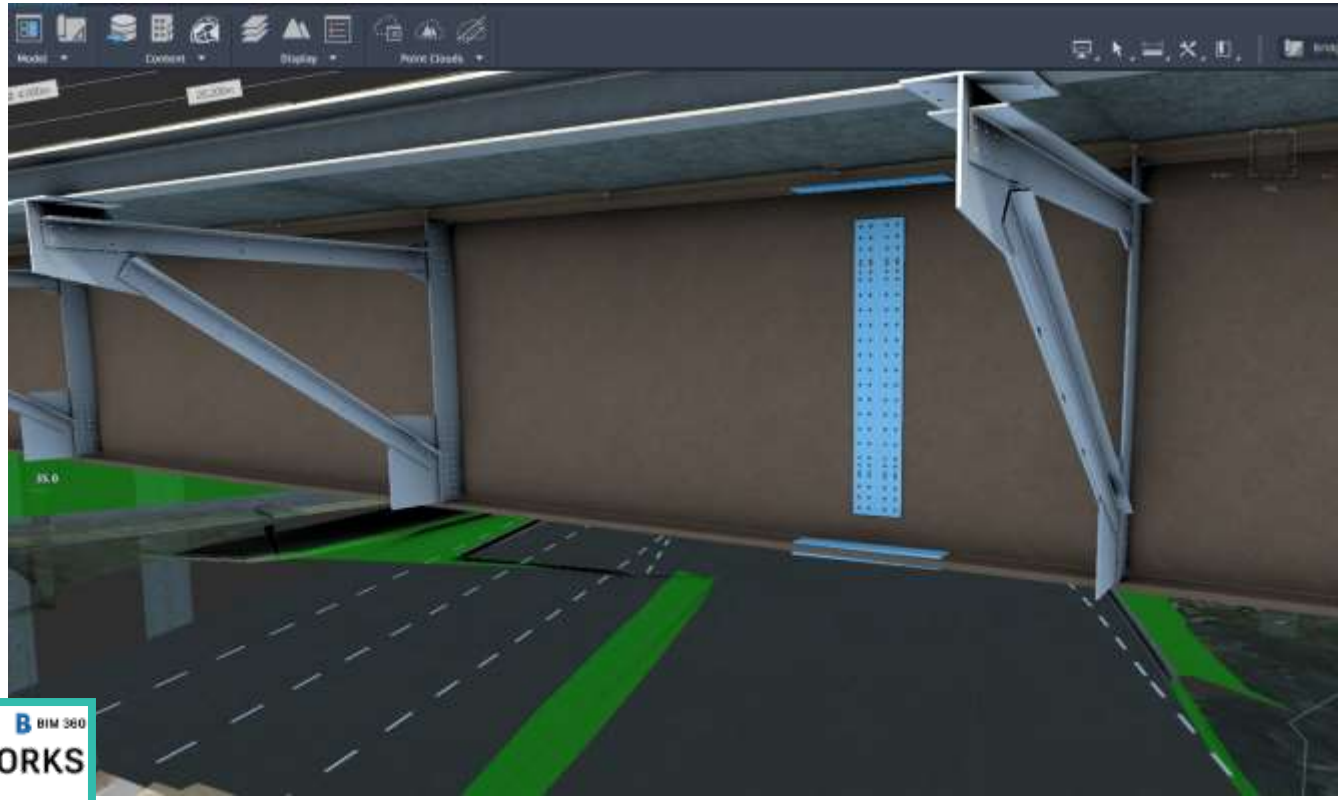
Pattullo Bridge Replacement Project

Sample Infraworks Image – Girder Slices and MUP supports



Pattullo Bridge Replacement Project

Sample Infraworks Image – Girder Splice and MUP supports



Tips and Tricks

So it works.

Tips

- No equations in slice columns
- No extra data at bottom of the spreadsheets
- Text format must be maintained matching original Including text colour!
- Bridge_LineOnly = True for no girder between slices

BIM 360 INFRAWORKS

Adjusting Cross Brace Locations Using Excel

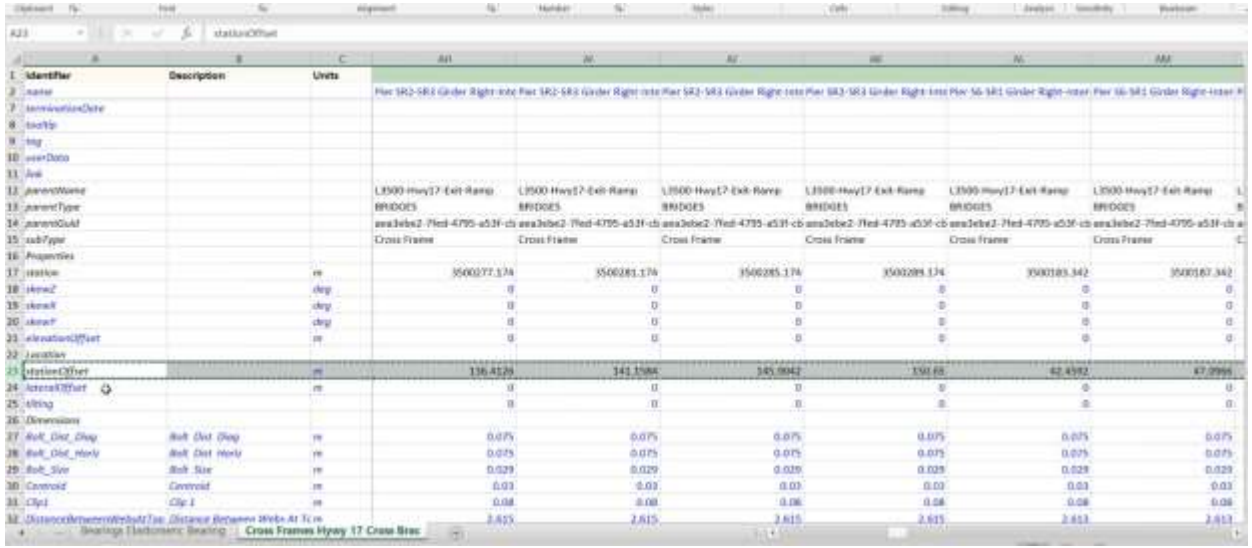
And more! Set pier locations and parameters for all the parametric models brought in from Inventor.

Edit bridge spreadsheet in Excel

- Export bridge to spreadsheet from Infraworks
- Adjust cross brace station offset parameters
- Save spreadsheet
- Close

Import spreadsheet to IFx

- In Infraworks
- Right click on bridge
  - Send to Spreadsheet
  - Update Existing




Video Example #5
Exporting Infraworks Bridge
To Excel For Editing

Structural Models to Revit

Exporting New Infraworks Structures to Revit

Yeah, you can further detail, reinforce and create drawings from these parametric models…. Then **UPDATE THEM WHEN THE MODEL CHANGES**!!! How cool is that!

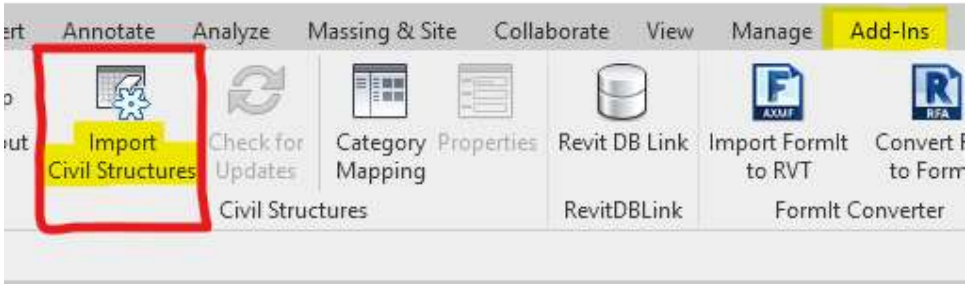
Publish Civil Structure –Create New

- In Infraworks Select a bridge
- Right click
  - Publish Civil Structures
  - Create New
- Name .imx logically (set up a convention)
- Chose location and save
- Wait ……
- 3 files (.imx, .json & .log)
- Open Revit

Importing New Infraworks Structures into Revit

Yeah, you can further detail, reinforce and create drawings from these parametric models…. Then **UPDATE THEM WHEN THE MODEL CHANGES**!!! How cool is that!

Import Civil Structures



- Create Revit Container
- Same name as .imx
- Shared coordinate system
  - acquired from Civil 3D file
- Set Shared Parameters file before import - Create empty one and save
- Import Civil Structures (Add-Ins ribbon tab)
- Select .imx exported from Infraworks
- Shared parameters will now be populated with Infraworks parameters

BIM 360 REVIT

Exporting Infraworks Model Changes to Revit

Yeah, when the Infraworks model changes you can **UPDATE REVIT WITH THE CHANGES**!!!
This is what you have been waiting for
…….hopefully not your whole CADD life.

Publish Civil Structure – Update Existing

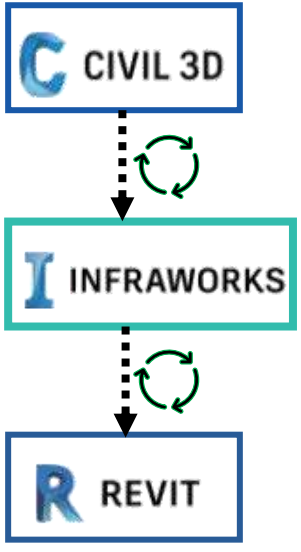
- Almost the same as creating new
- In Infraworks Select structure to update in Revit
- Right click
  - Publish Civil Structures
  - Update Existing
- Browse to previously created .imx and replace
- Press update
- Open Revit

BIM 360 INFRAWORKS

Wait!!! What?!

Did he just say **update Revit model with changes made in Infraworks model?** .....which **ALSO** captured **changes that were made in Civil 3D?**

Yeah... it will blow your mind!!

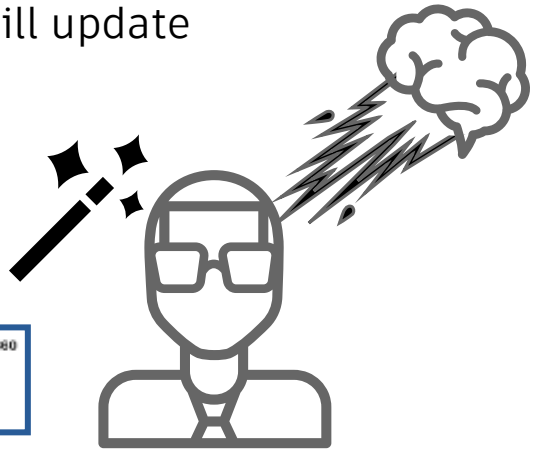


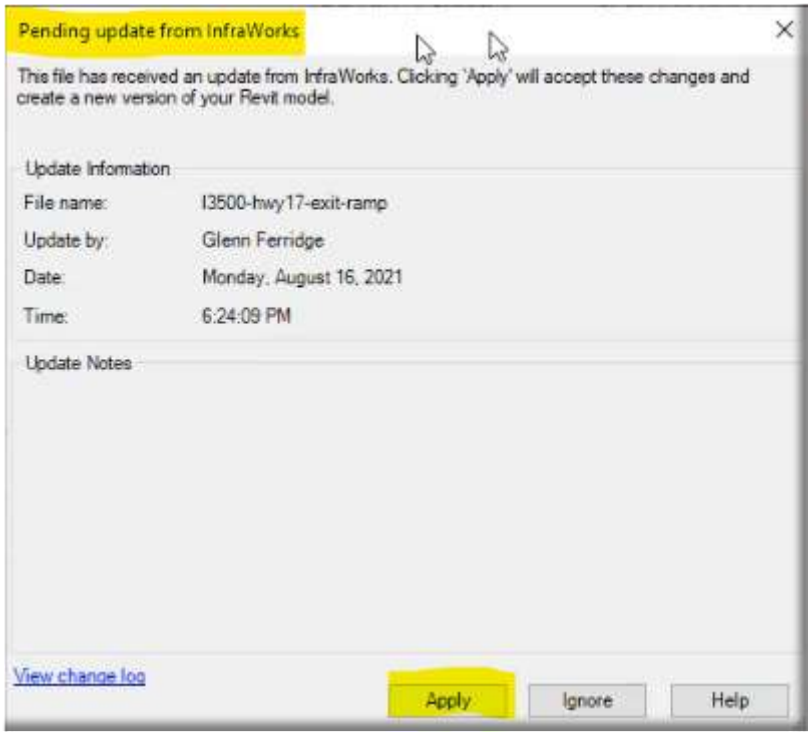
Updating Existing Revit Model With IFx changes

Change is good!.....positive change

Publish Civil Structure – Update Existing

- In Revit
  - Change notifications when **IMX** is updated
- Open Revit model container and apply update
- Model will update



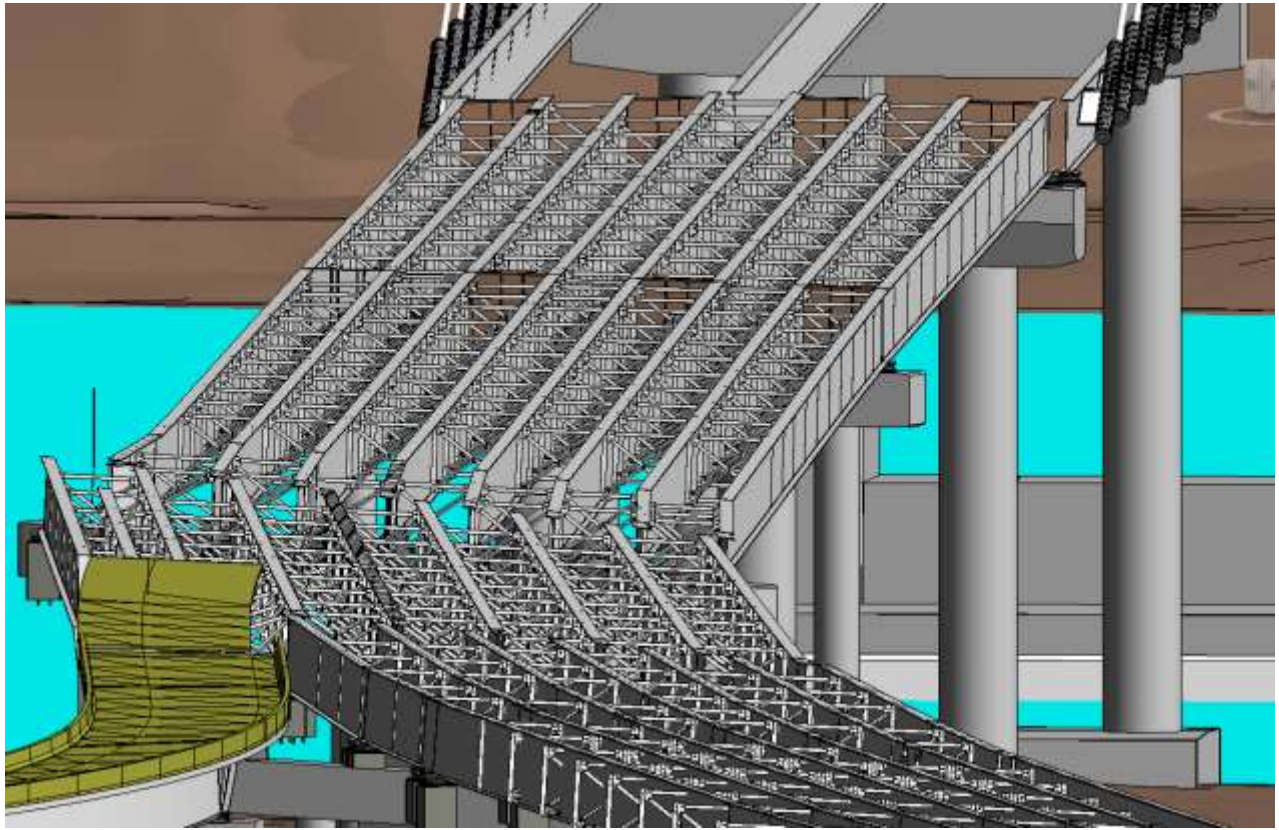



Video Example #6
Importing Infraworks Bridge
Into Revit and Updating

Pattullo Bridge Replacement Project

Sample Revit Image

- South approach
  (looking north)
- Substructure Framing

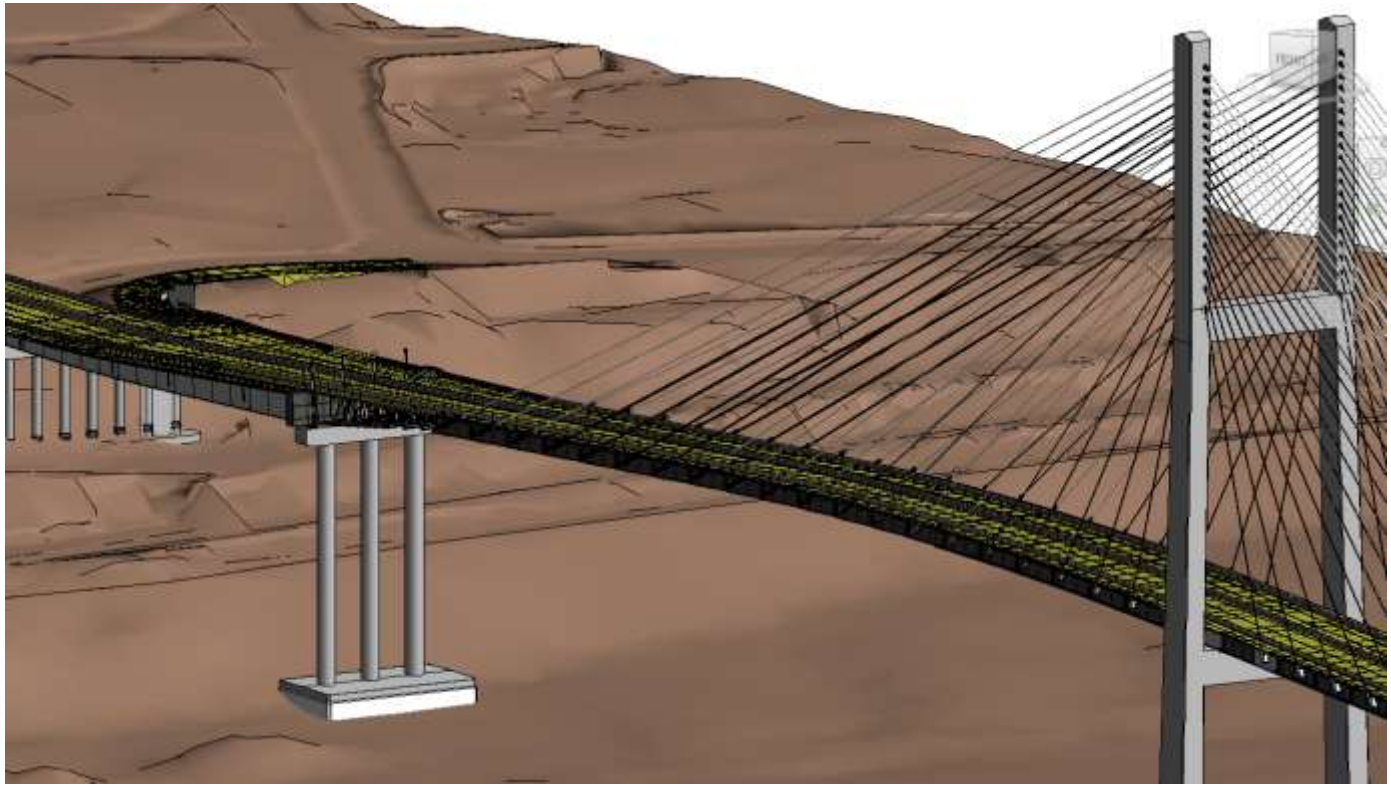


BIM 360 REVIT

Pattullo Bridge Replacement Project

Sample Revit Image

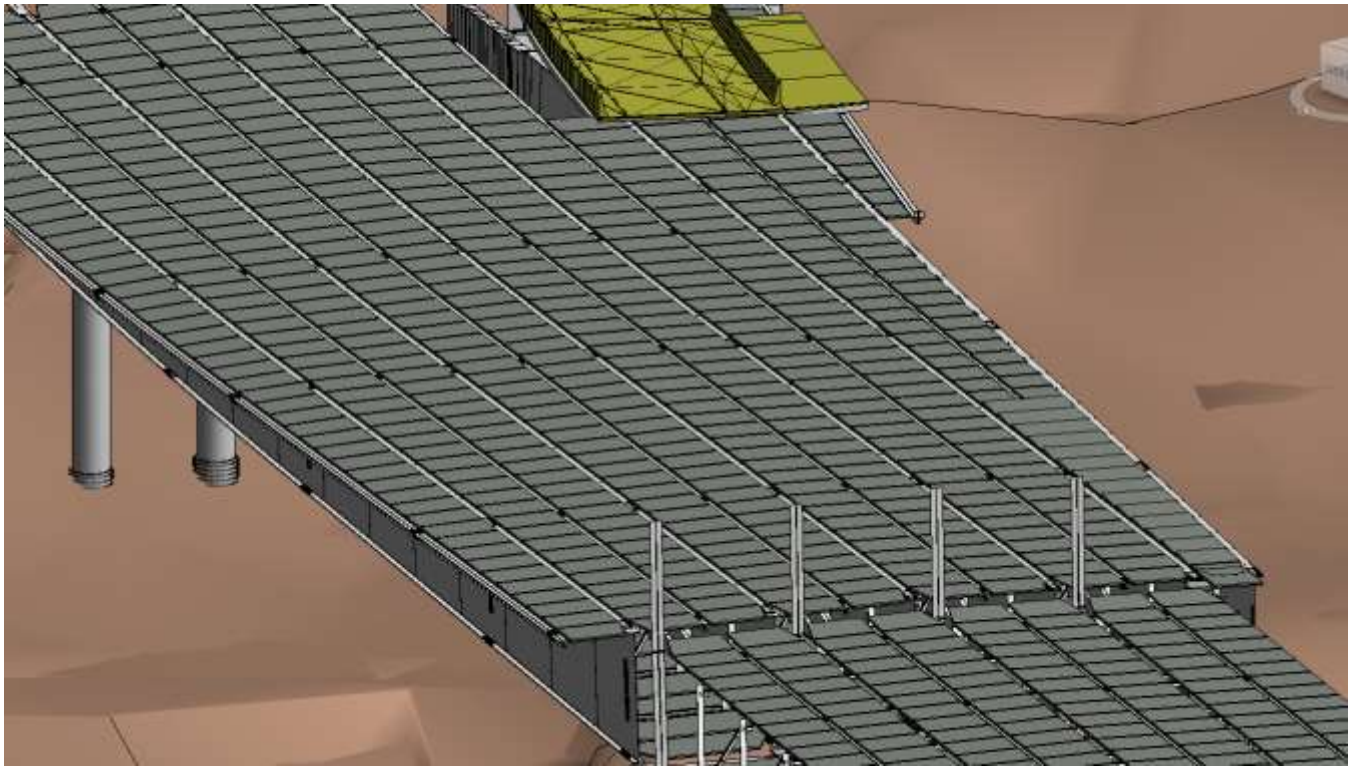
- North approach (looking north)
- Main Span tower
- Cables
- Piers
- Foundations



Pattullo Bridge Replacement Project

Sample Revit Image

- North approach (looking north)
- Precast deck panels

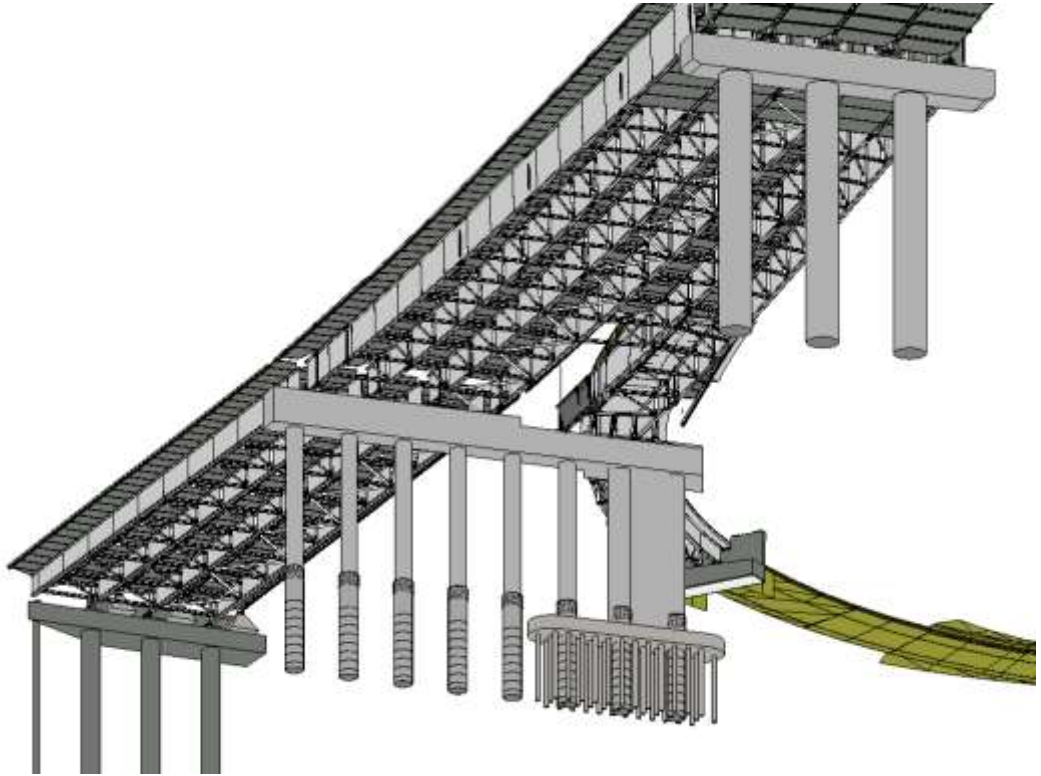


BIM 360 REVIT

Pattullo Bridge Replacement Project

Sample Revit Image

- North approach
  (looking north)
- Substructure & Superstructure

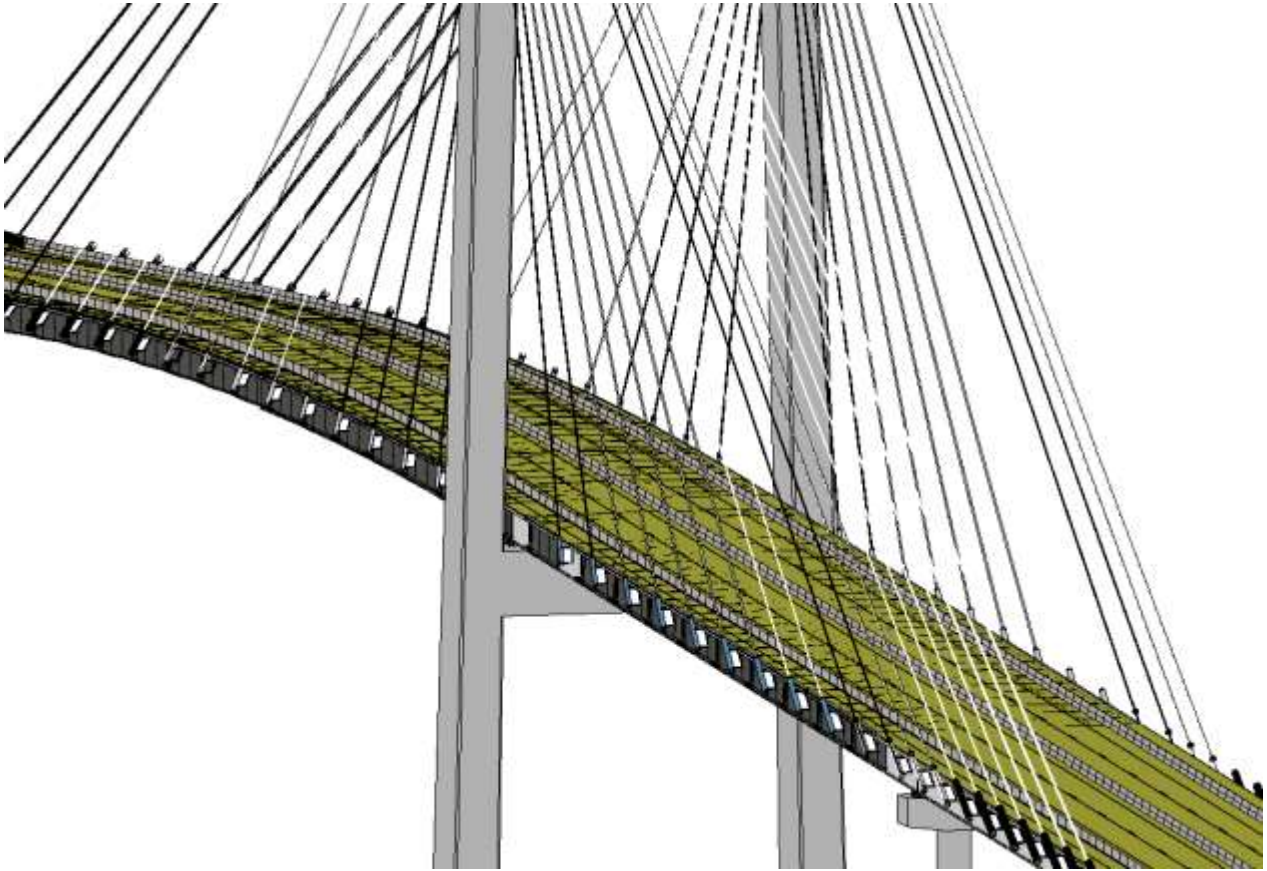


BIM 360 REVIT

Pattullo Bridge Replacement Project

Sample Revit Image

- Main span
  (looking north)



BIM 360 REVIT

Structural Models to Navisworks

Exporting Revit Bridge to Navisworks

To coordinate with the other disciplines such as underground utilities

In Revit file created from Infraworks .imx file

- Create 3D view – name it “Navis”
  - Turn off the following so only bridge is showing
    - Topography
    - Revit links
    - Annotation
- Revit file reader in Navisworks is looking for this view name

In Navisworks

- Append Revit file
- .nwc file is created in same folder as .rvt file appended from


Video Example #7
Importing Revit Bridge into Navisworks


Final Video Example #8
IFx Project Flythrough

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