Autodesk Relay Race - Infraworks 360: Taking preliminary design and running with it in Civil 3D

Scott Mizsak - CAD Technology Center

CV5904-L

Learning Objectives

At the end of this class, you will be able to:

Creation of an Existing Conditions

  Model Builder

  Manual insertion: Terrain, Images, Roads, Buildings, Utilities

Creation of Features

  Proposals, Design Roads, Bridges

Editing of Features

  Roads: PVI's, widening, intersections and side slopes

Importing into Civil CD

  Alignments & Profiles, Surfaces, Plan & Profile Sheets, Solids (FBX's)

About the Speaker

Scott Mizsak received his degree in Geography-GIS from the University of Minnesota in 2010. Prior to that Scott work for 6 years in the surveying industry where he was NSPS level III construction certified. Scott has worked with Autodesk products since AutoCAD Release 13 and is currently working as a Civil Application Engineer for CAD Technology Center, an Autodesk Gold Partner in the Midwest. He has experience working with Civil Engineering, Surveying and Construction firms, providing them with training and support. He specializes in AutoCAD Map 3D, Infraworks 360 and Civil 3D and is currently a certified WisDot Civil 3D Trainer. With the practical experience as a survey crew chief, he has valuable ability to apply the tools of the software to the real life issues that companies will face on a daily basis.
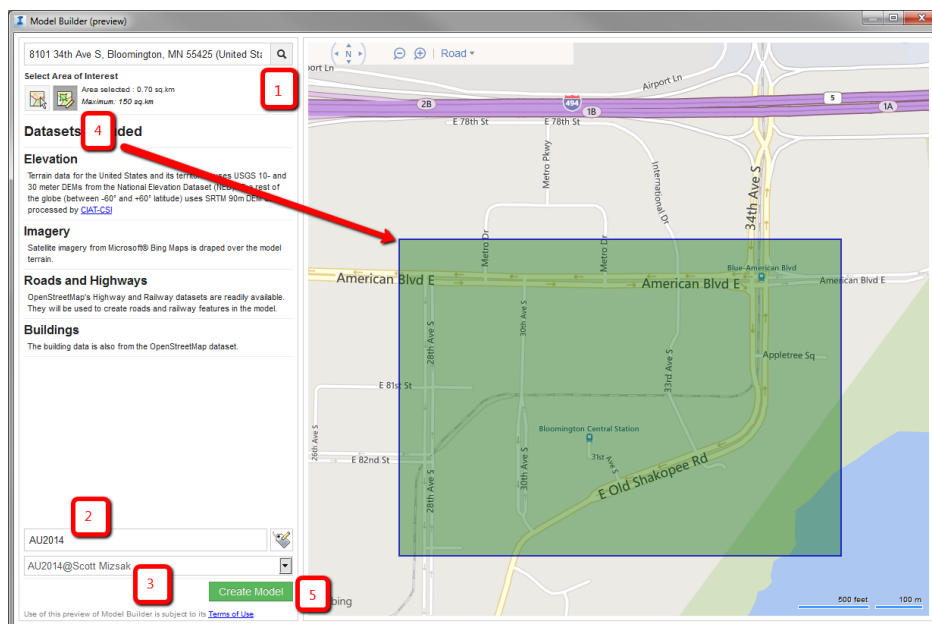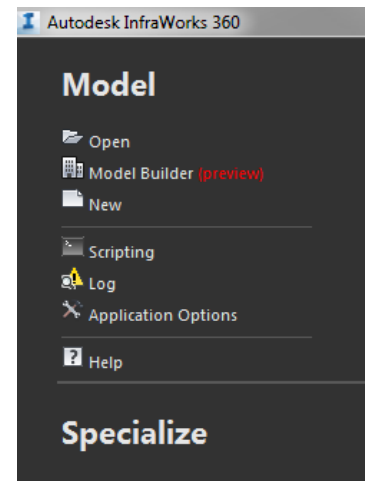
scottm@cadtechnologycenter.com

A. Creating the existing conditions

Model Builder:

1. Open Infraworks 360

2. Log into your Autodesk 360 account

3.Click on "Model Builder" under the Model tab of the Home Screen

Within Model Builder:

1. Enter your search area

2. Name your model

3. Set your Infraworks 360 Group (If you have multiples)

4. Select the area of interest (150 sq. km maximum)

5. Click Create Model (May take up to 15 minutes, I've never waited more than 5 minutes)

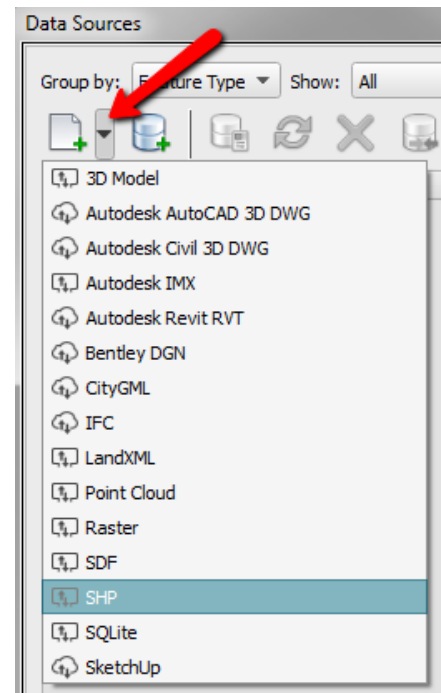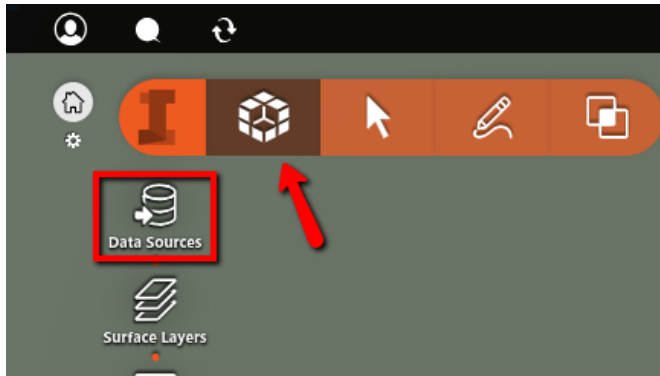The data that is used in this method is derived from Open Street Map
(www.openstreetmaps.org)

Inserting Data Manually - Storm Sewer

Under the Infraworks module - manage your model - Data Sources

15 options under the Add File Data Source

Elevations and Aerial Imagery will be under "Raster"

1. Open the Model "Bloomington"

2. Open a New Data Source and Select "SHP"

3. Navigate to the CV5904 Folder and select the strm_mainline_pipe.shp

4. Shape file will appear in the Data Sources as <No Feature Type>

5. Right Click on strm_mainline_pipe and select "Configure" You will see this dialog box
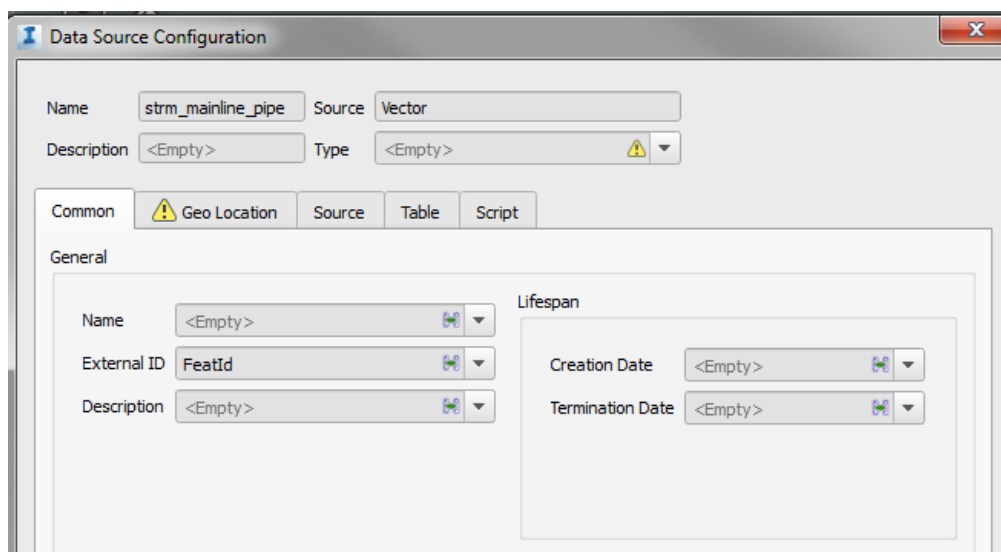
A. Change the Type to be "Pipelines"

B. Change the Rule Style to 'Pipeline/Red Pipe' by clicking on the "Pencil"

6. Switch to the Geo Location Tab

    A. Change the Coordinate System to "HennepinMN-F" Under USA, Minnesota

7. Switch to the Source Tab

    A. Draping Options - "Set Elevation"

    B. Data Column - "Elevation"

    C. Clip to Model Extents - Unchecked

8. Click "Close & Refresh"

9. Insert the Shape File "strm_junction" via the drag and drop method

    The drag and drop takes the user directly to the configure screen.

A. Change the Type to "Pipeline Connectors"

B. Set the Rule Style to 'PipeConnector/Red Circle'

C. Set the Elevation Offset: INV_ELEV - TOP_CAST_C

10. Switch to the "Geo Location" Tab

A. Change the Coordinate System to "HennepinMN-F" Under USA, Minnesota

11. Switch to the "Source" Tab

A. Set the Draping options to "Drape".

Note: Now the top of the structure will follow the terrain and the bottom of the structure we be the "Invert" elevation minus the "Top of Casting" elevation, yielding a negative number, thence having the Elevation Offset go down instead of up.


12. Click "Close and Refresh"

We now have a model of our storm pipe and manholes for the area. Note the structure to the Northeast that shoots off into the sky. Your model is only as good as the data that you are using. This holds true to the inverts of the structures. Because our model used a national source for the elevations but a local source for the Storm Network the two may not always lineup. This

completes the features that we want to include as the existing features for our site. Every new feature that we create now will a proposed feature and we will make it its own Proposal.

A Proposal is a way to convey multiple ideas in one model. The benefits of showing a road as a four lane road as one proposal and a two lane road with turn lanes in another or showing a proposed building facing north with a parking lot to the south in one and then the building facing east with the parking lot to the west in another is priceless. A proposal when created will take a snapshot of what is current and active in the model space. If a proposed road is active when a second proposal is created, then that proposed road will be part of the second proposal as well.
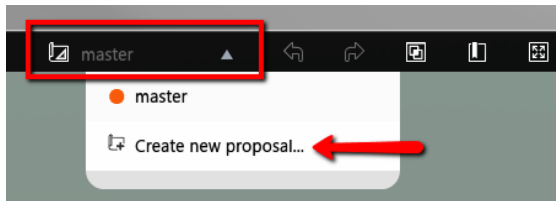
To create a proposal:
Click the down arrow next to the Proposal Icon
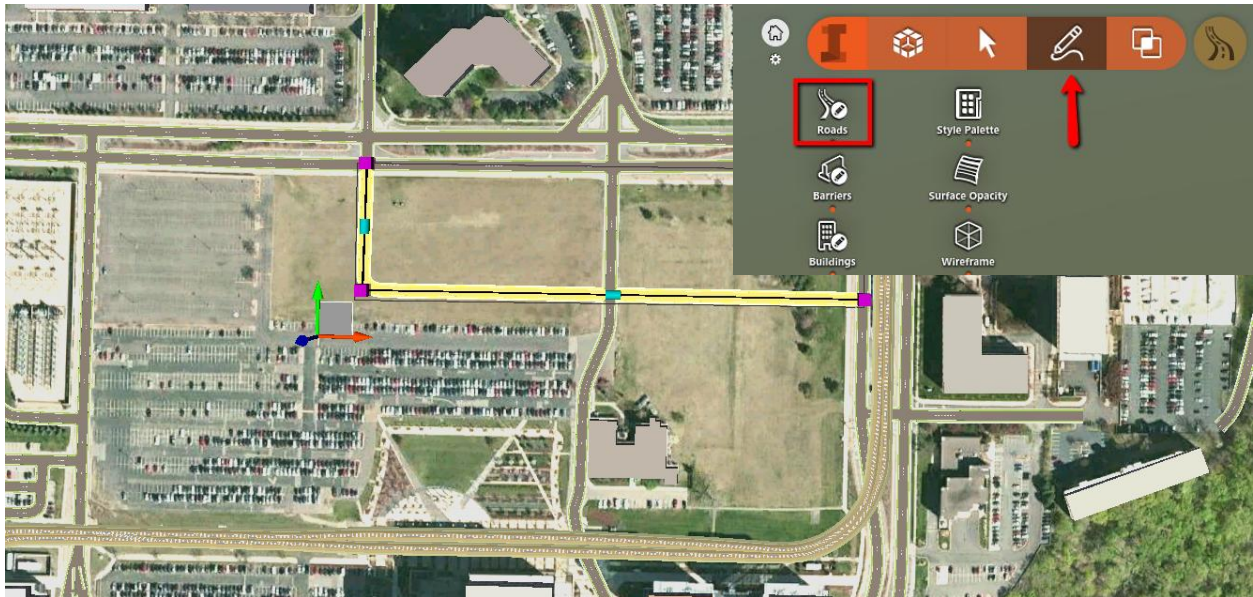Click "Create New Proposal"

Tip: Create a handful of proposals once the existing conditions has been created. This ensures that only the existing conditions are part of any new proposal.
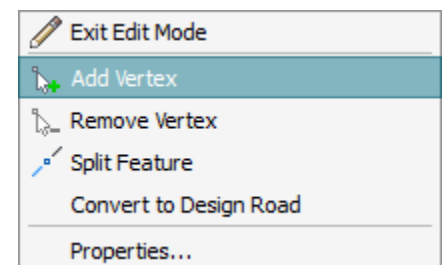
B. Adding Roads (New Proposal)

Create Roads:

1. Create a road in this general area and layout
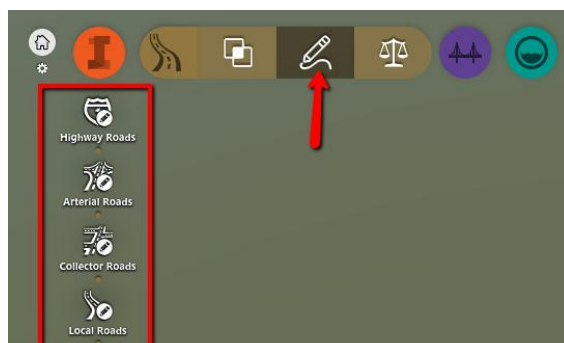

A. Radius of curve is determined so click at the PI

B. Right Click on the Road and notice the editing options
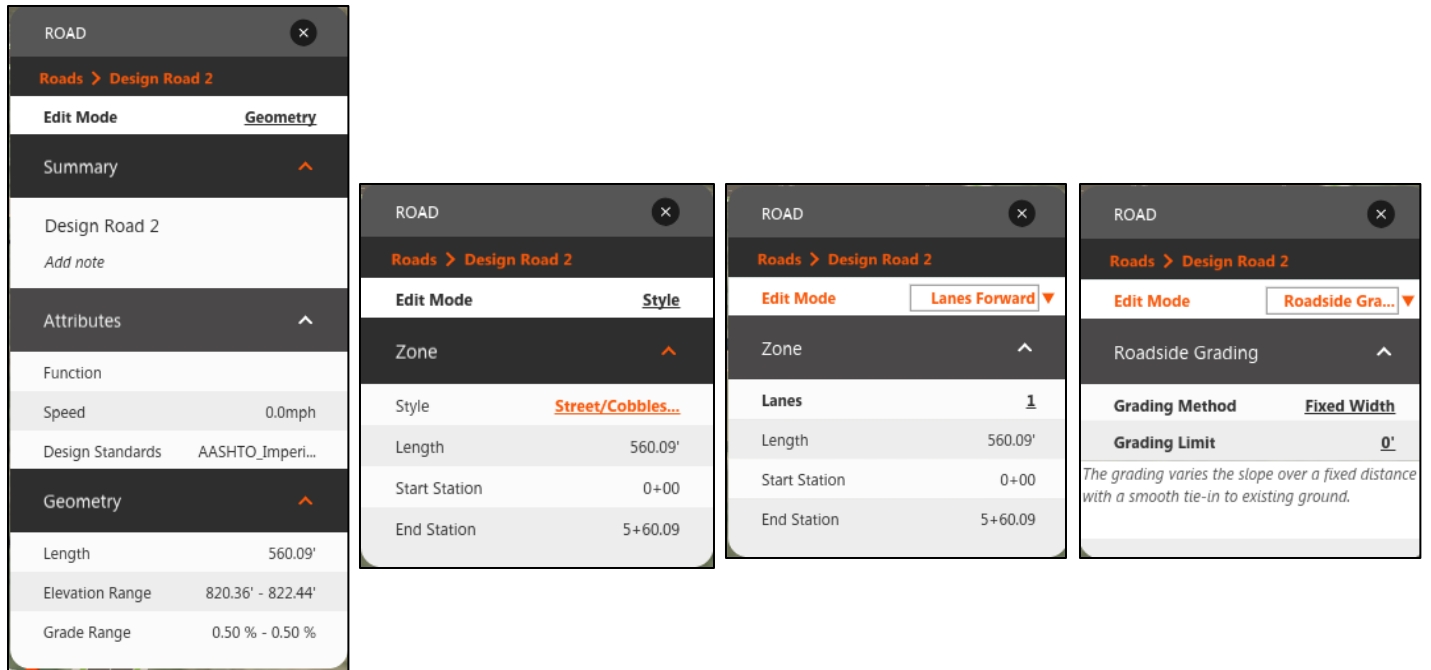
C. Delete this road

Design Roads:

1.Create a new road in the same location using the Roads Module

A. Four Options - Highway, Arterial, Collector and Local

B. Right Click on the Road and notice the editing options

C. Convert a Create Road to a Design Road (New Proposal)

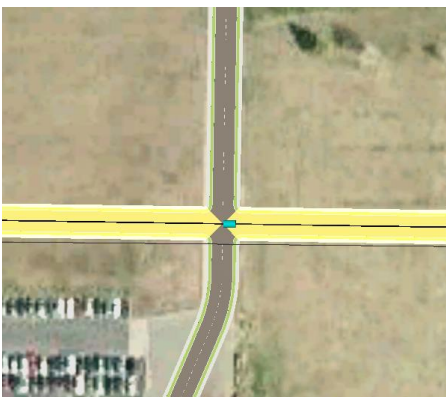1. Click on the intersection of our new "Design Road" and the existing road that runs north and south.

> **Note:** There is not the ability to edit the intersection at this point

2. Right Click on the north south road and select "Convert to Design Road"

> **Note:** all roads that come in from Openstreetmaps.org or via a shapefile import will be a basic "Create Road". By converting the road to a "Design Road" the edit ability of it increases.

3. Click on the intersection again... Notice the new editing capabilities.

Design Road with a Create Road   **Design Road with a Design Road**
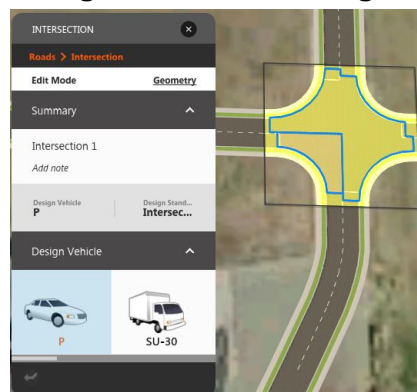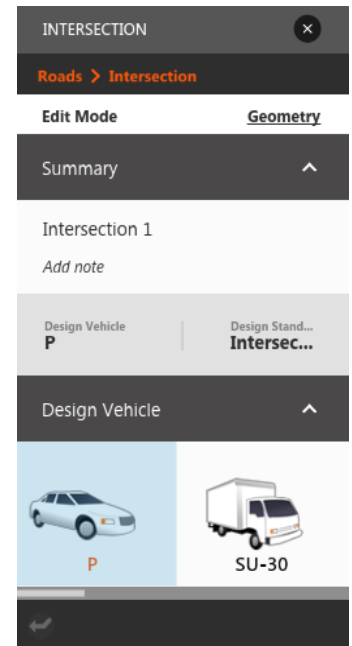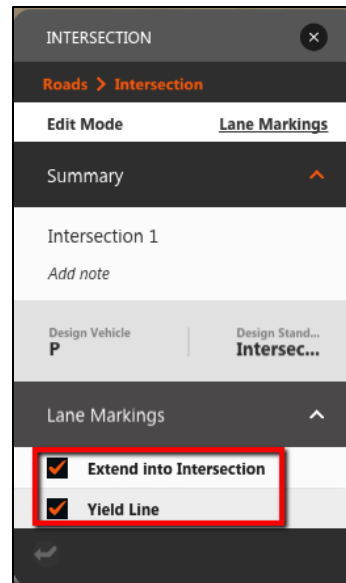
D. Edit an Intersection

1. Lane Markings

    A. Extend into Intersection

    B. Add a Yield Line

2. Curb Returns based on Vehicles

    A. Select the typical vehicle that will

    travel on this road. Select SU-30

Notice all four curb return radii changed.

3. Manually Adjust each curb return

    A. Click near a curb return

    B. Adjust the radius by clicking on the blue cone

        End User can hand enter a value of each radius.

4. Add Turn Lanes at the curb return

    A. Click near a curb return

    B. Add a turn lane by dragging the purple grip away

    from the curb return.
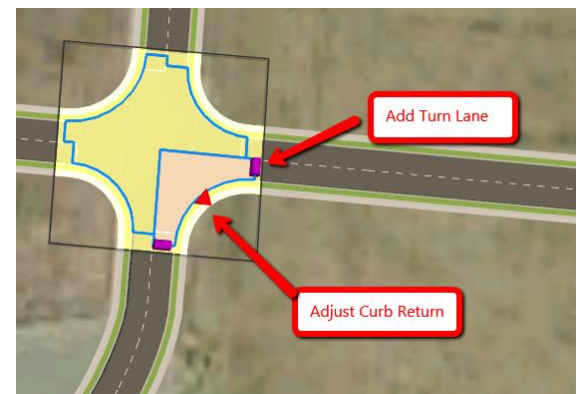
5. Intersection Parameters

    NE & NW Curb Return - 50' Radius

    SE & SW Curb Return - 35' Radius

    Turn Lane In and Out for the SE & NE Curb Return - Single Lane 25 feet in length

E. Add a Widening to a design road (New Proposal)

1. Select the East West Design Road

2. In the Edit Dialog box switch the Edit Mode

    From Geometry to Lanes Backward

3. To add the turn lane

    Click the Plus Sign next to Lanes

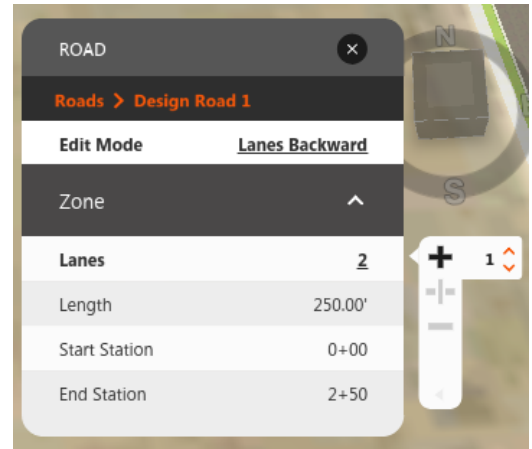   Select Number of Lanes to add (outside value)

    Select a Start Location

    Select an End Location

    Double Clicking each location works the best for me.

4. To fine tune the stationing click inside the new section

    Click on the blue grips and manually change the station value.

5. Widening Parameters

    Create a single lane Widening that is 250' in length that starts at 0+00 (Lanes Backward)

    Create a single lane Widening that is 200' in length from end of road (Lanes Forward)

F. Add a Bridge (New Proposal)

1. Select the East West road, Right Click and select "Add Bridge"

   Where's my "Add Bridge"?

   Switch your road edit mode from "Lanes Forward" to "Geometry"

2. Click the start location and end location

   Click the locations on the road or enter the values in the boxes.
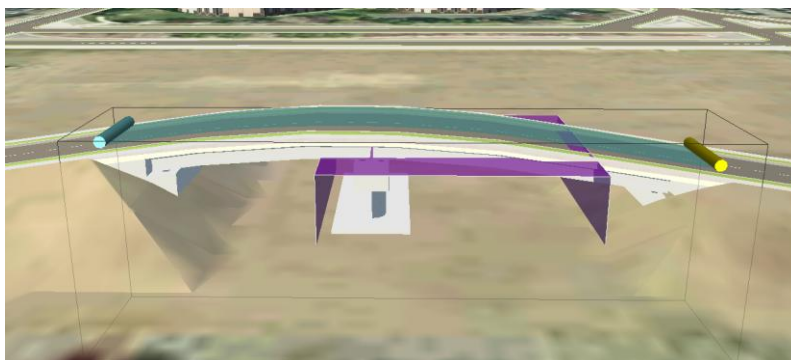
3. To select the bridge select the girders on the side

   Adjust the Type of Bridge

   In the dialog box check the "Show clearance envelope"

   Adjust stationing and Height of clearance envelope

4. Bridge Parameters

   Start bridge at a station in a 25' increment with a length of 150'
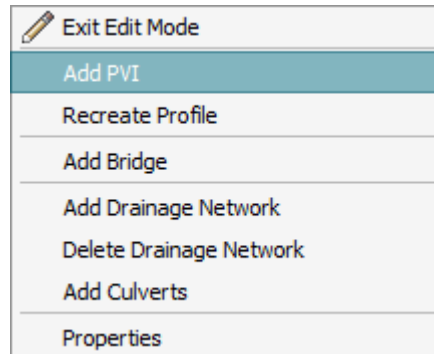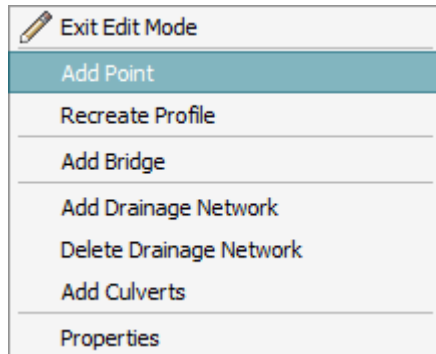
   Show the clearance envelope with a height of 17.00'

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G. Add a PVI to the Road (New Proposal)

1. Select the Design Road, Right Click and select add PVI

Note: Must be in the "Geometry" edit mode and in a model view other than plan. Depending on the angle of the view, when you right click the options will either be "Add PVI" or just "Add Point". The PI or PVI will be inserted where you right click on the road.

|				
✏ Exit Edit Mode			✏ Exit Edit Mode	
Add Point			Add PVI	
Recreate Profile			Recreate Profile	
Add Bridge			Add Bridge	
Add Drainage Network			Add Drainage Network	
Delete Drainage Network			Delete Drainage Network	
Add Culverts			Add Culverts	
Properties			Properties	

2. Edit the values of the PVI

Click the road to display the grips - Select the cubed grip at the PVI

Drag the grip left or right to adjust station

Drag the grip up or down to adjust elevation

Manually enter a station and or elevation (Cannot adjust the Grade In or Out)
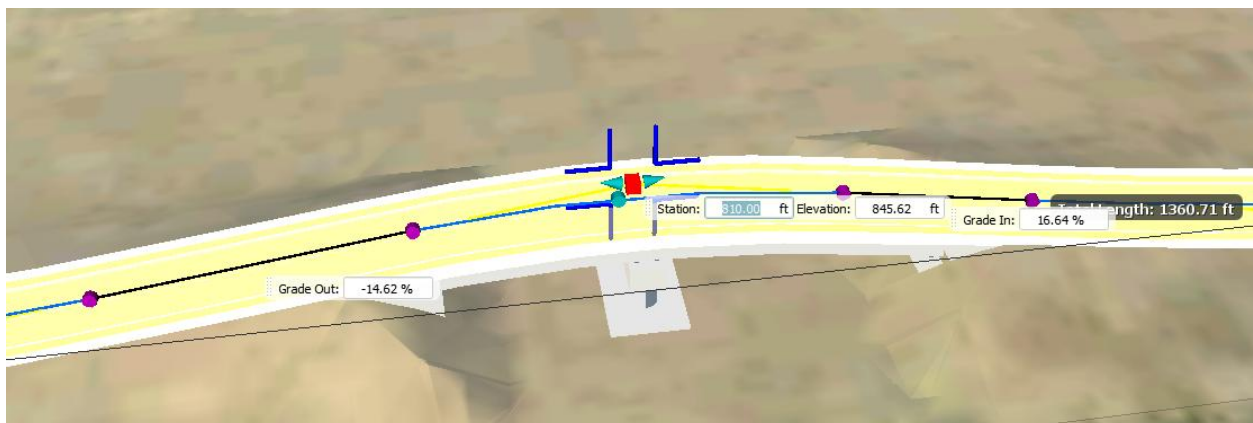
Select the Purple Sphere grips located at the vertical curve start or end location

Slide the grip up station or down station to adjust its overall length

Manually enter a curve length, station value, and or elevation

3. PVI Parameters

Place PVI at whole station over the column

Adjust the PVI elevation to allow the clearance envelope to work

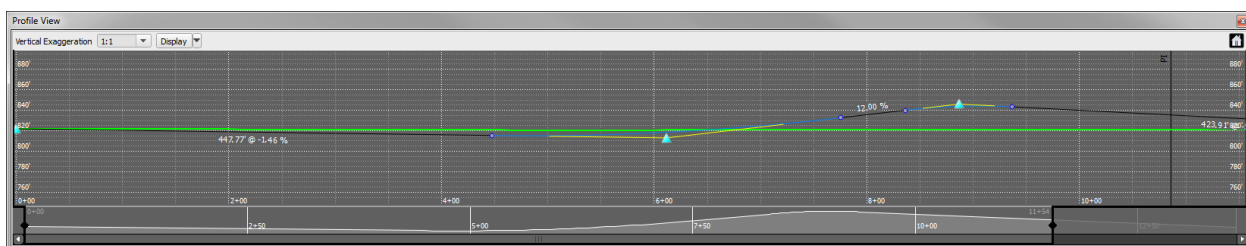**Adjust the BVCS and EVCS to allow the clearance envelope to work**
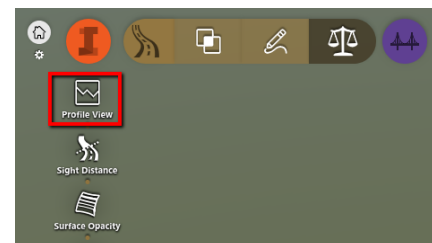
4. Add a Profile View of the road

Select the Design Road and then select Profile View

Can make rough edits by dragging the grips

Cannot hand enter values in the Profile View

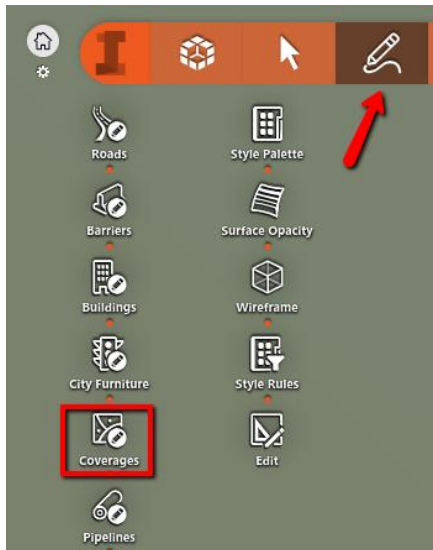Grips will highlight in both views when selected in the profile view.
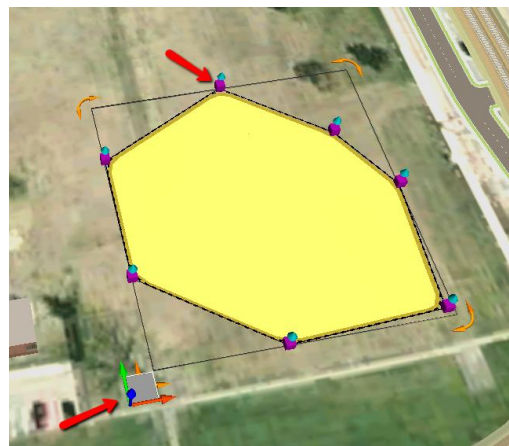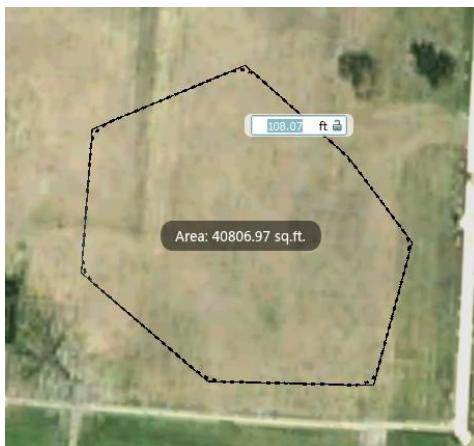
H. Site Grading (New Proposal)

Designing Berms and Ponds

1. Infraworks Module - Draw - Coverage Area

2. Select a coverage area style

3. Pick the Perimeter of your coverage area.

4. Double Click to complete the outline

Editing the coverage area

1. Click on the area and right click to edit

      a. Click on a purple cube grip to adjust the horizontal location of a single vertex

b. Click on a blue cone grip to adjust the vertical elevation of a single vertex

c. Click on an axis of the Gizmo to move the entire area in that axis's direction.

d. Click on the Right Angle box of the Gizmo to free hand the area's movement.

e. Right click near a corner vertex and select "Add Vertex" to eliminate the radius

2. Adjusting the side slope of the coverage area.
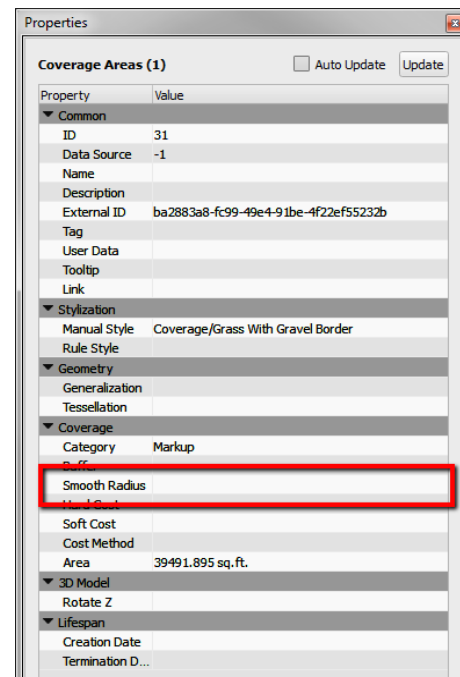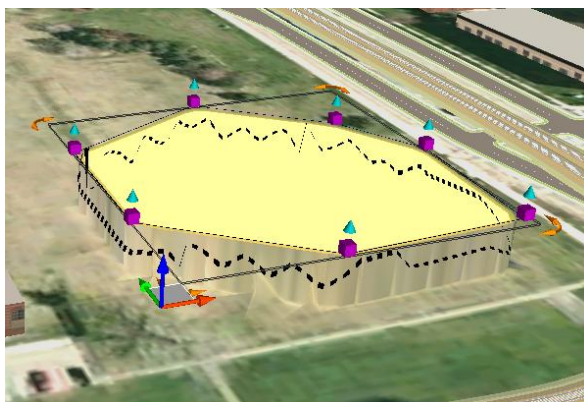
In Properties adjust the "Smooth Radius"

Note: When drawing a coverage area on top of a coverage area. Create the lowest coverage area first, then the higher one second.

I. Getting the Data for Civil 3D

1. Reduce the model extents for smaller file sizes

      Settings and Utilities - Model Properties

      Uncheck - Use the Entire Model

      Define Interactively - BBox

            Create a bounding box around just the road
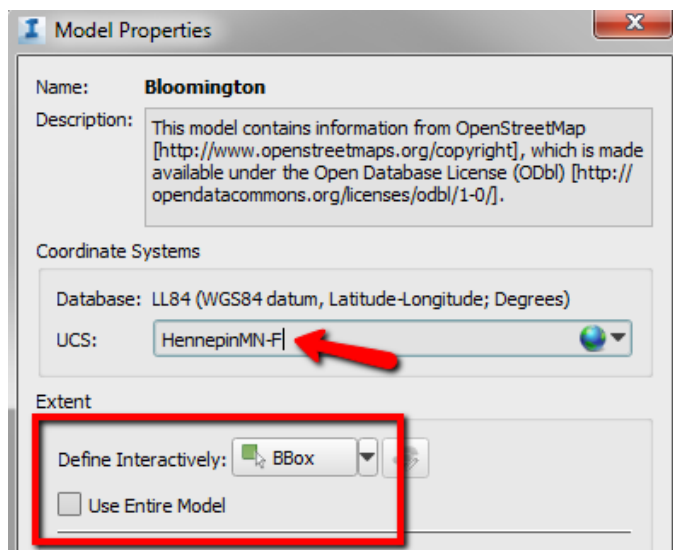
2. Export the IMX file

      The IMX file will export out three different surfaces: Exisitng Ground, Existing Transportation and Proposed Ground. It will also export out the design roads and bring them into Civil 3D as an alignment and a profile. The imx file will also bring in the pipes and pipe connectors as a Pipe Network within Civil 3D.

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Settings and Utilities - Export IMX
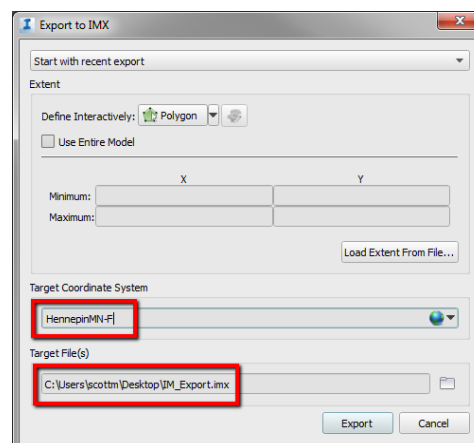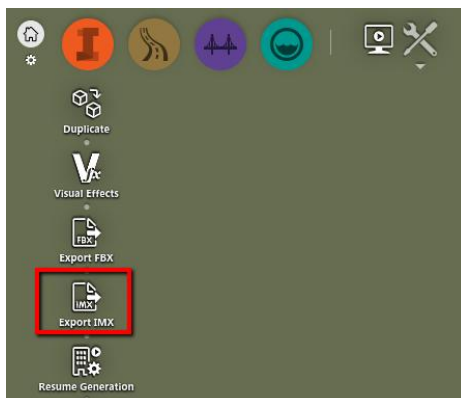
Check "Use Entire Model" if you have already reduce the model extents

Confirm target coordinate system - HennepinMN-F

Confirm target file name and stored location

3. Export the FBX file

The FBX file will export out a 3d solid models of the entire surface. The roads will be their own model while the ground and building will be their own. During the export there is the option to create three separate files or one overall file, create a single file. The fbx model will not retain the coordinate system it was derived from, so manual placement will be necessary. This model can be used for Vehicle Tracking as an overall model for the swept path of the vehicle.
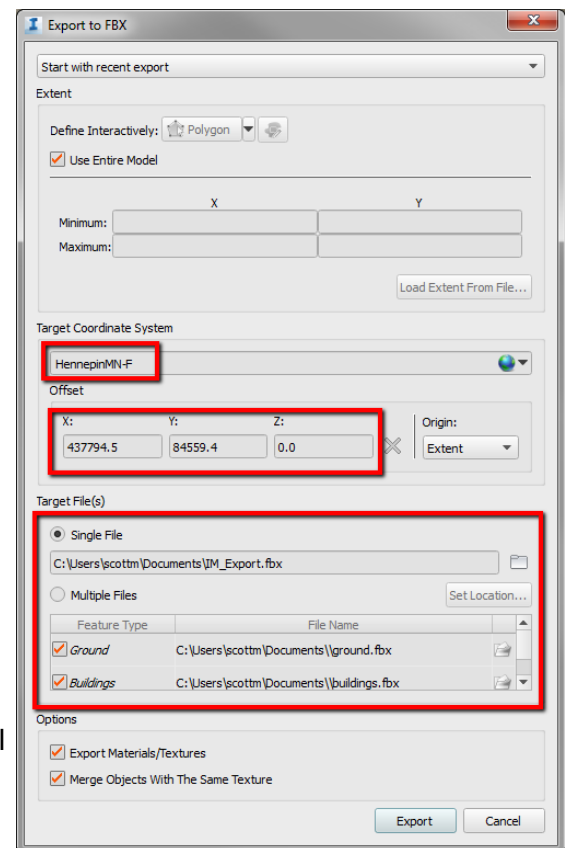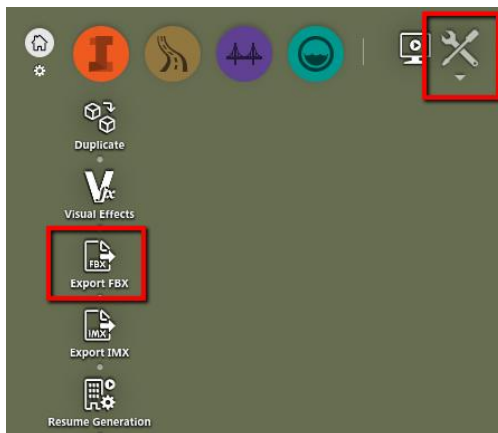

- Settings and Utilities - Export FBX
- "Use Entire Model"
- Coordinate System is ignored but **write down the offset values.** these are the coordinates for the lower left extents of the model
  - Target Files - Single
  - Target File name and location

4. Create Plan & Profile Sheets

   The ability to get a project to 30% complete at the time of submittal is even easier now with the Create Civil 3D drawings option. Creating Plan & Profile sheets in Infraworks is just as quick as it is in Civil.
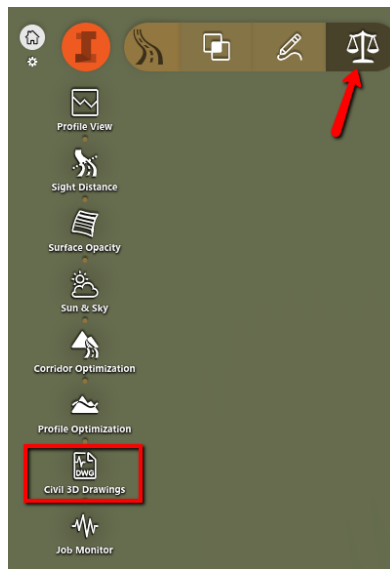
<u>Select a model road</u>

Design Roads - Review and Modify - Civil 3D Drawings

Select the Design Road

Specify the Station start and end

Check "Create Sheets"

Specify which template to be used

Select which layout (Scale) to use within the template

Plan & Profile option: Plan only, Profile only, Plan & Profile

Select sheet options: Per drawing, One New, In Model drawing

Station: Full length

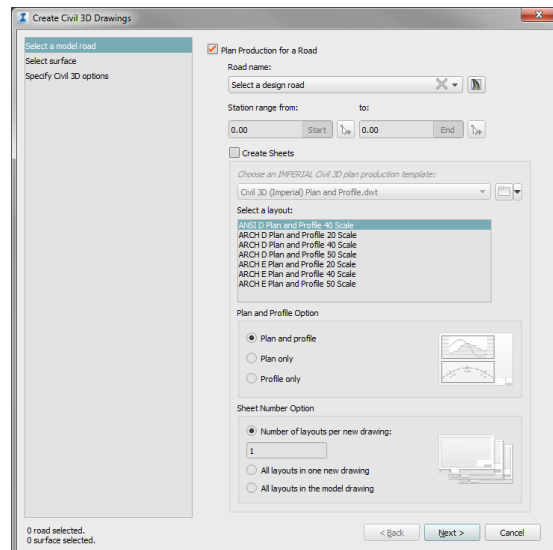**Create Sheets**

Civil 3D Imperial Plan and Profile.dwt

ANSI D Plan & Profile 40 scale
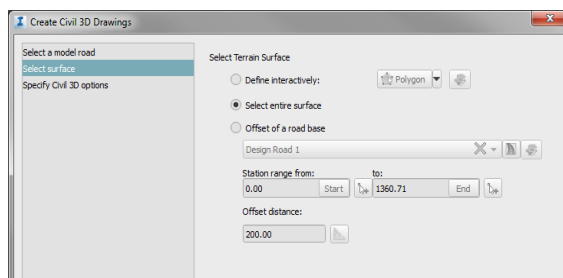
Plan and Profile

All Layouts in one new drawing

<u>Select Surface</u>

Select Terrain Surface: Interactively, Entire, Offset

Station Range: From - To

Offset Distance:

Specify Civil 3D Options

Template File (Model View)

Target Files

        Drawing

        Sheet set

Coordinate System

Send data and error reports

View drawings in AutoCAD Civil 3D

The Sheet set and the drawing will be stored in the same location on the computer

Set Values and Click "Generate"
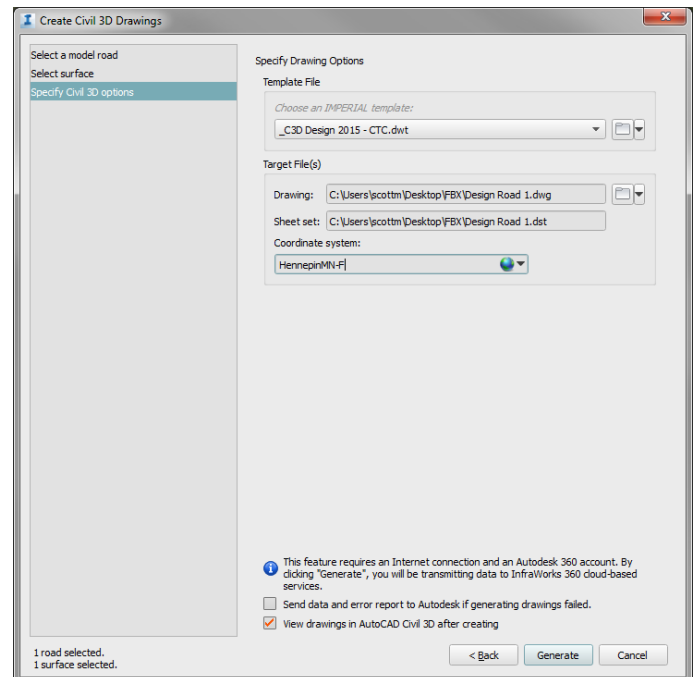
J. Importing data into Civil 3D

1. Importing the IMX file

        Open Civil 3D

        Toolspace - Settings - Drawing Settings - Units and Zones

                Set Coordinate System to Match the IMX file

        Insert Tab - Import Panel - Import IMX - Select IMX

        Note: Will load automatically so make sure you set the proper coordinate system first.

2. Importing the FBX file

Insert Tab - Import Panel - Import

Change the file type to FBX

Navigate to the FBX file

FBX Import Options

Import: Objects, Lights, Cameras, Material

Assign Objects to Layers: New Layer, Current Layer, By Material
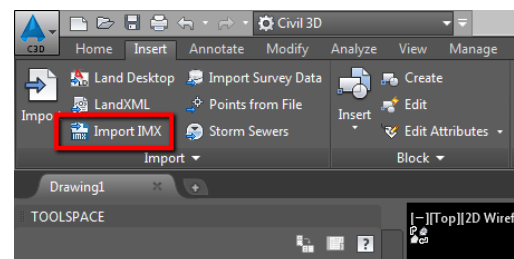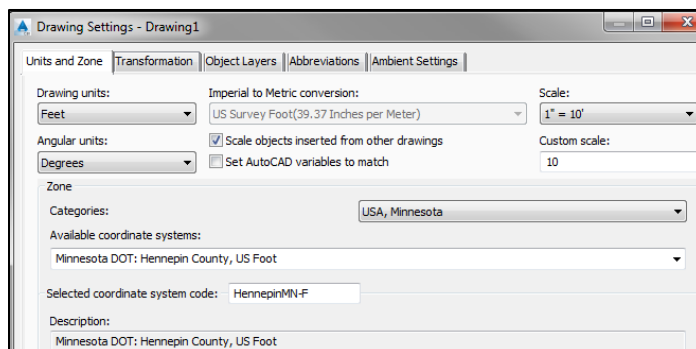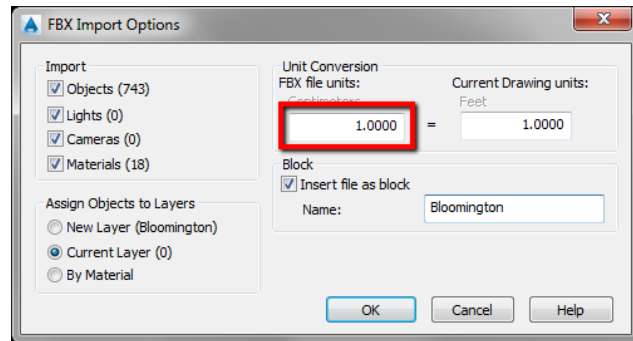
Unit Conversion: FBX Units, Current Drawing Units

Block: Insert file as a block

Settings:

Import: Objects and Materials

Assign Layer: New Layer

Unit Conversion: 1 unit = 1 unit

Insert File as Block = No

Note: This will drop the bottom left corner of the fbx at 0,0,0. To be able to place this file closer to the actual location you will have to manually move the object. The other option is to insert the fbx in as a block. Follow these next steps for the block option

Import: Objects and Materials
Assign Layer: New Layer
Unit Conversion: 1 unit = 1 unit
Insert File as Block = Yes
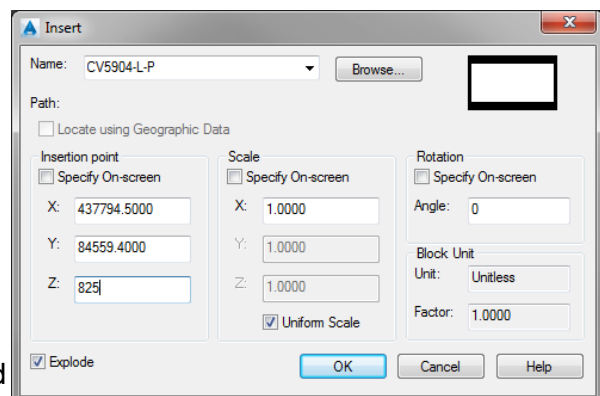

Insert Tab - Block Panel - Insert
Use the drop down and select the block
Insertion Point: Use the Offset values listed
when the Export to FBX was
performed. Elevation (Z value will be an estimate)
Scale: 1   Rotation: 0   Explode: No

K. Alignments and Profiles from the IMX

Now that we've imported the imx file from Infraworks to Civil, we can now make the finishing touches on the alignment and profile. As you recall we did not have the ability to adjust the grade in or grade out of a PVI within Infraworks, these edits can be handled easier within Civil. Our goal now is to take the Alignment and Profile provided from Infraworks and use the geometry editor in Civil 3D to make these finishing touches.

1.Click on our Design Road Alignment

- Notice the name of the Alignment. The name isn't that helpful when it comes to finding it in a list. So let's go ahead and rename our alignment with our last name as a street or avenue.

2. With the alignment still selected click on the "Surface Profile" in the contextual ribbon. There is a design profile already assigned in the profile list. Let's go ahead and add the AIM_Exisitng_Ground profile to the list and then click "Draw in Profile view". Then we will just take the defaults and click "Create Profile View" and place the profile view.

3. Now that we have a Profile view that contains an existing surface and the proposed of our road, we can edit the proposed profile by clicking on the proposed line, right clicking and selecting edit profile geometry. This will open the Profile Layout Tools for our road. Click on the third icon from the right, "Profile Grid View" to open the tabular form of the proposed layout. In this table I can adjust the PVI station and elevation. The grades in and out can also be adjusted.

Settings:
Adjust the Proposed Profile so that the PVI's are all at a whole station.
Adjust the grades in/out so that they are at a quarter percent interval.
Create a corridor with the alignment and profile then use the basic lane assembly on the tool pallet.
Add a polyline to match the widening in the fbx and then target this polyline as a horizontal target.

L. The next step??

Now that we finalized our road we could IMX out the alignment and bring it back into Infraworks for an accurate representation of the new model. We can also take this to the next level and take this model into Navisworks Manage for clash detection, animation and time liner.

M. Vehicle Tracking (Bonus)

Use your FBX model as a template for the swept path analysis. While the intersection tool will assist you with the turn radius of the desired vehicle at the intersection of two design roads. But what do you do when your road has a curve in it, can the 53' semi truck make that corner? Using Vehicle Tracking and the swept path analysis will allow me to see if that semi can make that corner. If it can't change the radius of the PI individually.

Use the Proposed Ground Surface that is generated with the IMX file. The one issue you will run into is with bridges. As we know, Civil 3D does not like two points with the same northing and easting but different elevations. So having an elevation for the bridge deck and then an elevation for the ground under the bridge will cause an issue in Civil. My solution was to temporary remove the bridge from my proposal and create the IMX file. This way the PVI's of the design road will hold for the surface but the FBX file will show the bridge and the piers and your truck will not get stuck on the bridge due to the crude surface that was generated.
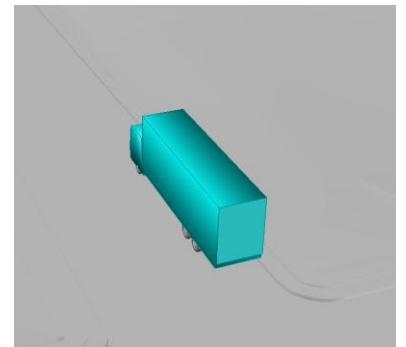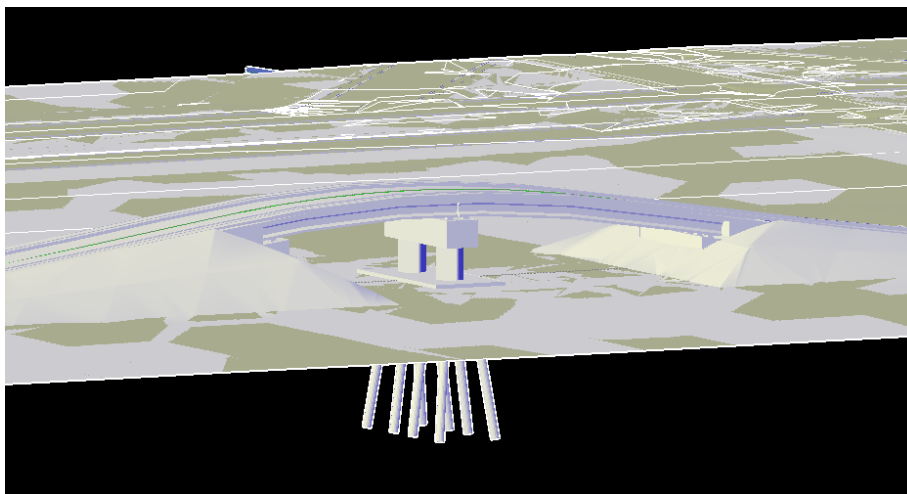
N. Sneak Peak (Bonus)

We will take a look at some of the new features that will be made available shortly after AU. New tools have been added on the Civil Side as well as the Infraworks 360 side. Sit back and take a look at the future of Civil 3D and Infraworks 360 2015.3.

Thank you for attending this lab… Do not forget to fill out your survey.