



CI11523

Creating 3D Model Assets for InfraWorks

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Learning Objectives

- Learn how to prepare a 3D model for import into InfraWorks with the correct materials and scaling
- Learn how to prepare animated 3D models for import into InfraWorks
- Learn how to create and organize custom model libraries in InfraWorks as well as export them for sharing with other users
- Learn how to build roadway assemblies using custom road and rail sections

Description

InfraWorks software ships with a basic selection of 3D assets for populating your models. In this class we will learn effective ways of preparing your own 3D models using applications such as 3ds Max software and Trimble's SketchUp modeling program. From here we will dive into InfraWorks software and learn how to import your custom assets, arrange them into libraries, and export them for use by other user. We will also demonstrate some effective techniques for using roadways and 3D models to create custom road and rail corridors in InfraWorks software.

Your AU Expert

Mark Kauffman's animation career stretches back to the wild and woolly days of the early 1990s. In 1995 he co-founded Paradigm Ranch Animation Studios, working on movie and television projects. In 1998 Mark joined the faculty at The Art Institute of Colorado, training students in the animation, graphic design, web, industrial design, and video programs until he left in 2012. In 2003 he joined the Project Visualization Group at WSP |Parsons Brinckerhoff (WSP-PB), serving as the team's technical lead. As lead he manages all technical aspects of production, manages the render farm, and oversees the group's research and development and new technology initiatives. In addition to his duties with the Project Visualization Group, Mark serves as a certified 3ds Max software trainer in WSP-PB's Autodesk Training Center, and he is the president of the Colorado AAUGA group, and a founding member of the Visualization Society of Colorado.

Introduction

I have been using InfraWorks since before it was Infrastructure Modeler and a little Autodesk Labs project called Project Galileo and most of my original production focus was on visualization. As time has moved on, I use InfraWorks in more diverse workflows outside of visualization, however, I am always concerned with my assets and how they look. Many of the assets that ship with InfraWorks are ok for basic entourage, but many of us users are beginning to build more and more complex models and we require more content.

Therefore, I decided to propose this class to the AU committee in the hopes it would inspire many of you to create your own libraries of content, and perhaps even spark a potential area on Autodesk's Content Store, <https://creativemarket.com/>, or perhaps even a content palette inside InfraWorks (hint, hint, dev team).

While this class and document will demonstrate the underlying concepts using 3ds max as the content creation tool, it is my intention to focus more on the workflow and the methods more than the specific application generating the content. In other words, what works for 3ds max will also work for Maya, SketchUp, and any similar digital content creation tool. One more thing before I get started is to acknowledge a few people on the Infraworks team who's helped directly or indirectly in making this a better document and a better class: Eric Fain who is part of the product development team and has been an excellent resource over the years; Jason Delany who created an excellent document detailing the technical aspects of how InfraWorks deals with bitmaps and 3D models formats; Eric Chappell who is the InfraWorks Product Evangelist and his regular webcasts highlighting the newest and sexiest features on a regular basis; and many others who posted content on the [Autodesk InfraWorks Infratips Website](#) . So, without further ado, let's get started.

Some Ground Rules

Before we get too deep into the weeds, I must lay out a few ground rules when it comes to working with InfraWorks. While we will *wade* (haha) deeper into these issues further on into the document, I wanted to highlight them first for quick reference.

1. **Scale** – InfraWorks likes only one scale size when importing 3D model content for the style library and that is metric. What does mean? It means whatever 3D model content creation tool you are using, you must use a system unit of Meters. While you can create content using another scale, the models end up being scaled incorrectly.
2. **No 3rd party materials** – What this means is you cannot use a material associated with a 3rd party render engine such as Mental Ray, V-Ray, Corona, etc. In 3ds max, this means you must use a standard material, which is a simple Phong based shader network containing diffuse, specular, opacity and bump. We will go into this in more detail later.
3. **Bitmap Types** – I have identified 5 bitmap types which you can use in InfraWorks; PNG, TGA, JPG, BMP and TIF. One thing I have also discovered is not all formats work with all your material channels. For instance, if you use a PNG or a TIF for a normal map, you will get no bump, whereas all 5 types will work for a greyscale based bump map. Again, ee will delve deeper later.
4. **Export Formats** – There are 3 primary 3D formats you should use for InfraWorks; FBX, OBJ, and DAE. While InfraWorks can support more 3D formats, these are the most flexible and therefore we will only focus on these formats.



5. **Animation support** – Animation support is limited, however, we will explore the animation workflow later on.

Materials

As I stated earlier, InfraWorks supports a standard Phong based material shading model, utilizing a diffuse, specular, bump and opacity channel. I will go on the assumption that you understand the concepts behind what each of these channels are and how they work. Therefore, let's focus on what will and will not work with Infraworks.

As I stated earlier, you can use many different bitmap types with Infraworks, specifically TGA, TIF, PNG, BMP and JPG. Which to use depends on what you are attempting to recreate. Here is a breakdown on the formats and what each can and cannot do:

	RGB	Alpha	Transparency
TGA	YES	YES	NO
PNG	YES	YES	YES
TIFF	YES	YES	YES
JPG	YES	NO	NO
BMP	YES	NO	NO

Looking at this chart, it would seem TIFF and PNG are the most flexible and you would be correct. I always recommend a lossless compression format such as TIF and PNG for two reasons. First, the lossless compression format ensures the smallest file size without sacrificing quality. The other reason is both of these formats are supported by Windows natively and therefore you can view thumbnails without any extra software. This saves time when trying to quickly view what the imagery looks like without having to open Photoshop or a similar image viewer.

Diffuse Channel

So, you can use both alpha and transparency in the diffuse channel in 3ds max to, in essence, “overlay” an image on top of the base diffuse color. While this is a nifty feature for 3ds max, this information does not make its way to InfraWorks. An alpha interpretation in 3ds max is transferred to InfraWorks as transparency all the way through the material. Here is an example of 3ds max and InfraWorks. You can see the alpha was used to “overlay” the bitmap on top of the object surface showing the blue diffuse color underneath (Figure 1). Once exported to InfraWorks, the alpha Knock all the way through, making the object completely transparent where the alpha resides (Figure 2).

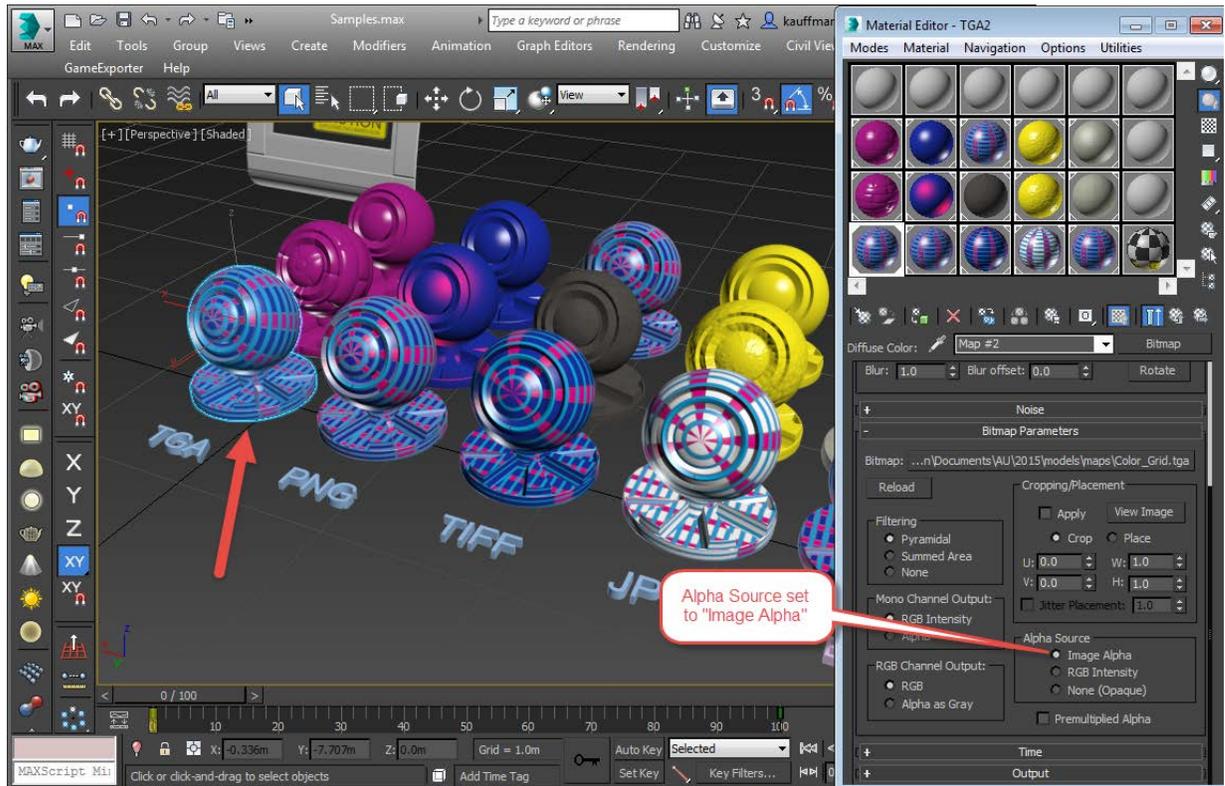


Figure 1

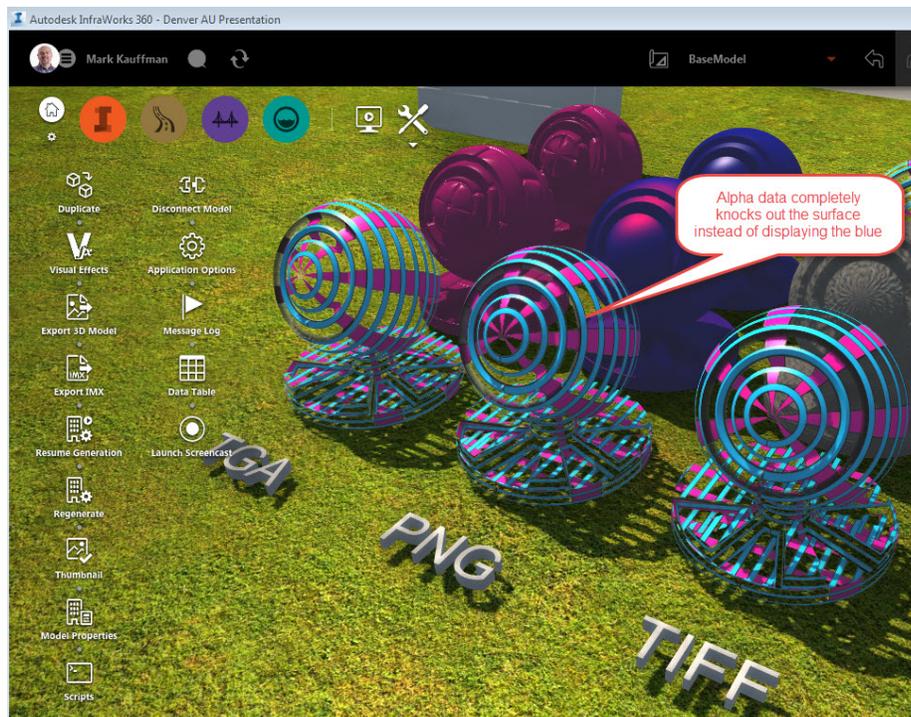


Figure 2

Your best bet is to use the RGB data only with the diffuse channel unless you plan on having transparency to clip something out.

Opacity Channel

Opacity can be handled in one of two ways. First, you can dial in a value in the 3ds max material editor using the Opacity spinner. You can also use a map in the Opacity Map Channel which uses greyscale information to explain transparency (Figure 3).

Infraworks does not use RGB data for the Opacity Map Channel, but instead uses greyscale data. If an RGB color file is used in the Opacity Map Channel, it will convert it to greyscale.

It is important to note, you cannot use the alpha channel information in the diffuse channel AND an Opacity Map Channel. This will result in some odd transparency problems. (Figure 4).

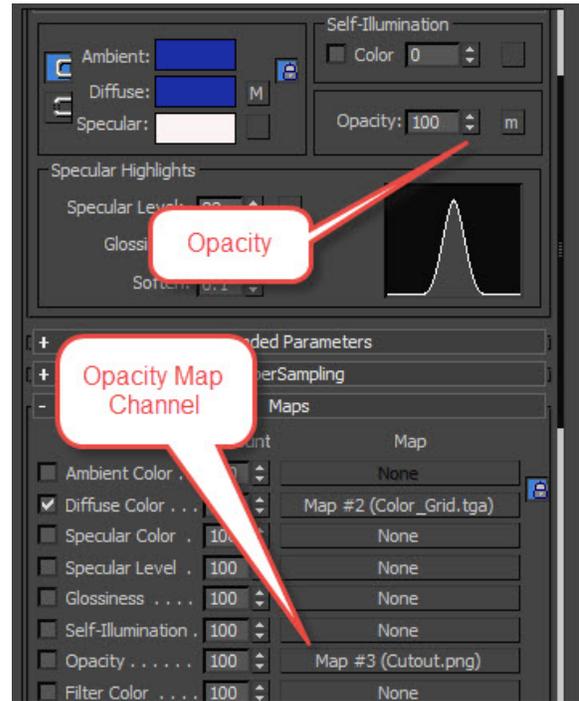


Figure 3

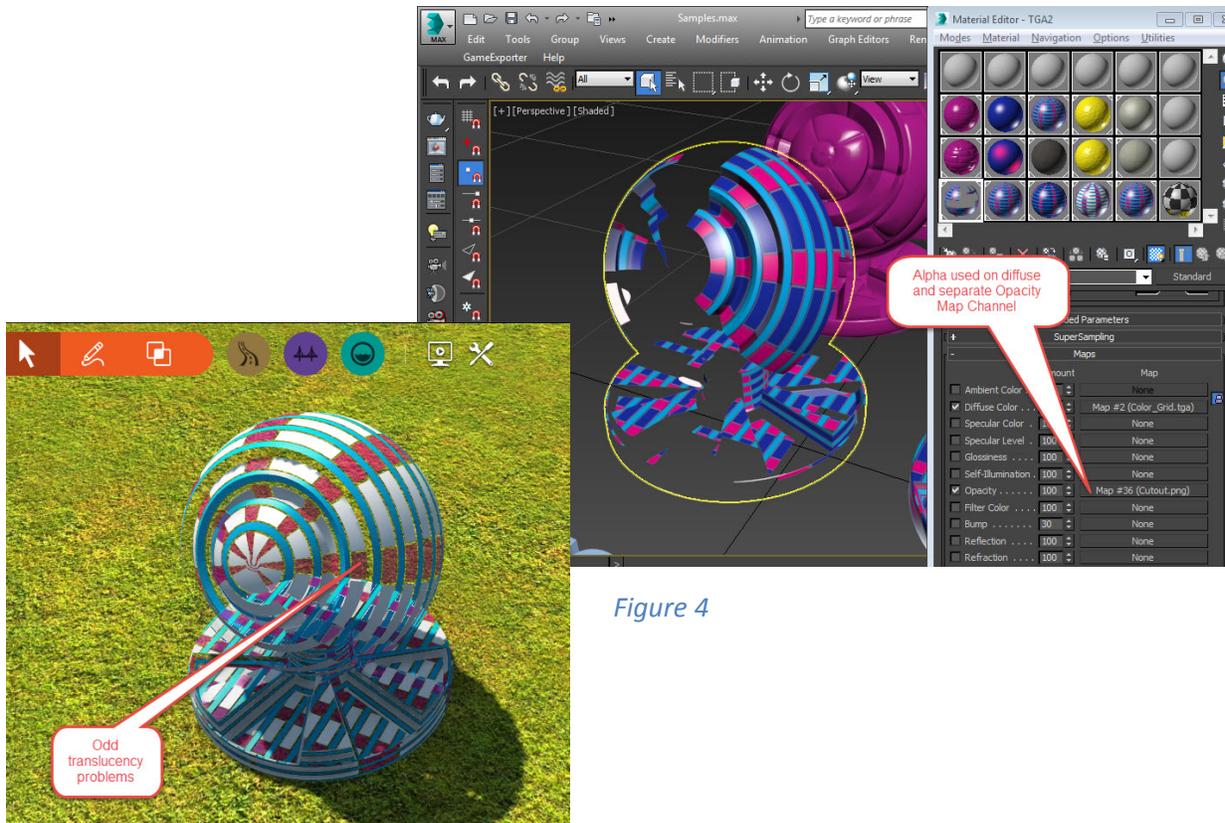


Figure 4

Specular Channel and Values

InfraWorks can use many elements within the specular channel. In 3ds max, you have a Specular Level and a Glossiness value as well as a Specular Map Channel and a Specular Color. InfraWorks can use all of these, however, not all of the 3D model export formats support all 4 elements. We will explore this further when we get to the section on 3D File Exchange Formats.

Bump/Normal Maps Channel

There are 2 ways to represent “bumpiness” with a material shader network and InfraWorks supports both methods. The first utilizes an 8-bit greyscale image to represent the peaks and valleys on a surface. In this case, the “peak” or “high” vales are represented by the lightest areas (255 white) and the “valley” or “low” areas are represented by the darkest areas (0 black).

The second method uses a normal map and this method utilizes RGB color values to explain the x, y, and z values of a surface. Normal maps are much more robust in explaining the bumpiness of a surface and are the preferred method for creating geometric details without the use of dense polygonal geometry, in high end game engines. Here is an example of two objects in InfraWorks, one with a greyscale bump map and the other with a normal map.

File Exchange Formats

There are 3 primary 3D model formats you will use for content with InfraWorks; FBX, OBJ and DAE. I have acquired a handy chart which breaks down each of the formats and what it supports:

<i>Material Setting (No Textures)</i>	<i>OBJ</i>	<i>FBX</i>	<i>DAE (Collada)</i>
Diffuse Color	Supports	Supports	Supports
Specular Color	Supports	Supports	Supports
Specular Level	Supports	Supports	Supports
Gloss Level	Does Not Support	Supports	Does Not Support
Self-Illumination	Does Not Support	Does Not Support	Does Not Support
Self-Illumination Color	Does Not Support	Does Not Support	Does Not Support
<i>Texture Types</i>			
Diffuse	Supports	Supports	Supports
Specular Level	Does Not Support	Does Not Support	Does Not Support
Specular Color	Acts as Specular level	Does Not Support	Does Not Support
Gloss	Does Not Support	Does Not Support	Does Not Support
Opacity	Supports	Supports	Supports
Bump/Normal	Supports	Supports	Does Not Support

This chart does present the user with a quandary. Which type should you use? Well, based on the chart above it would seem that overall, FBX seems to support the most for materials, while OBJ and DAE have a few aces up their collective sleeves with support for a specular map and support for animation,

respectively. I personally use FBX for the majority of my workflow, but I have been making exceptions from time to time based on my needs. I hope the developers will eventually democratize all these formats so that no matter where you are coming from, you have support for all that you might need.

Animation

As I stated earlier, animation is only supported with the DAE format. A few things to note about animation, however. First, only simple transformational animation is supported such as a move, rotate and scale. When you export your animation, you should make sure you set your preset to Autodesk Media & Entertainment and make sure Animation is selected in the rollout (Figure 5).

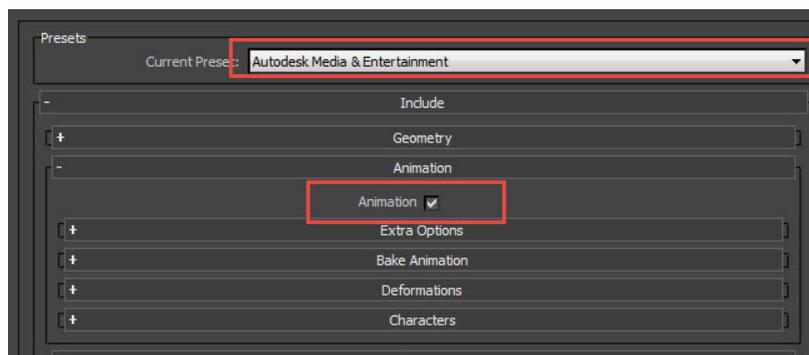


Figure 5

Second, you must make sure you have animation turned on in InfraWorks. Believe me this drove me absolutely batty when I first tried to import animation and nothing happened. To turn on animation in InfraWorks, you need to open the Visual Effects Card and click the “on” switch to activate (Figure 6).

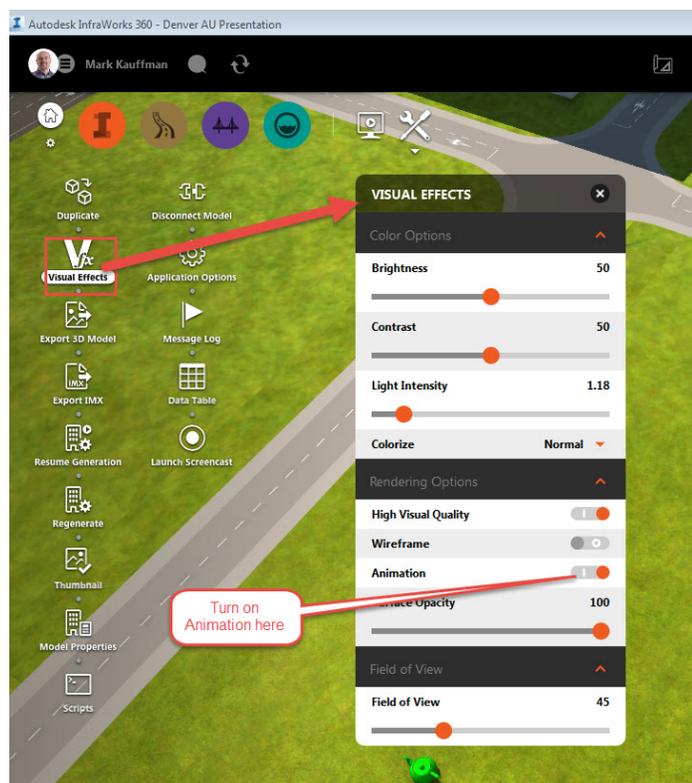


Figure 6

Building Libraries

Now that you have a good understanding of what InfraWorks can and cannot import and support, it's time to begin building some libraries, or as they are called in InfraWorks, catalogs. InfraWorks comes with some basic 3D models to work with, but as is often the case, we have projects that contain specific items we will need for a project or perhaps you have a transit agency or a construction company with which you work on a frequent basis and you want all that content on hand for you and your team. We will walk through the process of creating catalogs, merging content from other catalogs, importing your custom content into a catalog, exporting content for others to use and importing content catalogs and styles. Let's start by looking at the process of creating a catalog.

3D Model Catalogs

This exercise will walk you through the process of creating a new 3D Model catalog. To start, open an InfraWorks model and open up the style palette. Here is the base layout with a brief explanation of each tool (*Figure 7*):

1. **Create new style catalog**
2. **Delete an existing catalog** – This will delete whatever is currently highlighted
3. **Import style catalog**
4. **Export style catalog**
5. **Duplicate style catalog** - This will duplicate whatever is currently highlighted
6. **Rename style catalog** - This will rename whatever is currently highlighted
7. **Create new style in current catalog** – This creates a new style in the catalog that is listed in the popup menu at the top (currently 3D Model)
8. **Delete style from the current catalog** - This will delete whatever is currently highlighted
9. **Copy currently highlighted style from one catalog to another**
10. **Create a duplicate style** - This will duplicate whatever is currently highlighted
11. **Rename style** - This will rename whatever is currently highlighted
12. **Edit style** - This will edit whatever is currently highlighted

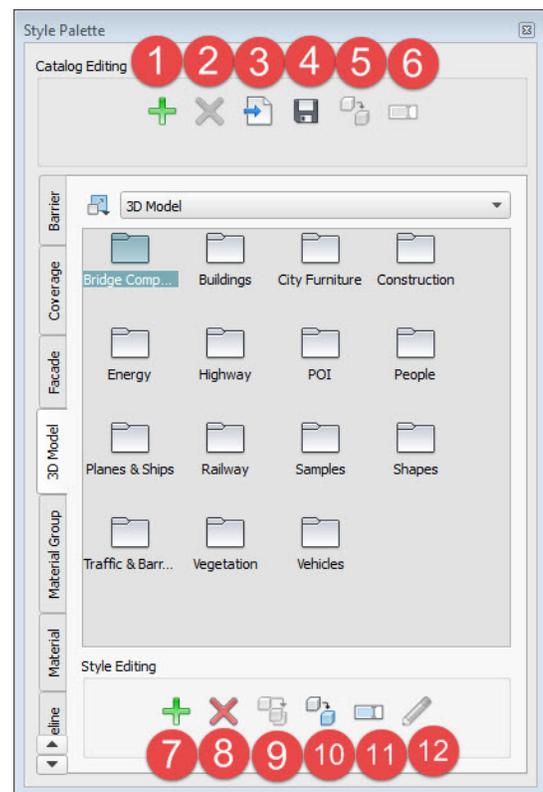


Figure 7

We will create a catalog and call it **High Res Cars**. Click on the new style catalog button (Figure 8). Once create, this will automatically navigate to the new catalog as you can see (3D Model/High Res Cars).



Figure 8

We will now add two cars to the library (you will find the cars at this [link](#)). Click on the green plus at the bottom of the window to create a new style (Figure 9):



Figure 9

A new window will pop up where you can select your model. Select the file called Prius.fbx and import it using the "Model URL" loader. (Figure 10). You will see many options here, but most of what you need set is already set correctly. Some are useful if your model loads and displays incorrectly.

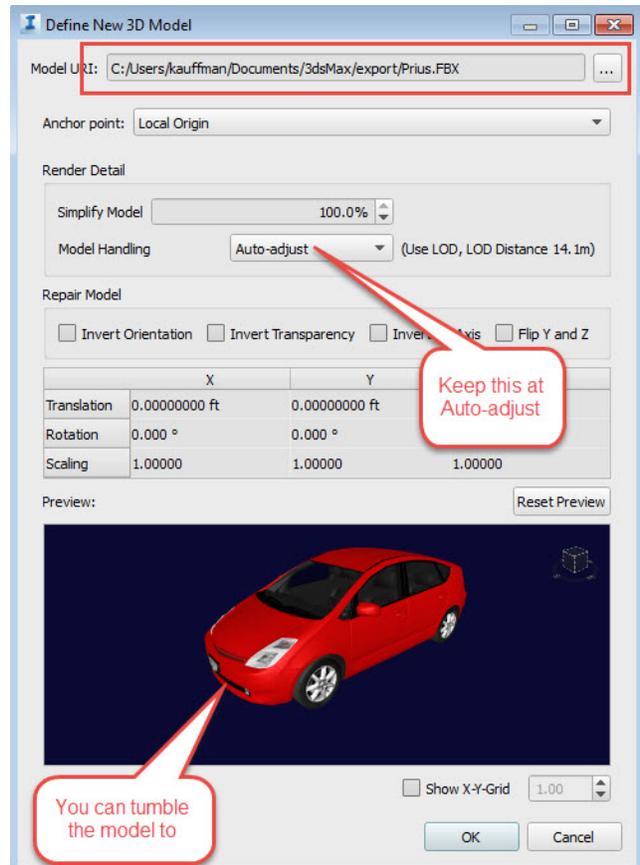


Figure 10

I highly recommend you create all your content at 0,0 and set your pivot at the base of the object (Figure 11).

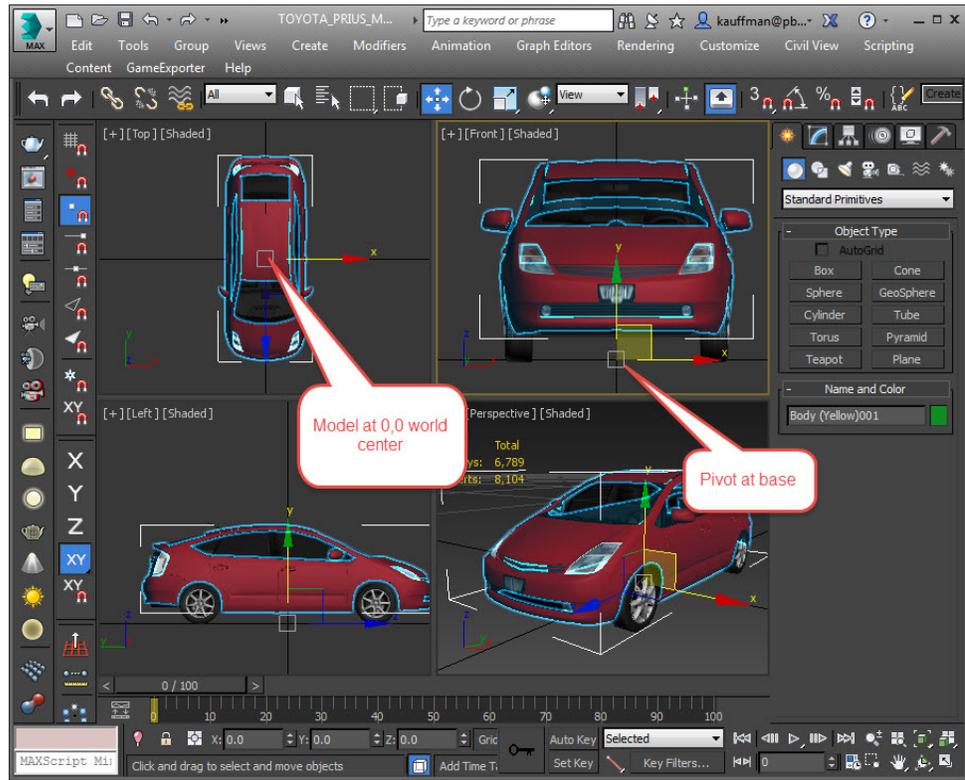


Figure 11

Once you have completed the import of your model, click OK to close the dialog. Your model will appear in the Catalog in your Style Palette with the name 3D Model. You can now rename it to a specific name to help identify it. In this case, type Toyota Prius – Red. You can also adjust the scale of the icons as they are displayed in the catalog window (Figure 12).

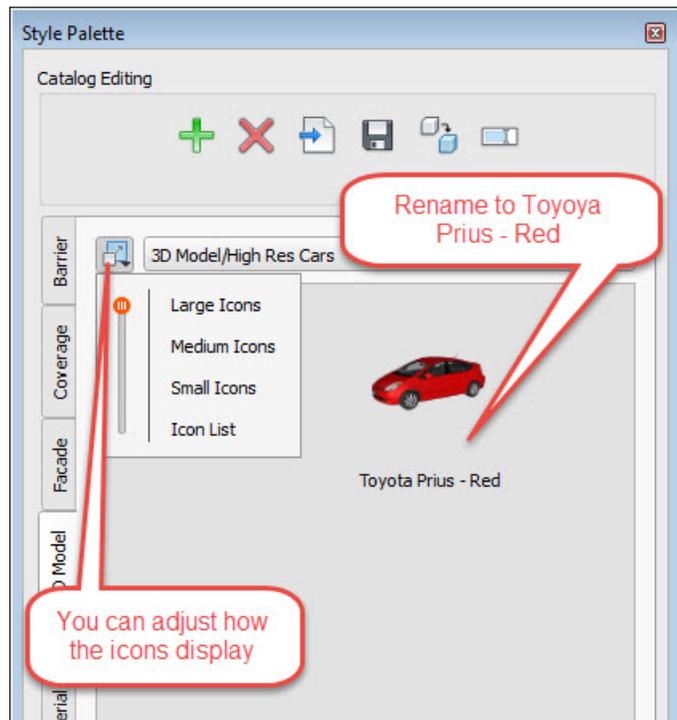


Figure 12

Repeat the process for the Accord Model as well (Accord.fbx included from this [link](#)). You now have two cars in your catalog. As a fun exercise for those of you with 3ds max Design 2012 and on or 3ds max 2016, i.e. those with the Civil View content, you can go through the process of converting the entire vehicle library over to a standard material format and then exporting to FBX for insertion into InfraWorks. The Prius and Accord were from this library. If you go to this folder, you can find all the 3ds max vehicle files (adjust the path relative to the version of 3ds max on your machine):

```
C:\ProgramData\Autodesk\Civil View\2016\Country Kit US
Metric\Objlibs\Vehicles\
```

All the maps for these vehicles are located here (adjust the path relative to the version of 3ds max on your machine):

```
C:\Program Files\Autodesk\3ds Max 2016\maps\CivilView\VehicleMaps
```

I have also included in this [link](#) 2 Maxscripts which will assist you. The first called ***mr_to_standard_convert.ms*** is from Dave Tyner which converts all Arch & Design materials into Standard materials. The second is called ***detachbyID.ms*** and was written by Jefferson Lim which will select and detach all your material ids into separate objects and separate materials. This is necessary due to the nature of the Multi/Sub Object Material used by Civil View in the creation of these vehicles. If you export this object without this conversion process, the materials will not load properly.

Export Catalogs

Exporting catalogs is very easy. Make sure you are in the Catalog you would like to export, select the Export Catalog icon (item 4 from the list above), select a location where you would like to save the file and type a name. InfraWorks will save a *.JSON file. I have included a sample JSON file in the class field ZIP located [here](#).

Import Catalogs

Importing is equally as easy. You need to be at the level where you want to import your catalog. For instance, if you are at the root of the 3D Model Catalog, your catalog will be at that level. If you are in a folder down level from the root, the imported catalog will appear there once imported.

Custom Road and Railway Models

Since the release of the 2016 version of InfraWorks 360, a new feature has been added which significantly augments what you can do with roadways and railways. It's called the "Custom Profile" and it rocks! (Figure 13) It basically allows you to load a roadway section into the panel and extrude it along your roadway/railway path.

The custom profile works in a manner similar to the "decorations" feature. In this case, you insert a vector shape along a specific target track (Figure 14). This requires an SDF formatted file, which is Autodesk's geospatial format similar to a SHP file. I have included a few samples in the class files, but you must acquire a copy of Autodesk Map 3D or Civil 3D to create this file type. ☹

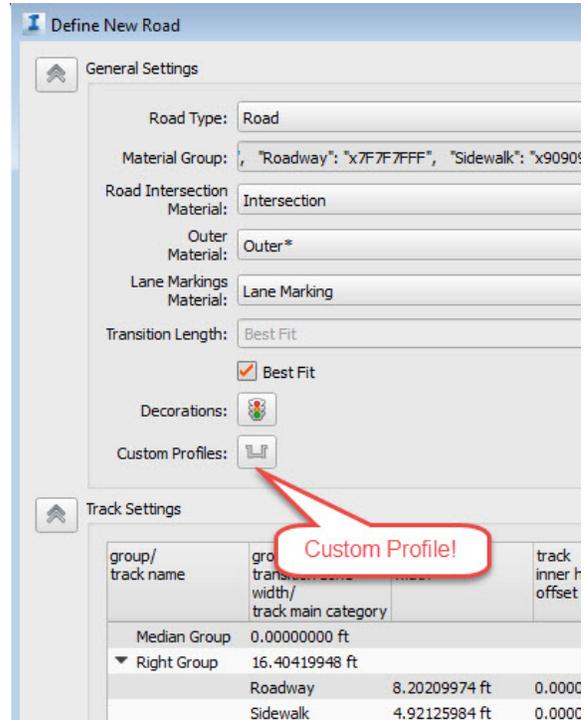


Figure 13

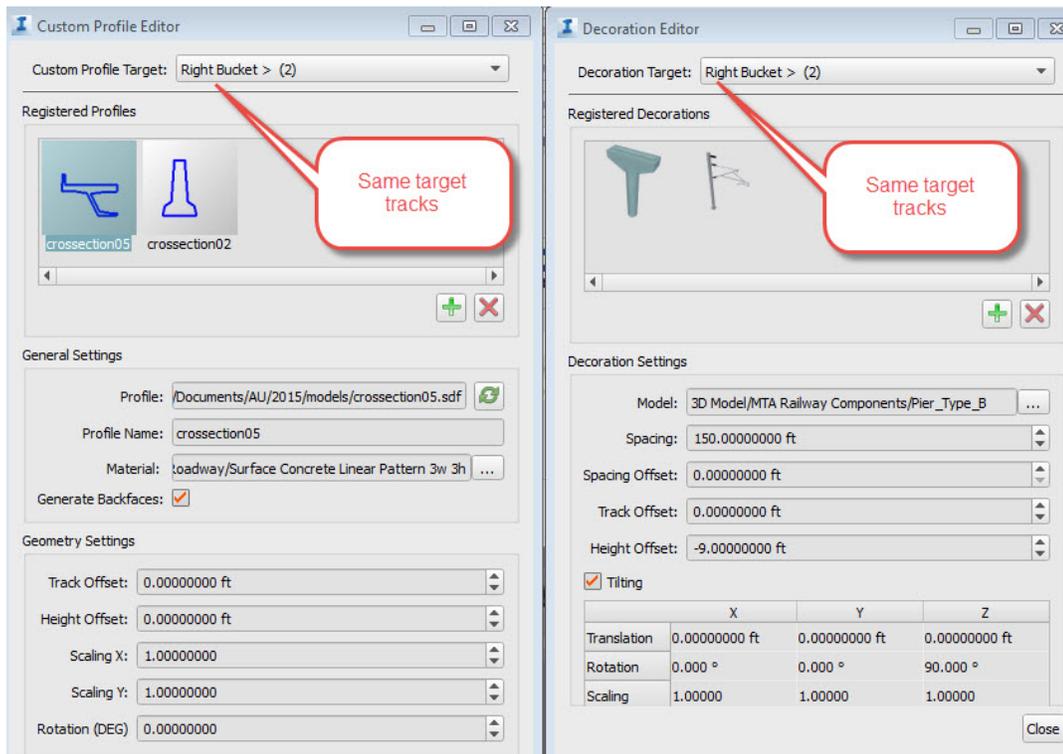


Figure 14

In this exercise, we will create a new road, add two custom profiles and three custom 3D model styles to make a light rail guideway bridge. Start by opening the Style Palette and selecting the Road tab. At the root of the Road styles, create a new catalog by clicking on the green “+” symbol and call the new catalog “LRT Rail Components” (Figure 15). You might be asking yourself why use a roadway style instead of the railway style? Well, a roadway style can use the design road functionality and the creation capabilities for roads is much more flexible compared to the railway creation tool. Click the green “+” at the bottom of the style palette to create a new road style.

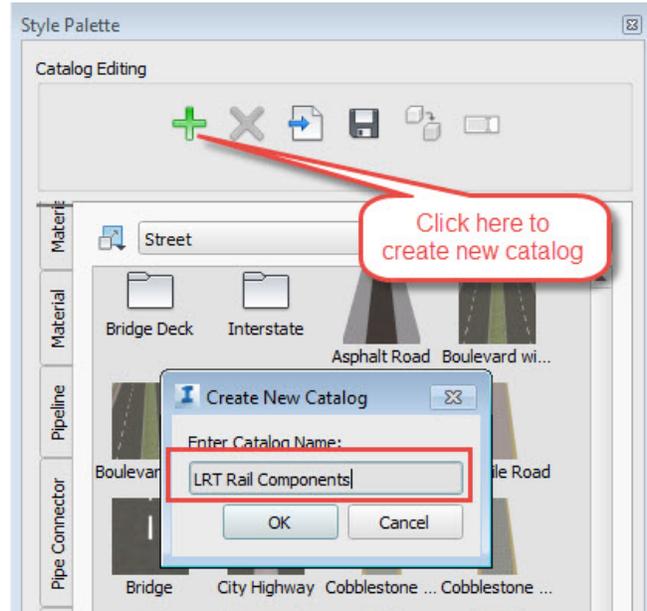


Figure 15

In the Define Road Dialog, click on the “custom profile” button to open the custom profile tool. You will add two SDF files (crosssection02.sdf and crosssection05.sdf from class files) with the default values, with the exception of the material. In this case, assign the Concrete Swirl Pattern 3w 3h from the Material/Roadway catalog (Figure 16).

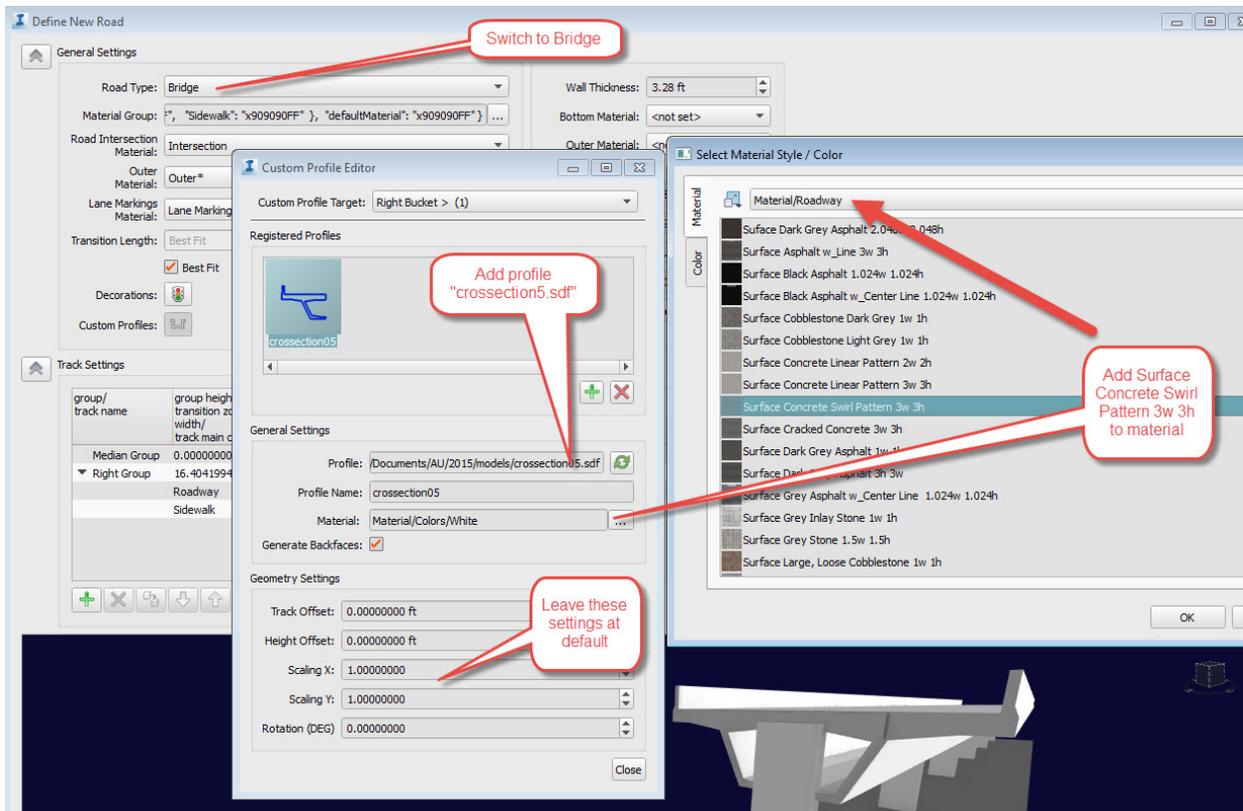


Figure 16

You should see a box girder structure with piers in your preview window below. Next, you need to add an Overhead Cable System (OCS) pole for either side, tracks to repeat along the guideway and a custom pier. To add these components, close the custom profile editor dialog and click on the Decorations button. In the decoration editor, add the following items to the Right Bucket decoration target from the MTA Rail Components catalog including these values for each component (*Figure 17*):

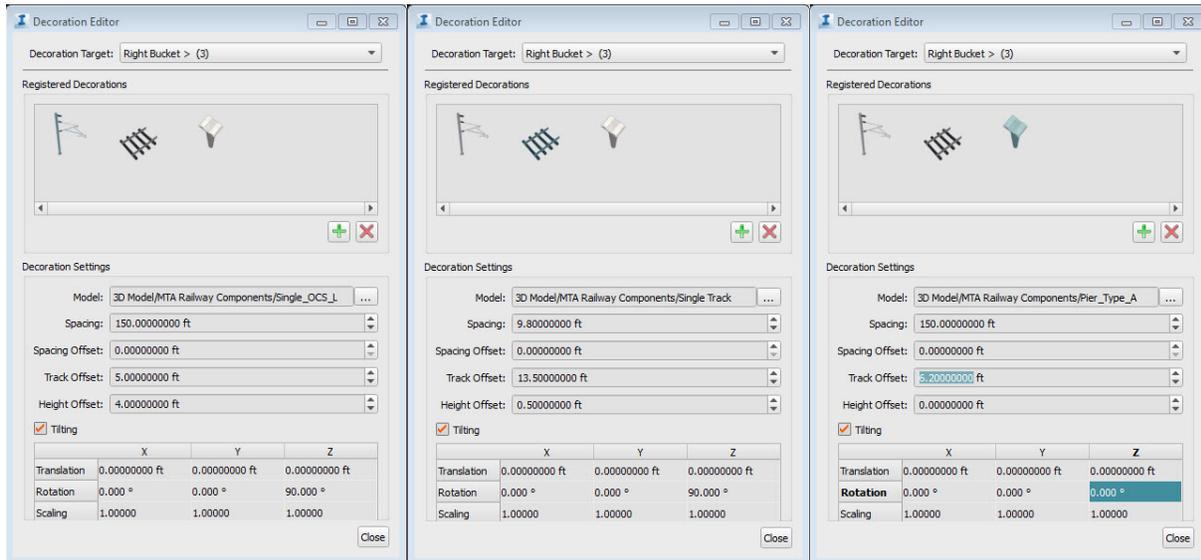


Figure 17

Finally, turn off the piers and click ok to save your settings (*Figure 18*). Name your style LRT Guideway A.

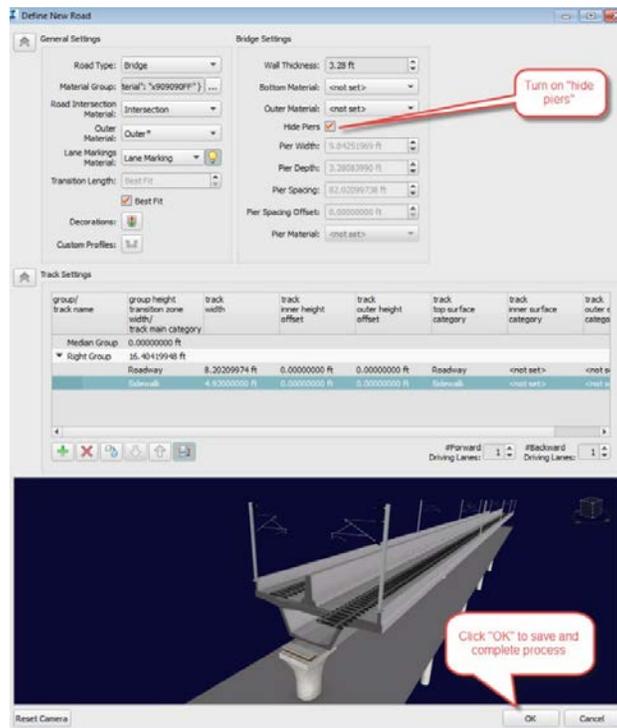


Figure 18

Let's draw a roadway and select this style. Here's what it will look like once dragged above the surface (Figure 19).

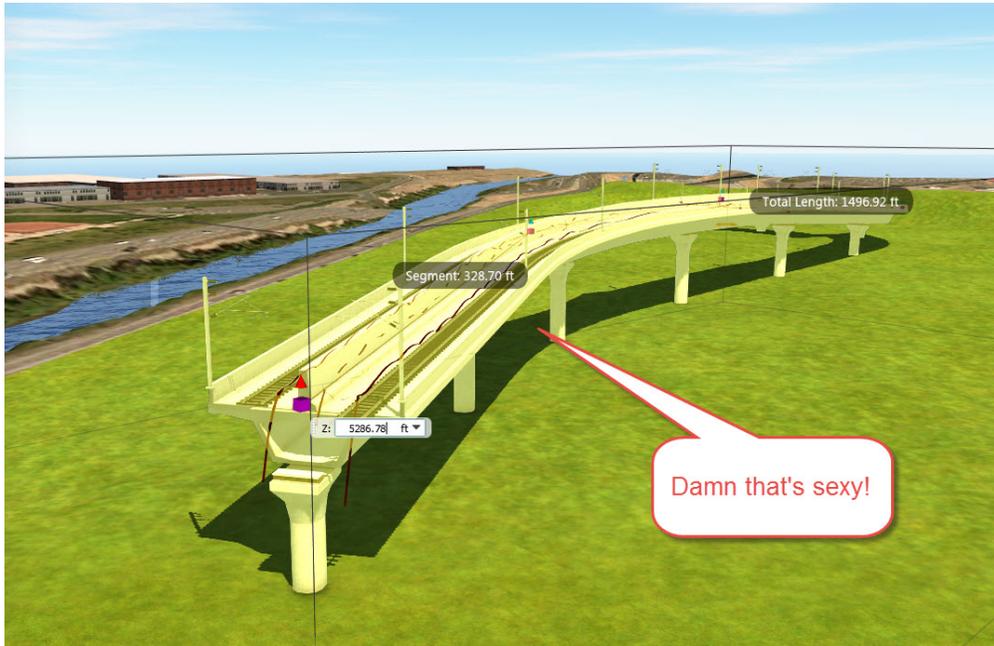


Figure 19

Let's take it one step further by duplicating the style and modifying it. Make the duplicate a road instead of bridge and swap out the crosssection5.sdf for crosssection3.sdf. I am including an export of these styles with the class files [here](#). Now we have the 2 styles connecting (Figure 20).

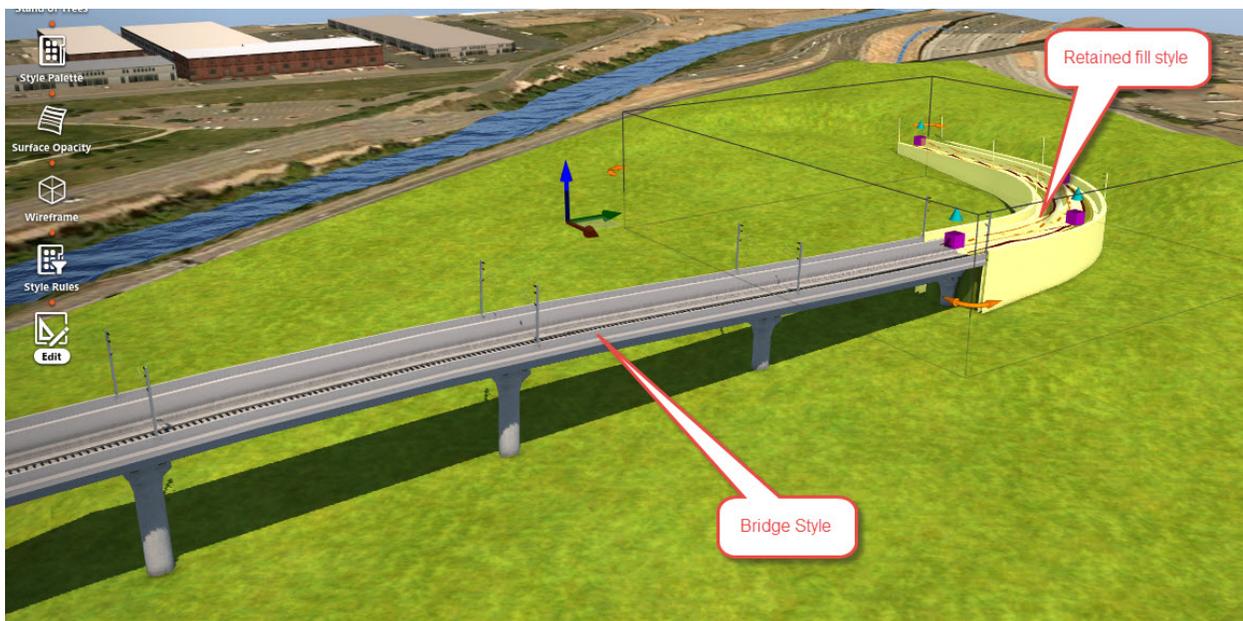


Figure 20

Conclusion

We have learned many things about creating models for InfraWorks. The limitations on the types of materials you can use, the channels that are available and what types of maps you can use. We explored the various 3D formats which InfraWorks can support and what features each format can bring over such as animation, what texture types and what material channels. We examined the process of creating Style catalogs and how to arrange them. Finally, we learned how the new custom profiles feature in road and rail styles allow you to create some intricate parametric geometry for your InfraWorks models.

Using these techniques, you can create some very intricate and robust InfraWorks models that not only demonstrate the AEC aspects of your project, but show them in high quality style.