CS227071

Using InfraWorks 360 for Better Site Logistics

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Learning Objectives

After completing this class, you will be able to do the following;

1. Understand the reasons to use Infraworks in conjunction with Sketchup, Revit, and Bluebeam
2. Create 3D backgrounds using model builder
3. Learn how to add, move, rotate, and scale objects in a scene (such as equipment, buildings, roads, fences, signs, people, and vegetation)
4. Produce presentation material such as storyboards, images and VR models

Description

Although InfraWorks software was created for designers and civil engineers to plan and design infrastructure projects in the context of the real world, it is useful as a site logistics planning tool. This class will cover workflows on how to use InfraWorks 360 to create professional 3D site logistics plans. We will use InfraWorks 360's model builder to create the site background, use ReCap Photo to import a 3D model created from site photos, use Bluebeam to create annotated terrain overlays, and show how to import 3D models from several sources such as SketchUp and Revit to create 3D model styles. We will use the proposals tab to show the different phases of construction, enabling phased site logistics. And we will review how to use coverage areas to model excavation in the 3D terrain. We will also show how to export professional graphics using the storyboard, and we will discuss how to import models for use in virtual reality.

Speaker

Don Josephson, Howard S. Wright, A Balfour Beatty Company

Don has been in the construction industry in the Pacific Northwest for almost 12 years. He graduated with a B.S. in Construction Management from Brigham Young University-Idaho in 2007. He spent 7 years as a Project Engineer/BIM Coordinator where he learned the ins and outs of many types of commercial construction. He is in his 5th year as a BIM Manager. Through the course of his career, Don has managed and helped manage the coordination process for over $3 Billion worth of construction comprising more than 30 buildings. Don is passionate about the benefits that come from proper planning and strives to use the appropriate tools to best communicate that plan to others. There are few things as satisfying as digging into a new project, identifying issues followed by solutions and then seeing those solutions successfully executed. BIM has changed the way that we can communicate. Don is a Revit Architecture Certified Professional.

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Learning Objective 1 - Understand the reasons to use InfraWorks in conjunction with Sketchup/Revit/Bluebeam

Introduction

As a BIM/VDC Manager I am often involved in pursuing work and in the early stages of site planning. Site logistics are key to addressing public safety, material handling, site constraints and potential issues such as overlapping vertical work. Good visuals help communicate our work plans and strategies to audiences including owners, architects, subcontractors and the public to understand how we will accomplish our work. This class will discuss and demonstrate some tips and tricks that I have learned along the way to meet these objectives. I hope that you will be able to evaluate your own workflows and find ways to integrate some of the items that I will be reviewing today.

For years I have been developing different workflows related to site logistics. For a time, I was enamored with the geo-locate capabilities of Sketchup and at other times the rendering capabilities of Revit. Then there is the ease and speed of bluebeam to create simple 2D plans. Ultimately, I have continuously searched for ways to create 3D backgrounds that help us communicate our plans in the most efficient and effective manner possible.

I would open google earth and dream of the day that I could get that into a usable, editable format in Revit or Sketchup. Even with the geo-locate function of Sketchup, I still couldn't bring in the background buildings, this was especially true when google earth no longer supported exporting the historic buildings. So, I resorted to modeling the surrounding buildings in Sketchup or Revit, but this can be a tedious and time intensive process.

I was introduced to InfraWorks here at Autodesk University a few years ago. I signed up for the class because I had heard about the magical model builder function new with InfraWorks 360. Not having a surveying background, the idea of having to go mine for all the proper files on my own to create 3D backgrounds and then align them using coordinate systems that were Greek to me, seemed daunting. The idea that terrain (complete with draped satellite imagery), roads, waterways, and buildings would all magically combine into an editable background for site logistics was an exhilarating concept. It was from that seed that my curiosity and excitement bloomed. Below you will find ways in which I have incorporated InfraWorks into my site logistics workflows.

Why Use InfraWorks

Table 1 below outlines various features available in different software as they relate to Site logistics. Although there are work arounds to some of the items show below, I tried to fill out the table relative to the direct capabilities of the software. Some of the check marks or lack thereof are open for discussion and debate. Some key things to note in table 1 are that InfraWorks is the only software listed that can automatically generate buildings, terrain and roads. Also, InfraWorks does not have annotation functionality like Revit or Bluebeam, and while it does allow for animation, it requires use of 3DS or similar software to prep the models. Fuzor from Kalloc Studios allows easy animation of objects and pedestrians but needs topo surfaces to be brought in from other sources such as InfraWorks. Understanding these and other differences can allow you to make decisions on what software to use for what portion of the workflow. Below, you will see 4 workflows that we have used.

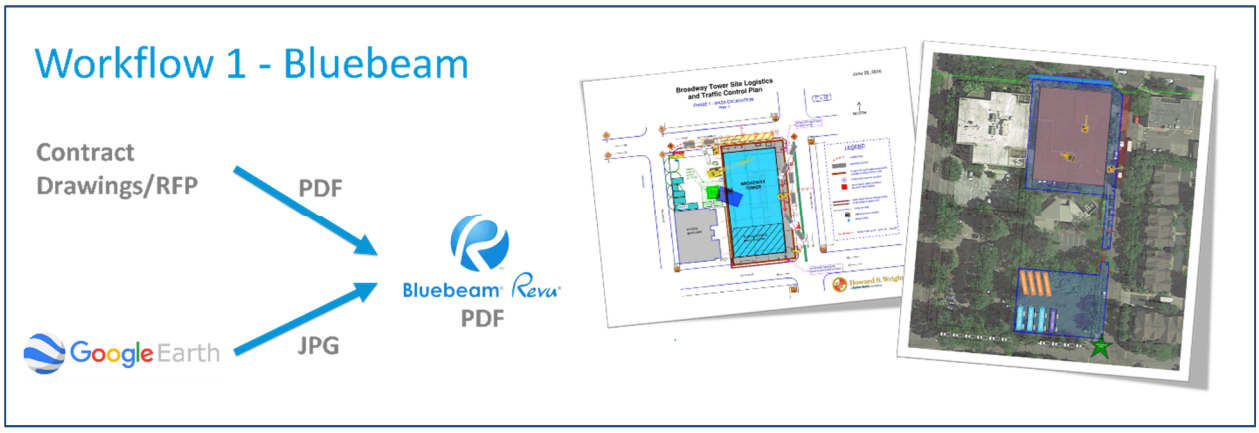
Table 1: Software Features

Features	Bluebeam	Sketchup	Revit	InfraWorks	Fuzor	ReCap Photo
Background Creation						
Realistic Backgrounds (with Textures)	X	X	X	X		X
Can overlay 2D Contract Drawings	X	X	X	X	X	
Road Tools				X		
Waterway Tools				X		
Lighting Tools		X	X	X	X	
Sky Effects			X	X	X	
Automatically generated Buildings				X		
Automatically Generate Terrain				X		
Automatically Generate Roads				X		
Buildings						
Can model 3D Buildings		X	X	X		
Photorealistic Materials		X	X	X	X	X
Can Import 3D Buildings		X	X	X	X	
Equipment/Entourage						
Can Import 3D Construction Equipment		X	X	X	X	

3D Pedestrians		X	X	X	X	
3D Signage		X	X	X	X	
3D Vegetation		X	X	X	X	
3D Construction Fencing		X	X	X	X	
3D Equipment can be Manipulated/Animated		X		X	X	
Phasing						
Can Create Phasing Views/Plans	X	X	X	X	X	
Presentation/Deliverables						
Can Produce Annotation	X	X	X			
Can Produce Animations		X		X	X	
Can Produce High Resolution 3D Images		X	X	X	X	X
2D Plans (Dimensioned)	X	X	X			
Rendering			X	X	X	
VR Capable					X	

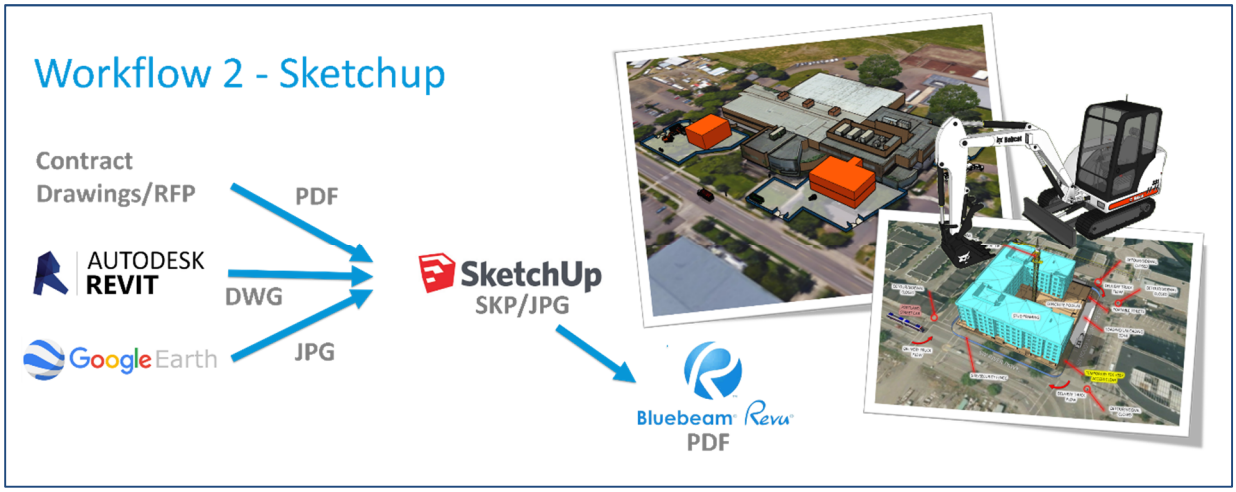
Workflow 1 – Bluebeam

A bluebeam centered workflow allows you to start with either 2D drawings or a snapshot of maps or google earth. You can easily add many different markups to create scaled, effective site logistics. Most of our site logistics begin in this manner. The biggest drawback is that they are 2D. You can do markups over 3D views as well, but they are still limited when it comes to removing buildings, excavation, animation etc.



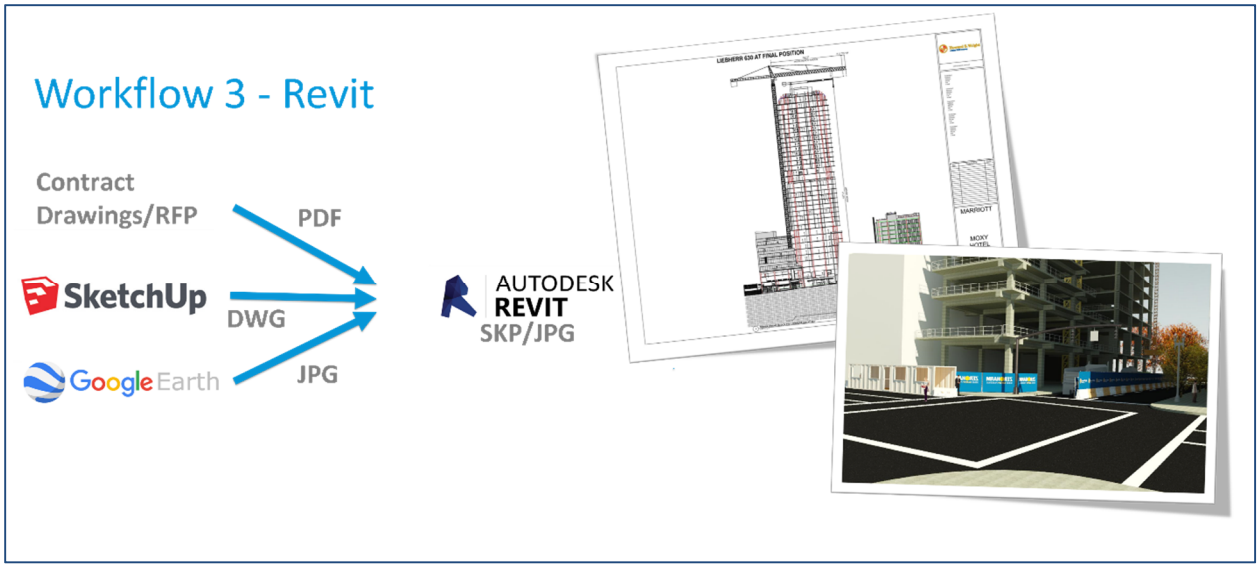
Workflow 2 - Sketchup

Sketchup offers many benefits. For one, the Trimble Warehouse offers a large, free library of high quality models of buildings and equipment. The scenes function in Sketchup allows for easy phasing simply by hiding and grouping using the Outliner tab. Another benefit is the ability to apply photos as materials. A few of the drawbacks with Sketchup are the lack of the model builder and the resolution of the geo-location background imagery.



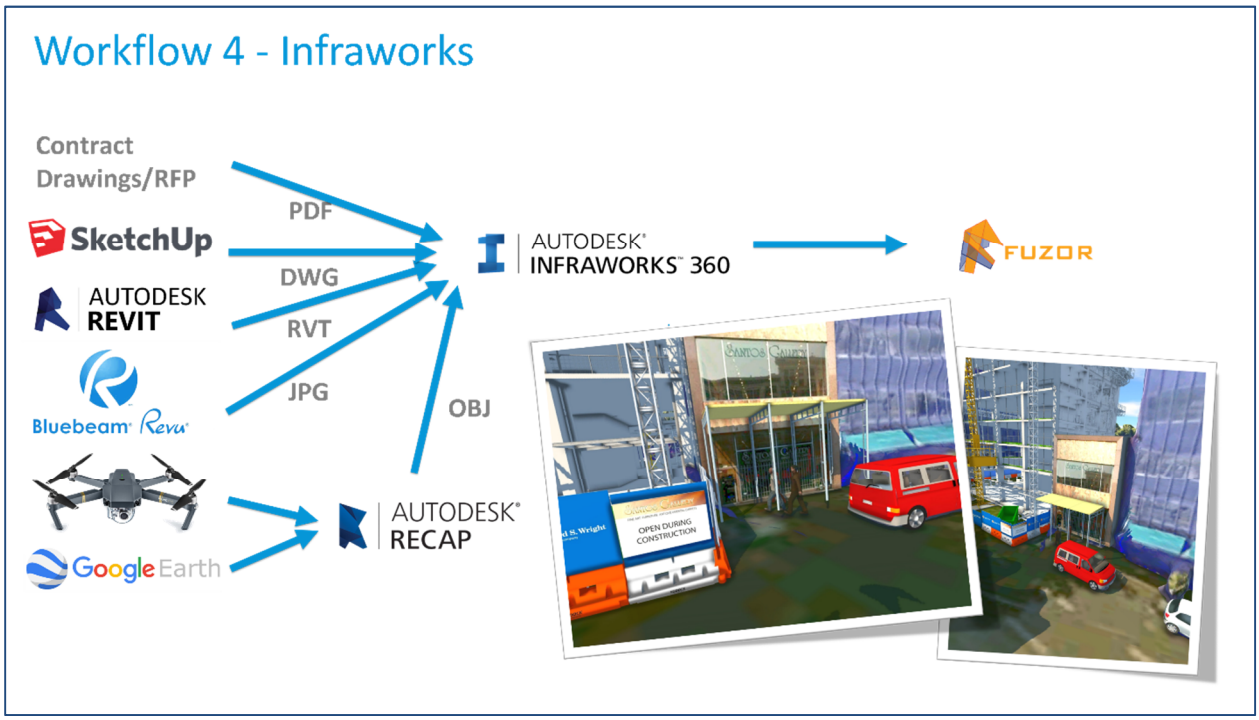
Workflow 3 - Revit

Revit's main advantage is that it was created with drawing production in mind. The ability to create accurate drawings for tower cranes, man lifts etc. means that Revit will continue to be part of the site logistics tool chest for the foreseeable future. It's rendering capabilities are superior to the other software discussed here but requires rendering in the cloud and use of cloud credits. Revit also needs to get its' topo surface from somewhere else, such as a civil cad background or from importing Sketchup or InfraWorks topo surfaces unless you want to try and do one manually point by tedious point. Also, Revit requires all adjacent buildings, trees, roads and other items to be modeled from scratch.



Workflow 4 - InfraWorks

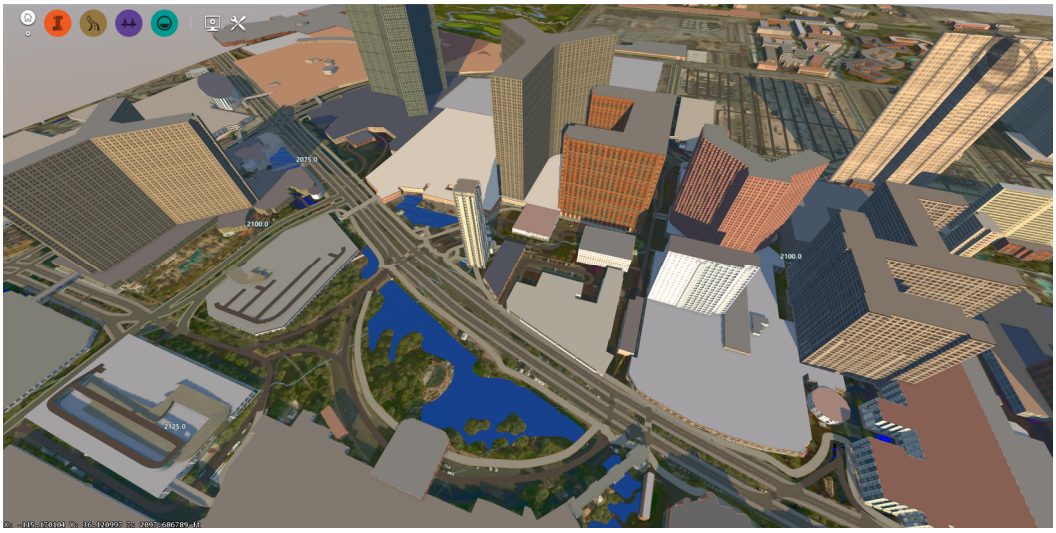
As stated, InfraWorks allows for automatic model creation when it comes to roads, buildings and terrain. InfraWorks allows input from the contract drawings, Sketchup, Revit, Bluebeam, Drone Imagery, ReCap Photo models etc. to help create a realistic background. Then InfraWorks does a great job with excavation, site fences etc.



As much as I like it though, I hope that the buildings aspect will improve in the future. Currently, the buildings are generic and are not always the right elevation. As an example of

what it produces now and what I hope to see in the future, see the snapshot below of Las Vegas direct from the Model Builder with all default settings vs. a Google earth view of the same area.

Las Vegas from InfraWorks Model Builder



Las Vegas from Google Earth

InfraWorks also does not allow for Virtual Reality, nor does it allow animation or 4D scheduling without the use of other apps such as 3DS. This is where we currently use Fuzor. Fuzor has both capabilities and I am excited to explore deeper into using InfraWorks and Fuzor together.

Learning Objective 2 - Create 3D backgrounds using model builder

First and foremost, the model builder is only available in InfraWorks 360 not stand alone InfraWorks. The models are stored in the cloud.

About Models

Models are collections of information, styles, and data. Two elements make up a model on your system: the database (*.sqlite) and a data folder. Each model has certain properties assigned to it, such as the database and UCS coordinate systems, model extents, and default terrain style.

You can create, open, duplicate, delete, or interact with your models from InfraWorks Home, which displays when you launch InfraWorks 360. To redisplay InfraWorks Home after opening or creating a model, click  from the Intelligent Tools strip.

About Creating Models

There are two ways to create a model in InfraWorks 360.

1. Create a model with Model Builder.

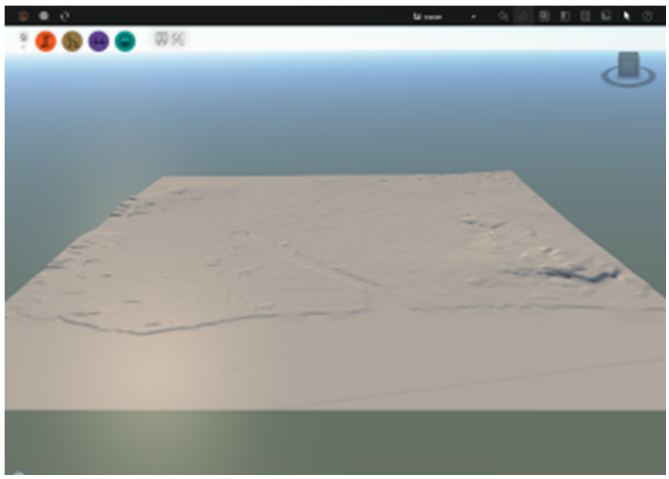
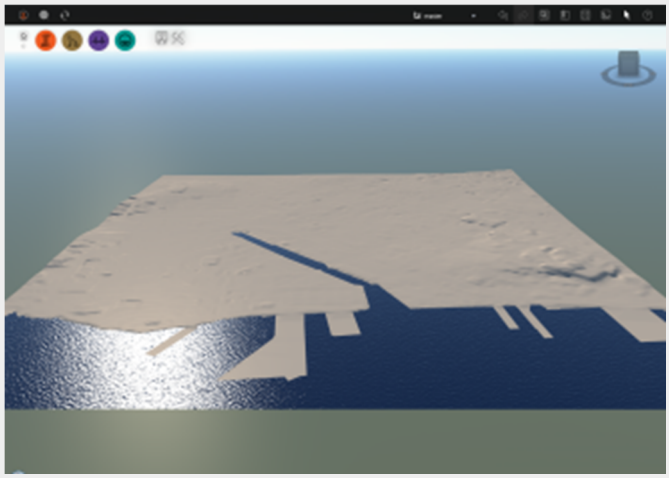
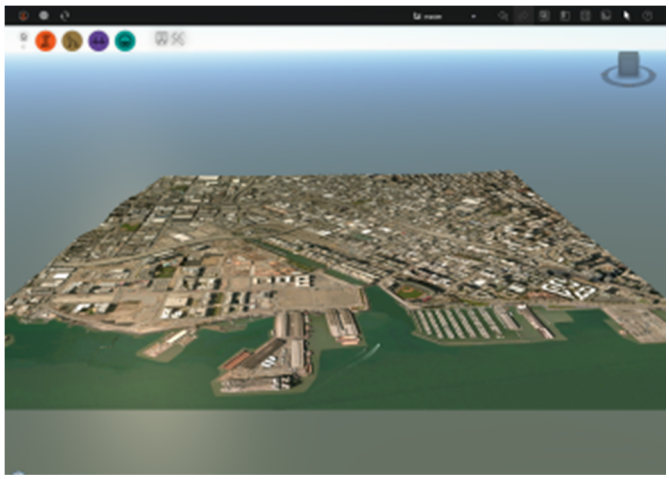
Model Builder finds and acquires high-resolution data layers and then builds models for the area of interest you specify.

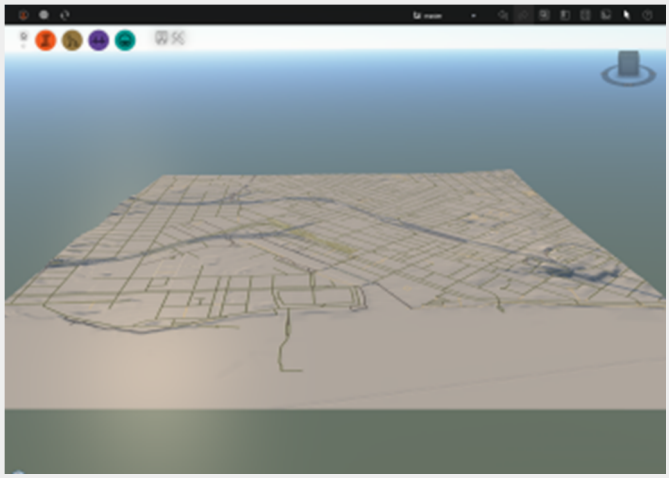
2. Create a model manually.

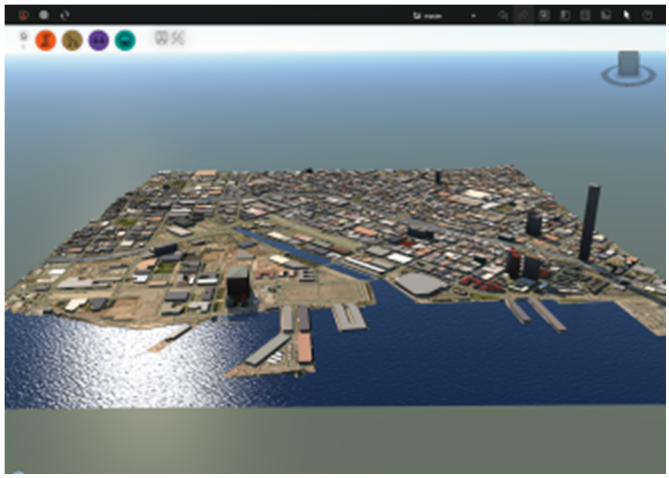
Not Covered in the class

About Surface Layers

In an InfraWorks model, the terrain (elevation data) represents the land upon which the model is built. Surface layers are draped to the terrain. When importing data, you can specify "Don't Drape" for features that you don't want to drape to the terrain.

Data Layer(s)	Example	Notes
Terrain (Elevation)		Raster-based data (grids) or vector-based data (TIN or contour files) are supported for terrain data.
Terrain and Water areas		Water areas are represented by coverages and draped on the terrain. • You can sketch or import coverages. • Closed polyline coverages represent moving water bodies such as rivers, creeks, and streams. • Polygonal coverages represent more static bodies of water like oceans, seas, and lakes.
Terrain and Aerial Imagery (Orthography)		Aerial imagery is draped on the terrain.

Data Layer(s)	Example	Notes
Terrain and Transportation Data (Roads and Railways)		Roads and railways are draped on the terrain. • You can sketch or import roads and railways. • Imported roads and railways are represented in InfraWorks as planning roads and railways, which only support basic geometry. This is also true for models that were created by the Model Builder. • With Roadway Design for InfraWorks 360, you can convert planning roads to design roads and work with more advanced road and railway geometry.
Terrain and Building Data		Buildings are draped on the terrain. • You can sketch or import buildings. • Configure imported buildings data to specify desired settings such as roof height, roof material, building facade, and base color.

Data Layer(s)	Example	Notes
3D Model Data		You can add 3D models such as solar arrays, vehicles, trees, barriers, street decorations, and so forth to your designs. You can also add animated 3D models to your model. • You can sketch or import 3D models. • Sketch 3D models through the Style Palette. • Import 3D model data for different feature class types. • Edit a style to add 3D model decorations to that style. • Import or sketch animated 3D objects.
Terrain, Water Areas, Aerial Imagery, Transportation Data, Building Data, and 3D models (City Furniture, Trees, and so forth.)		Use the Model Explorer to control the visibility, display, and selectability of different model data.

Using Model Builder

Create models quickly with the Model Builder. Model Builder finds and acquires high-resolution data layers and then builds models for a specified area of interest (AOI). Model Builder stores and publishes models in the cloud.

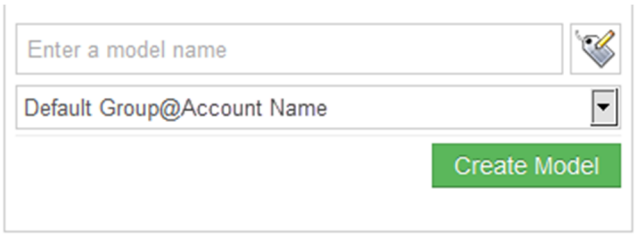
1. From InfraWorks Home, click  to expand a horizontal menu, and select Model Builder.

Note: You can choose New to create a model manually, and choose Open to select a SQLite model file to open.

2. Select an area of interest on the map.

Note: The Model Builder supports model areas up to 200 square kilometers, or lengths up to 200 kilometers in latitude or longitude.

3. Enter a name for the model and select the InfraWorks 360 group for the new model.



Note: Optionally, click  to enter a description for the model.

4. Click Create Model.

InfraWorks 360 sends an email notification to the email address associated with your Autodesk 360 account when Model Builder has finished loading the model.

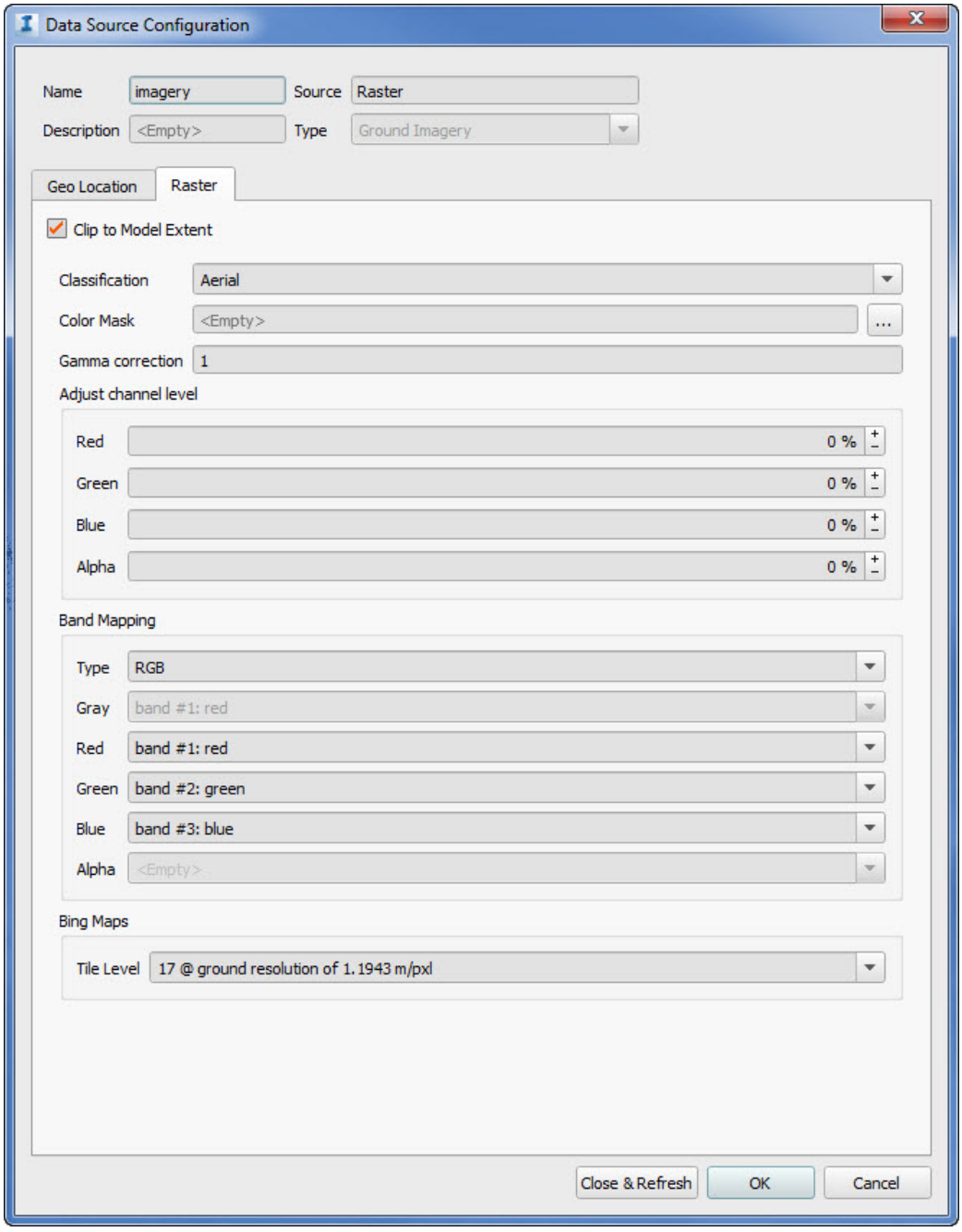
Adjust resolution of ground imagery

Specify ground imagery raster data settings such as Classification, Color Mask, Gamma Correction, Channel Level, and Band Mapping.

This topic describes how to configure raster data for use as ground imagery. To configure raster-based data grids as terrain, see To import terrain.

1. Click  to open the Data Sources panel (keyboard shortcut: Alt +1).

2. Select the raster data source, and click Configure.

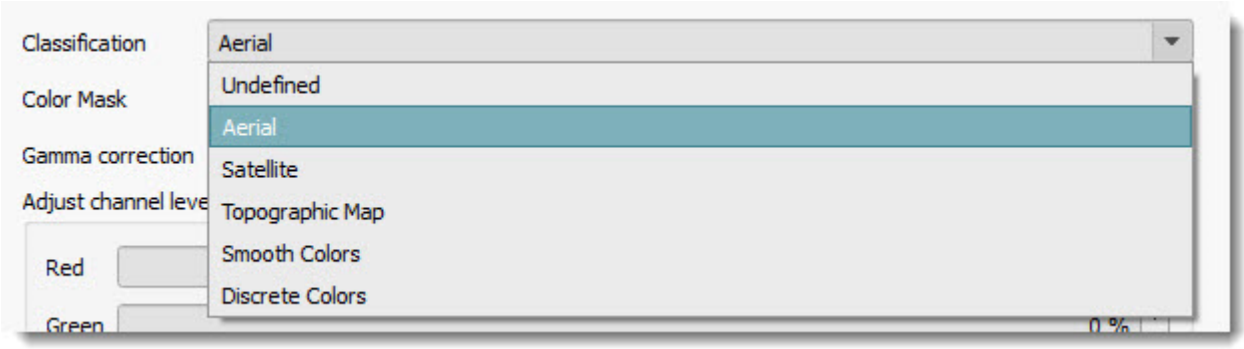
3. 

4. Select the Raster tab in the Data Source Configuration dialog, and specify desired settings. See Below.

- **Clip to Model Extent:**

Checkmark this setting to limit the extent of imported raster data to the model extent (by default, your model extent is set to the boundaries of the database coordinate system). This may accelerate import performance and reduce the disk size of your project. You can define your model extent with the Model Properties dialog. However, note that your imported raster data will be clipped to the model extent at the time of import, meaning that if your model extent increases later, the raster data will still be clipped to the smaller extent-- and will have to be reimported to match the new, larger model extent.

- **Classification:** Specify how to classify the raster data source type. Set the correct classification to improve performance or display quality.



- **Color Mask:** If you specify a color mask, all pixels in the raster image matching your color mask color will be displayed as fully transparent. The RGB value you specify will be used exactly without approximation, so image formats using lossy compression techniques (such as JPG or MrSID) are not recommended for color masks. Color masks work best when using uncompressed GeoTIFFs for your raster data source.

- **Gamma Correction:** Set gamma correction to adjust the luminance of your raster imagery. A proper gamma correction will improve the visibility of brightness variation in your model.

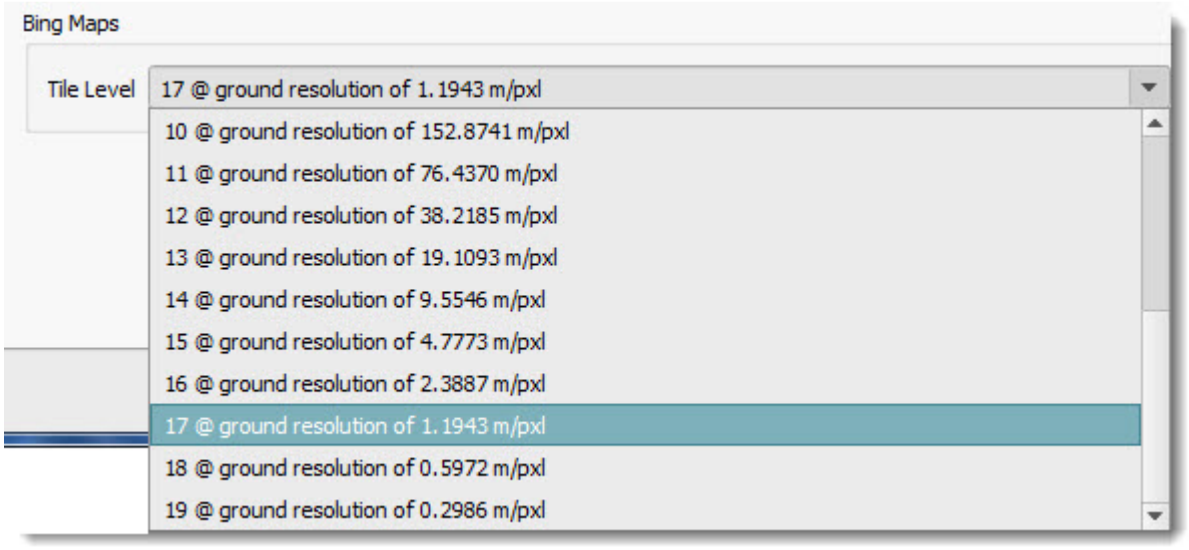
- **Adjust channel level:** Adjust the scale at which red, blue, green, and alpha channels appear in your raster image. For example, if your raster imagery has an unwanted red tint, you could adjust the red channel level to a lower value to reduce the red displaying in the image. The alpha channel describes transparency per pixel.

- **Band Mapping:** When you import a raster image to be a ground imagery layer in your model, you can choose which bands from the source raster image to map to channels in the raster ground imagery layer that InfraWorks 360 will create.

The Type field specifies the available bands InfraWorks 360 can bring in from your source raster image. For example, if you choose Gray as the Type, you will only be able to map bands to the Gray channel in InfraWorks 360, which creates a grayscale image. Once you specify a type, use the remaining available fields to determine which source image bands will be mapped to which channels in your ground imagery layer:

  - Gray: A grayscale image
  - Gray + Alpha: A grayscale image with a transparency band.
  - RGB: A multiband color image.
  - RGB + Alpha: A color image with a transparency band.

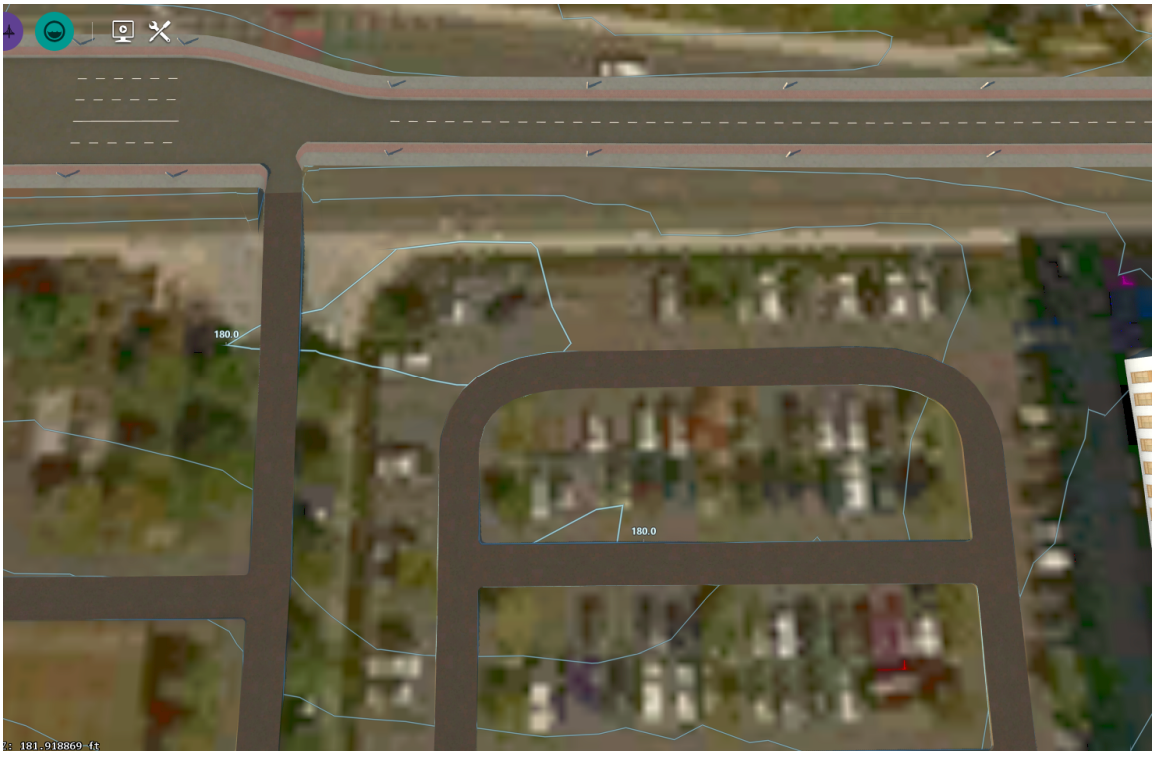
- **Bing Maps:** The Tile Level option is only available for raster ground imagery data in models created using the Model Builder. By default, all Bing Maps raster ground imagery is set to Tile Level 17.



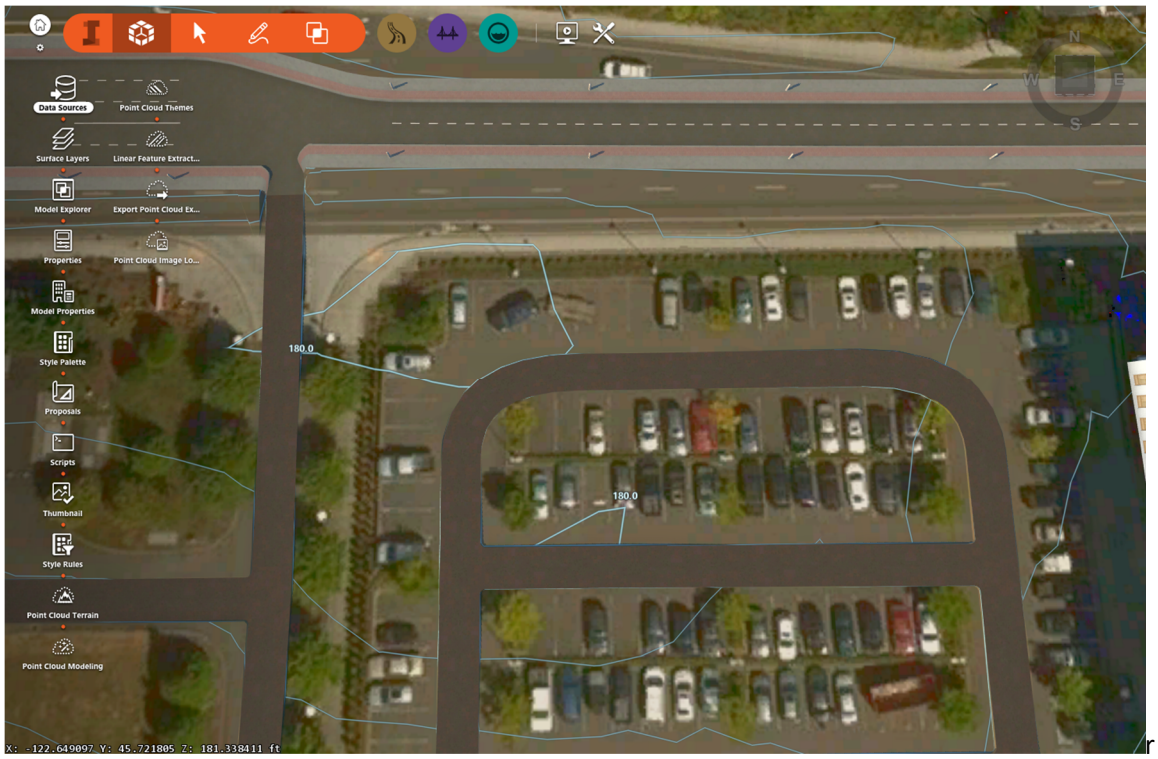
Setting a higher Tile Level, such as Level 18 or Level 19, will provide higher resolution ground imagery if higher resolution data is available for that location. However, be forewarned, this may increase the size of the model exponentially.

Using the higher resolution is much better for site logistics. I use 19. If that isn't high enough, I will use a terrain overlay of Google Earth.

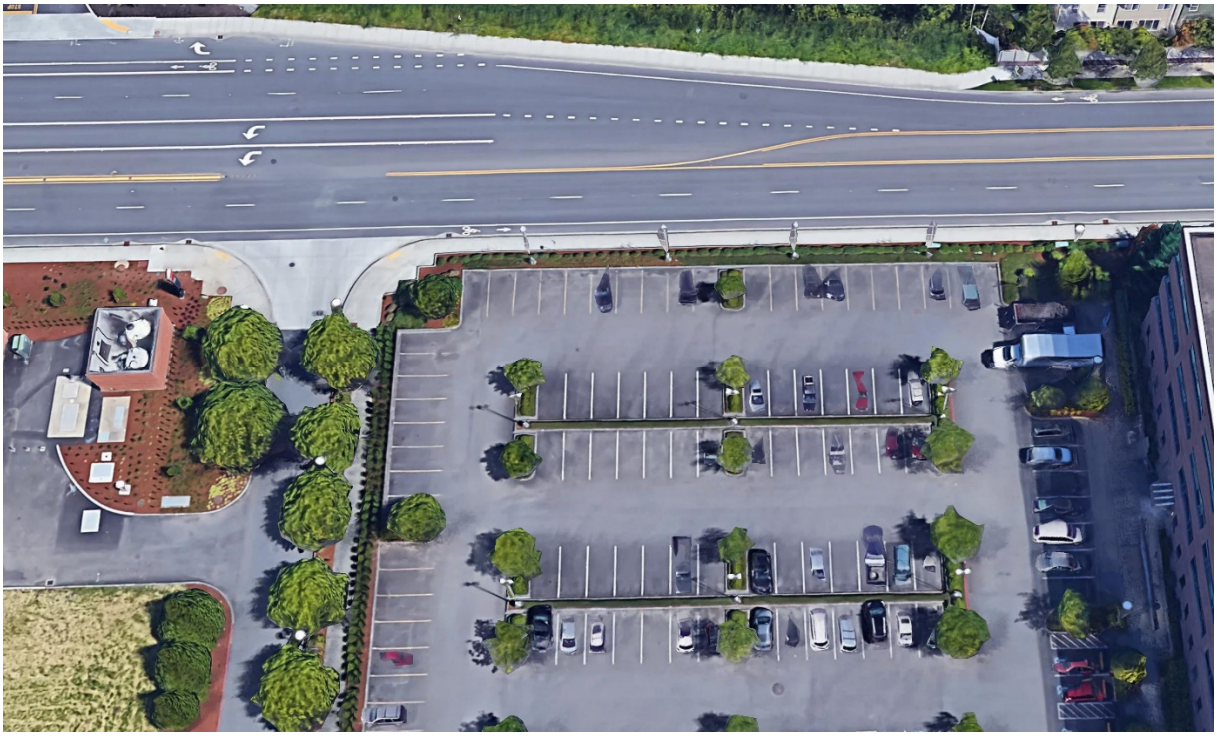
Bing Image Tile level set at 17 (default)



Bing Image Tile level set at 19



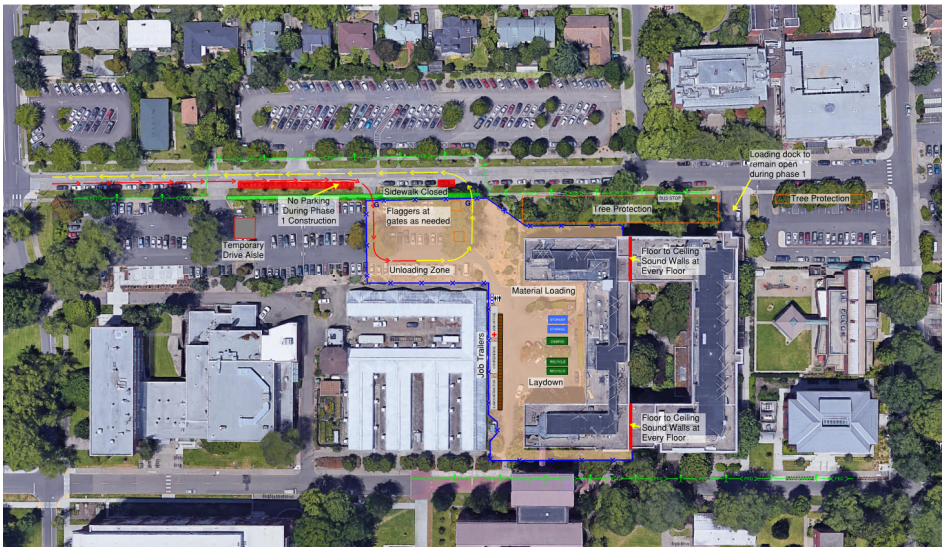
Google Earth Pro High Res Export (used for terrain overlay)



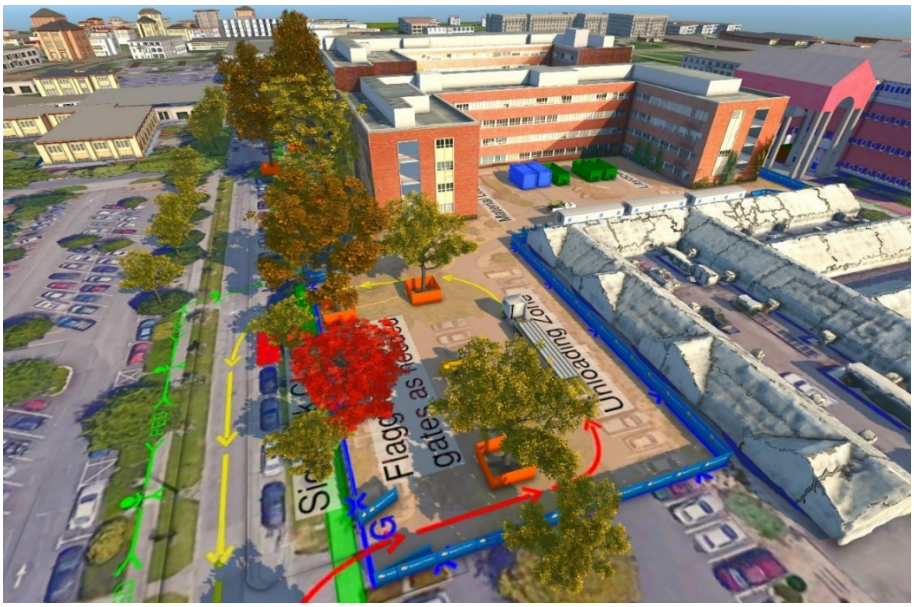
Terrain Overlays

One of the biggest advantages for Terrain overlays is that I can sit down with the site superintendent and quickly draw up a 2D plan. Then we can import that as a terrain overlay and trace over the 2D objects to create a perfectly matching 3D model. Updates can be brought in quickly by exporting another jpeg from bluebeam and refreshing the overlay in the data sources tab. A very important aspect though is that like roads, Terrain Overlays cannot be copied from one proposal to another. There is a work around to this though using the merge proposals feature.

Terrain overlay showing fencing, traffic routes and pedestrian routes.



Terrain overlay showing fencing, traffic routes and pedestrian routes.



To import 2D vector terrain overlays

Import 2D DWG vector data as overlays that are draped to terrain. After configuring and placing a 2D overlay in your model, you can position the overlay more precisely in-canvas using reference points.

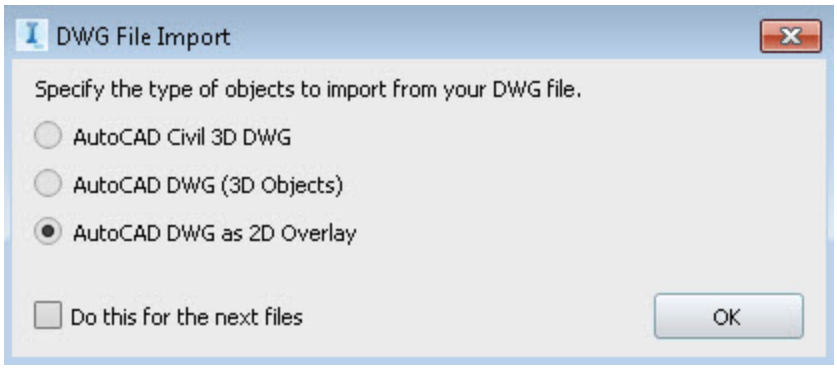
1. Click  .

2. Click  (Add File Data Source) in the Data Sources panel and select your vector data source.

- Click AutoCAD DWG as 2D Overlay to open a 2D AutoCAD DWG or DXF object. This cloud import option requires an internet connection and a valid Autodesk Account.

- Click Vector Overlay to import a DWG or DXF file on your local system or a mapped network drive.

3. Specify AutoCAD DWG as 2D Overlay if prompted, then click OK.



4. Double-click the imported data source in the Data Sources panel to open the Data Source Configuration dialog.

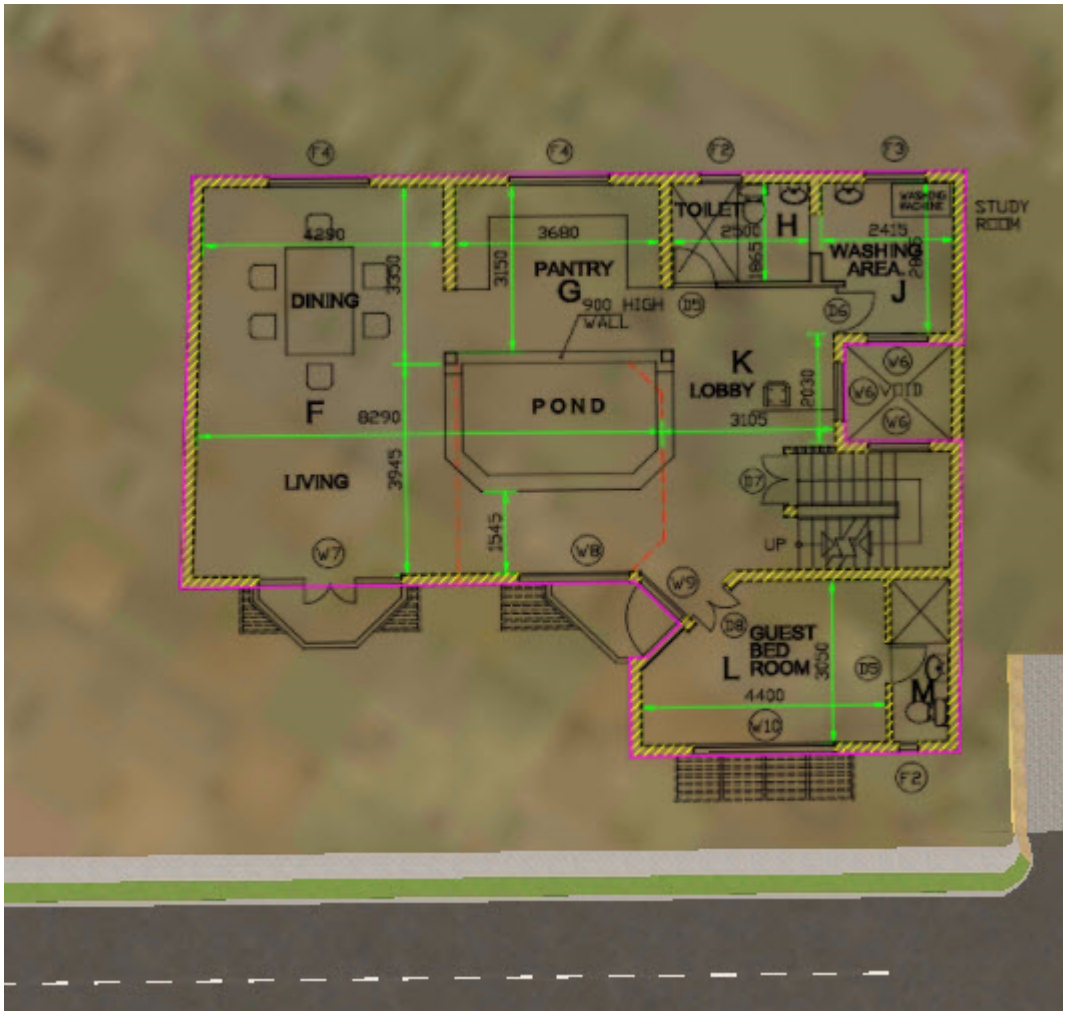
5. Choose Terrain Overlays as the Type if it is not already specified.

6. Click the Geo Location tab.

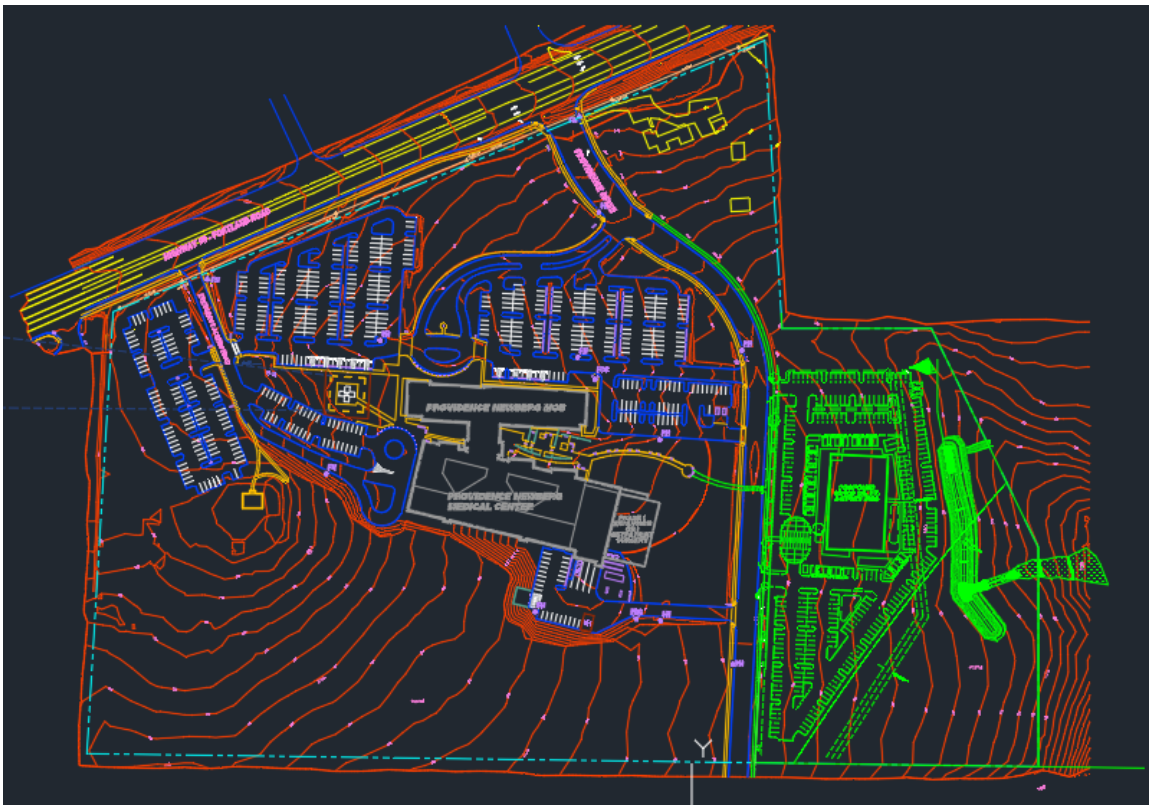
7. Click Interactive Placing.

Note: Terrain overlays do not support world files. While not recommended as a best practice, you can manually enter latitude and longitude coordinates in the Position panel within the Data Source Configuration dialog. See To specify geolocation settings for more information.

8. Click Close & Refresh.



Sample Vector terrain overlay



9. You can rotate, re-size, or move the overlay in Edit Mode using the grips and gizmos.

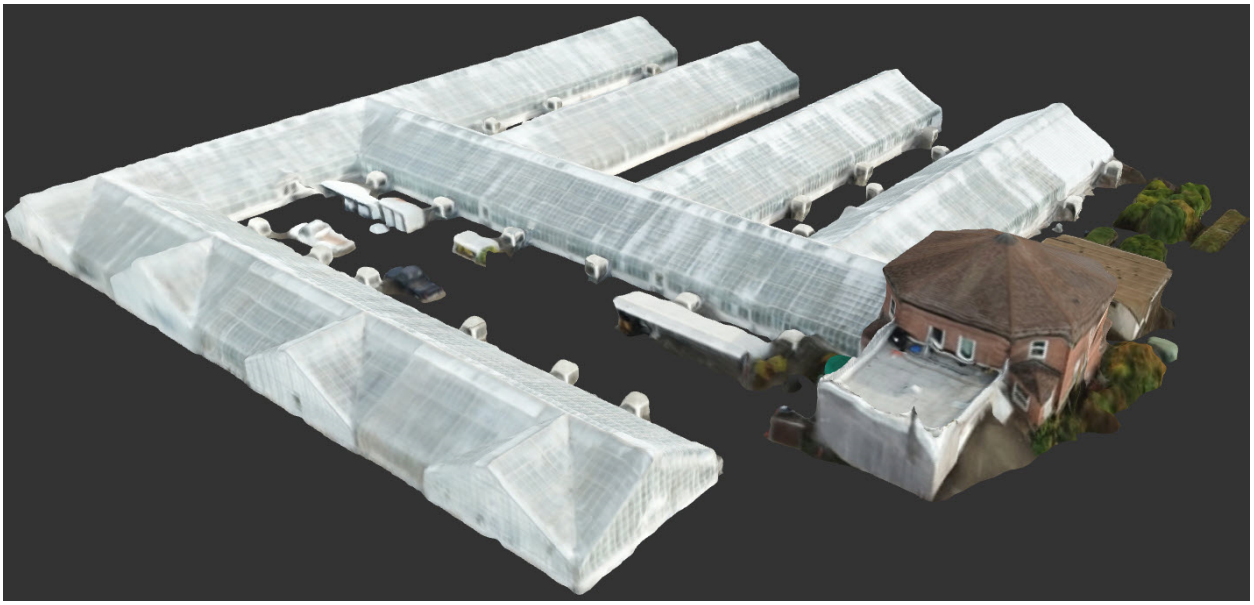
10. To position an overlay more precisely, right-click the selected overlay and click Place by Reference Points. See: To position 2D Overlays using Reference Points.

ReCap Photo Model

ReCap Photo was a real eye opener for me. This was my first chance to experiment with photogrammetry and what I experienced got me very excited. In my mind, what I saw in Google Earth was now a very close reality. Being able to create models out of photos. This method captures far more data than hand modeling and is true to life when it comes to textures and finishes as well as relative placement and scale of one object to another. The main downfall right now is that the buildings are still not editable, and the trees can get in the way, but there is a huge amount of possibility for this moving forward. See below for some models we cut out of larger site models and used in conjunction with model builder buildings, and Sketchup buildings.

Model from drone imagery

Model from drone imagery.



Learning Objective 3 - Add, move, rotate, and scale objects in a scene

The double click required for placing objects took me a while to get used to but once you start working with it, it begins to make sense. Also, I first tried to place items directly from the styles pallet, not from the create conceptual design features button  . Once an object is placed however, you can drag other models from the styles pallet over the existing objects to replace them, for example trying out different types of trees. I have also found it easier to use copy paste of objects then modify the object to what I want.

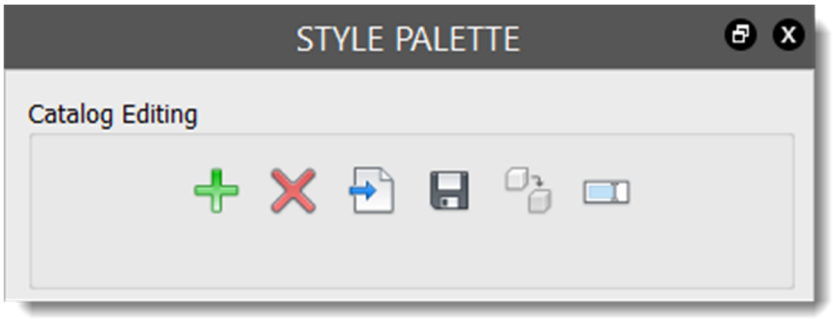
To manage styles and style catalogs

Style catalogs are collections of styles by feature class. You can add, delete, copy, or rename individual styles or entire style catalogs. You can also import or export style catalogs in a .STYLES.JSON format.

- Options for managing entire style catalogs are at the top of the Style Palette.
- Options for managing individual styles are at the bottom of the Style Palette.

Click  to display the Style Palette.

Manage Style Catalogs



Icon	Objective	Description
	Add New Style Catalog	Add a new style catalog to the Style Palette for the desired feature class.
	Delete Selected Style Catalog	Note: To restore a deleted catalog, import it.

Icon	Objective	Description
	Import Style Catalog From File	Import style catalogs in .STYLES.JSON format. If the file you specify is not compatible with the style category, it cannot be added.
	Save Selected Style Catalog	Specify a location to export the selected style catalog in a .STYLES.JSON format.
	Copy Selected Style Catalog	All styles from the original catalog are copied into the new catalog.
	Rename Selected Style Catalog	Enter a new name for the selected style catalog.

Manage Styles

Icon	Objective	Description
	Add New Style	Add a new style to the current style catalog and choose its properties. You can also add a 3D model style or a material style to a style catalog.
	Delete Selected Style	Delete a selected style from the current style catalog.
	Copy Selected Style To Another Catalog	Copy a style from one catalog to another. You can only copy styles into catalogs for the same feature class.

Icon	Objective	Description
	Copy Selected Style to Current Catalog	Duplicate the selected style in the current catalog, for example, to create a new style based on an existing one.
	Rename Selected Style	Enter a new name for the selected style.
	Edit Selected Style	Open the Style Editor and edit the properties of the selected style. See About Editing Styles.

Advanced tips

Click  to adjust the size of the previews in a style catalog. Move the slider to make the preview images larger or smaller. Your changes affect only the current tab.

To import a 3D model into a style catalog

You can import a 3D model object into a style catalog as a new style.

For example, import a 3D model of a house and use it to replace the style for a house object. Import a model of a tree or shrub and use it to style or create trees and shrubs in the model.

Note: You can also import a parametric model into a style catalog as a new parametric model style for bridge design or road decoration. See: To import parametric decorations.

1. Click  .
2. Click the 3D Model tab on the left side of the Style Palette.
3. From the style catalog list, open the catalog for the new style.

If necessary, open a sub-folder for the style.

4. In the Style Editing area (at the bottom of the palette), click  (Add a New Style to the Current Catalog Above).
5. Click the Browse button for the Model URI, navigate to the model file, and open it. You must specify a file of the type FBX, 3DS, OBJ, DAE, or DXF.

Click and drag in the preview to rotate the model image. Enlarge the dialog box to see a larger preview. You can also display the bounding box for the image or display the preview on a grid. When you display a grid, you can control the grid spacing. To return to the original preview orientation, click Reset Preview.

6. Indicate the model's anchor point, if necessary.

7. Use the Render Detail settings to control how models of different sizes and levels of complexity are represented in the model.

- Render Detail — Use these settings to control how models of different sizes and levels of complexity are represented in the model.
  - Simplify Model reduces the number of triangles that define the shape of the model, which reduces detail.
  - Model Handling specifies how the model will be rendered. Try the Auto-adjust setting first and make further adjustments only if necessary.
- Model Repair — Use these settings if the model does not appear as expected.

For details on the Model Handling and Model Repair settings, see the Advanced Tips section below.

8. Specify translation, rotation, and scaling values for each axis of the model.

Translation moves the model along the specified axis. To change the value for the Translation, enter a positive or negative number for the X, Y, or Z axes. For example, to move the model to the right, enter a positive value for X.

Rotation changes the angle of the model. To change the value for Rotation, enter values in degrees for the X, Y, or Z axes. For example, to turn the model perpendicular to its original position on the ground, enter 90 in the Z field.

To resize the model, enter multiplying values for Scaling for the X, Y, or Z axes. For example, to make the model twice as tall, enter 2 in the Z field.

9. When you are finished, click OK in the Style Editor.

The style thumbnail appears in the catalog. Click in the name area to rename it.

Advanced Tips

If you need to adjust the model handling, use these guidelines:

Auto-adjust	InfraWorks determines the settings for the 3D model.	If the automatic setting applies LOD, you can change the LOD Distance setting by selecting LOD explicitly and then adjusting the LOD Distance.
Direct Display	InfraWorks applies your settings for Simplify Model and the options under Repair Model but does not adjust how the model is rendered.	Use this setting if the model uses a small number of triangles to define its shape, for example, a house with little detail.
Use LOD	InfraWorks uses LOD (Level of Detail) to generate a series of simplifications,	Use this setting if the model has a great deal

	assigning the best one based on viewing distance. If you select this option, specify the LOD Distance.	of detail with many triangles defining its shape, for example, a detailed city furniture model. LOD reduces the complexity of a 3D model as it moves away from the camera. The number of triangles defining the model are reduced to one quarter their previous value at each transition distance. (The transition levels are determined by the application.) The LOD Distance setting represents the first transition distance. At distances smaller than this, the model appears with full detail. Note: If you reduced the value for Simplify Model, the level of detail starts with the reduced value.
Tile	The surface of a model is tiled to display graphics smoothly and efficiently. When a single object spans multiple	Use this setting if the model has a large bounding box, and if

	tiles, its display can be erratic. If the object is on the periphery of the visible area of the model, it may not appear at all, or it may suddenly appear when the viewer pans closer to it. The Tile setting avoids these issues by permanently attaching the 3D model to multiple tiles. It does not affect your ability to view or manipulate the model.	much of the bounding box is empty. For example, a model of a bridge might span several kilometers, and the bounding box would contain a lot of empty space. The model will be imported in such a way that it can span multiple tiles in the model effectively.

Use the Repair Model settings to adjust the model when it does not appear as expected.

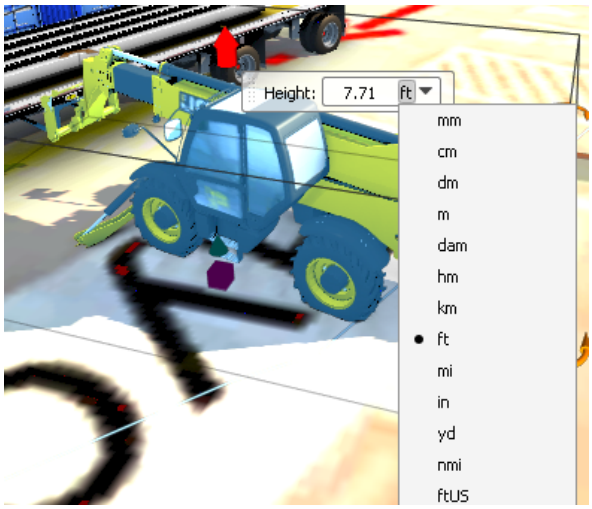
- Invert Orientation — Inverts the direction of the *face normals* that make up each surface of the model.
- Invert Transparency — Makes the transparent areas of the model solid and the solid areas transparent.
- Invert Up Axis — Flips the model upside-down.
- Flip Y and Z — Controls whether the 'up' axis runs along the Y or Z axis. Some applications use the Y axis as the 'up' direction while others use the Z axis.

Importing large 3D models (100 megabytes or larger, approximately) can affect performance. Models over a gigabyte in size cause the import operation to fail. If you have large 3D models, simplify them in their source applications (for example, in Autodesk Revit or 3ds Max) before importing them.

Move objects

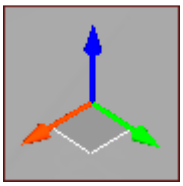
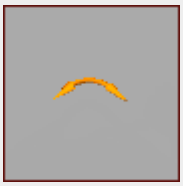
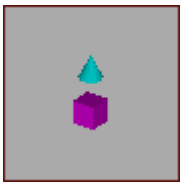
There are four types of transform gizmos in InfraWorks to move objects along the X, Y, and Z axis, as well as to rotate objects, adjust height, and adjust elevation.

Transform gizmos let you quickly adjust a feature, or selection set of features with the mouse or by entering a value.

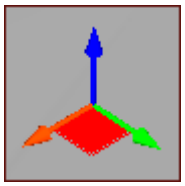
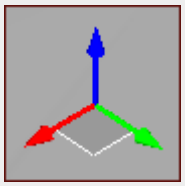
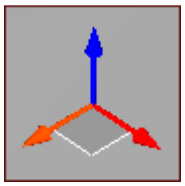
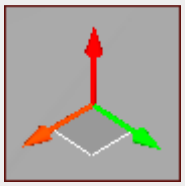


You can change the unit of measure for the selected object. You can move the value box by dragging it to a different location.

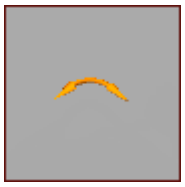
There are four transform gizmos:

Gizmo	Visual
Move	
Rotate	
Height/Elevation	 

Move Gizmo

Handle	Purpose	Visual
XY Plane	Relocate a feature somewhere on the XY plane.	
X Axis	Constrain the relocation of a feature along the X axis.	
Y Axis	Constrain the relocation of a feature along the Y axis.	
Z Axis	Constrain the relocation of a feature along the Z axis.	

Rotate Gizmo

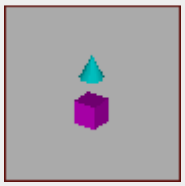
Handle	Purpose	Visual
Rotation	Rotate a feature around the Z axis.	

Height/Elevation Gizmos

The height gizmo adjusts the height of one or more selected features. The elevation gizmo adjusts the elevation of control points.

The height gizmo is available for buildings, city furniture, and trees only. For trees and city furniture, the height gizmo proportionally scales the selected features. For building features, the height gizmo changes the height of the building, but the footprint remains the same.

The elevation gizmo is available for roads, railways, and coverages. The elevation gizmo is always associated with a control point. The handle of the elevation gizmo is the blue cone above the magenta control point.

Handle	Purpose	Visual
Height	Alter the height of building features, or the scale of trees and city furniture.	
Elevation	Adjust the elevation of a control point for a selected road, railway, or coverage.	

You can move one or more objects along the XY plane or a specific axis.

To move objects on the XY plane

1. Select one or more objects to move.
2. Place your cursor on the XY Plane handle of the Move gizmo.
3. Click and drag the cursor to a new location anywhere on the XY plane.
4. Release the mouse button.

To move objects along a specific axis

1. Select one or more objects to move.
2. Place your cursor on the X, Y, or Z Axis handle of the Move gizmo.
3. Click and drag the cursor to a new location along the selected axis.
4. Release the mouse button.

To add or modify city furniture

Add 3D model objects such as kiosks, newspaper stands, people, vehicles, or signage as City Furniture, to provide more context and scale in your model. City Furniture is a Furniture layer in the Model Explorer. Information about City Furniture appears on the Properties Palette. The number of city furniture items you add or remove appear in the City Furniture section of the Proposals Manager.

To add city furniture

1. Click  .

2. Select a 3D model draw style and click OK.

Note:

- If you want to use different 3D model styles than what are shown in the Select Draw Style catalog, you can create and edit new 3D model styles using the Style Palette. See About editing styles for more information.

- You can also import a 3D model object into a style catalog.

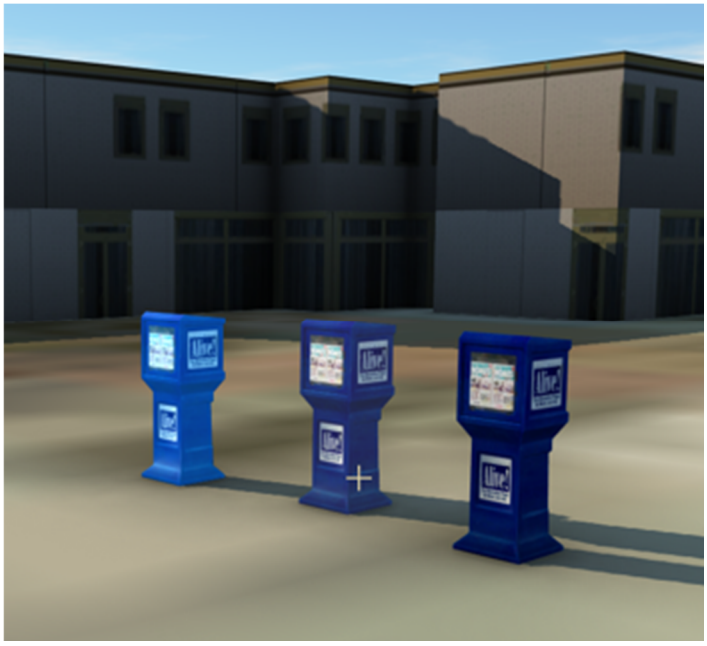
You can add city furniture as a single piece of furniture at a point, or as a series of furniture items spaced along a linear path that you define.

Single furniture

Double-click at a point on the terrain to add a single city furniture model object.

Series of furniture

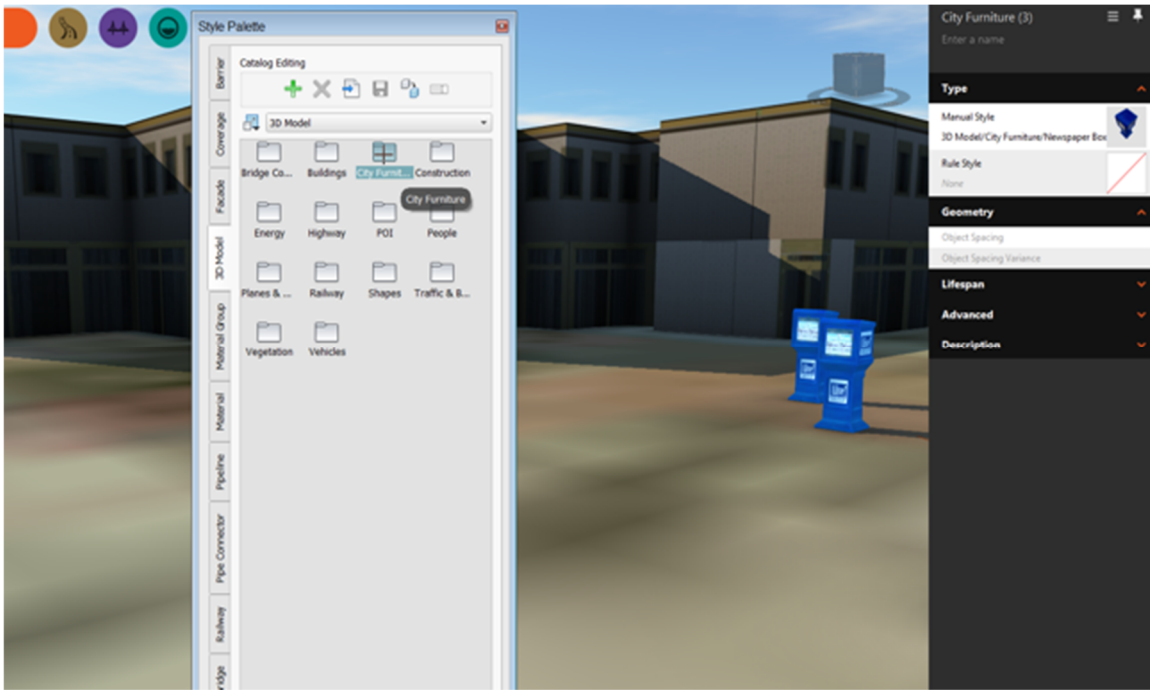
Single-click individual points to create a path for the city furniture. Double-click the last point to end the path.



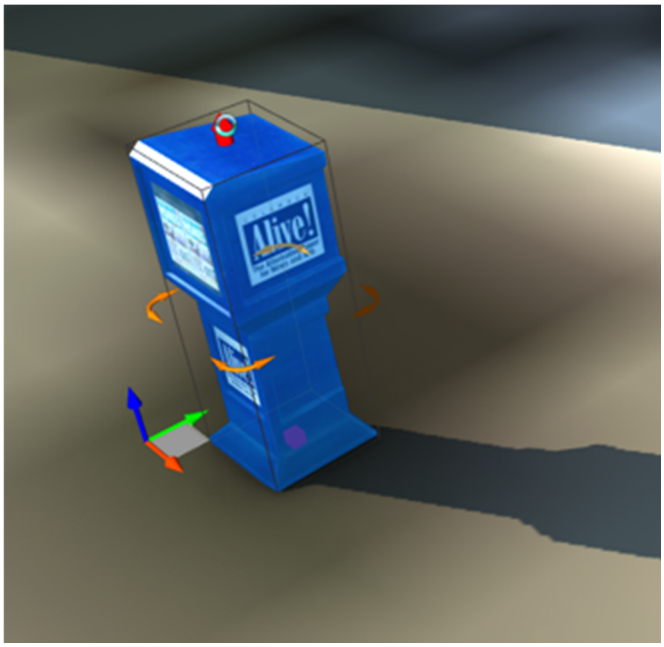
Modify city furniture style

Once you sketch city furniture, you can change its 3D model object style.

1. With the feature selected, click the thumbnail for the Manual Style on the Type panel in the Stack, and choose a different 3D model style from the palette. See To apply styles to individual features.



2. Use the elevation gizmo to adjust the height or orientation of the city furniture.



To add barriers

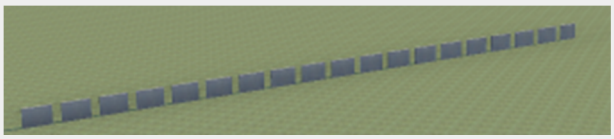
1. Click    .

2. Select a barrier or 3D model style. You can select any type of model, including items like street lights, cars, or safety cones. These items are treated as "barrier" features in the database.

Note:

- If you want to use different barrier styles than what are shown in the Select Draw Style catalog, you can create and edit new barrier styles using the Style Palette. About editing styles for more information.
- Once you have sketched a barrier, you can modify its style. See To apply styles to individual features for more information.

3. Do one of the following to sketch your barrier:

Action	Result	Visual
Double-click a point.	A single barrier object is placed at that point.	
Draw a line for the barriers. Single-click to draw each point of the line.	Barriers appear along the line you drew.	

4. Use the gizmos to adjust the height, angle, and rotation of the barriers.

Barriers are a Structure layer in the Model Explorer, and information about them appears on the Properties Palette. The number of barriers you added appears in the Barriers section of the Proposals Manager.

To add or modify coverage areas or create a hole in terrain

Sketch coverages in a model or proposal. Coverages are draped to the surface of the terrain, and can also be used to shape terrain, create terrain holes, specify avoidance areas, and create surface modifications. You can also add or modify coverage areas to resemble parks, empty lots, parking areas, etc.

Use the Terrain Hole coverage style to render part of a terrain area as a hole. This style is useful for cutting rectangular openings with a clean edge in a surface. For example, if you are modeling a rail line, the Terrain Hole can show the station entrances under the ground.

Note: You can also add or modify land areas in a model or proposal. Land areas automatically flatten the terrain surface, and use grading styles to specify desired cut, fill and material properties.

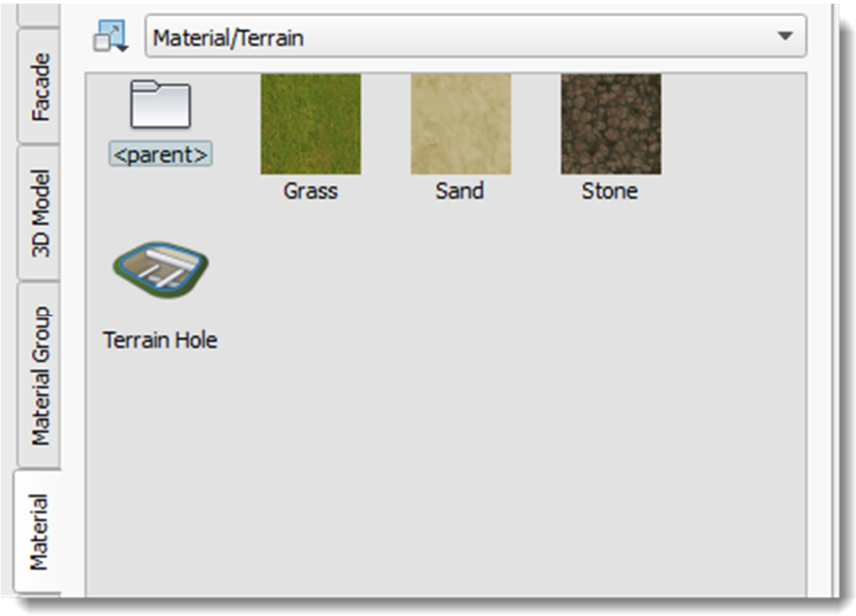
To add a coverage area or terrain hole

1. Click  .

2. Click on a coverage style to select that style for your coverage. Select a Terrain Hole coverage style if a terrain hole is desired.

Note:

- There are three multi-scale terrain textures available as material styles in the Materials/Terrain style catalog.

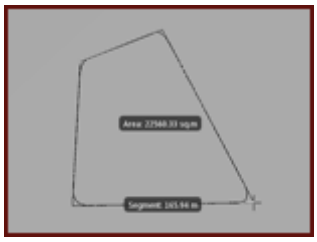


- If you want to use different styles than what are shown in the Select Draw Style catalog, you can create and edit coverage styles using the Style Palette. See About editing styles for more information.

- Once you have sketched a coverage, you can modify its style. See To apply styles to individual features for more information.

3. Sketch the coverage area in the model or proposal.

Note: To flatten a coverage area, see To shape terrain.

Action	Result	Visual
Click the starting point for the coverage area and click each corner. Double-click to finish the area.	The boundary is filled by the coverage style you selected.	

Coverage areas are a Surface layer in the Model Explorer, and information about them appears on the Properties Palette. The number of coverage areas, as well as information (such as area) appears in the Coverages section of the Proposals Manager.

Advanced Tips

Assigning the Transparent color material to a coverage renders that coverage feature with a transparent material. If there are other coverage features (with non-transparent materials assigned to them) that cover the same area, the transparent coverage reveals those materials.

Assign a multi-scale terrain texture (Grass, Sand, or Stone in the Materials/Terrain catalog) to a coverage area style for optimal visual results.

To add or modify land areas (preview)

Similar to coverage areas, land areas are used to identify areas for development. When you sketch a land areas in a model or proposal it will flatten the terrain surface where it is drawn. Land areas can also be used to add grading styles to a specified area. Grading styles allow you to specify cut slope, cut material, fill slope, and fill material values.

To sketch a land area

1. Click  .

2. Click on a land area style in the Select Draw Style catalog that displays.

Note:

- If you want to use different land area styles than what are shown in the Select Draw Style catalog, you can create and edit land area styles using the Style Palette. See About editing styles for more information.

- Once you have sketched a land area, you can modify its style. Land area styles are located in the Material style tab in the Land Cover style catalog, and land area grading styles are located in the Grading tab See To apply styles to individual features for more information.

3. Sketch the land area in the model or proposal.

Note: Land areas flatten the terrain surface when they are sketched.

4.

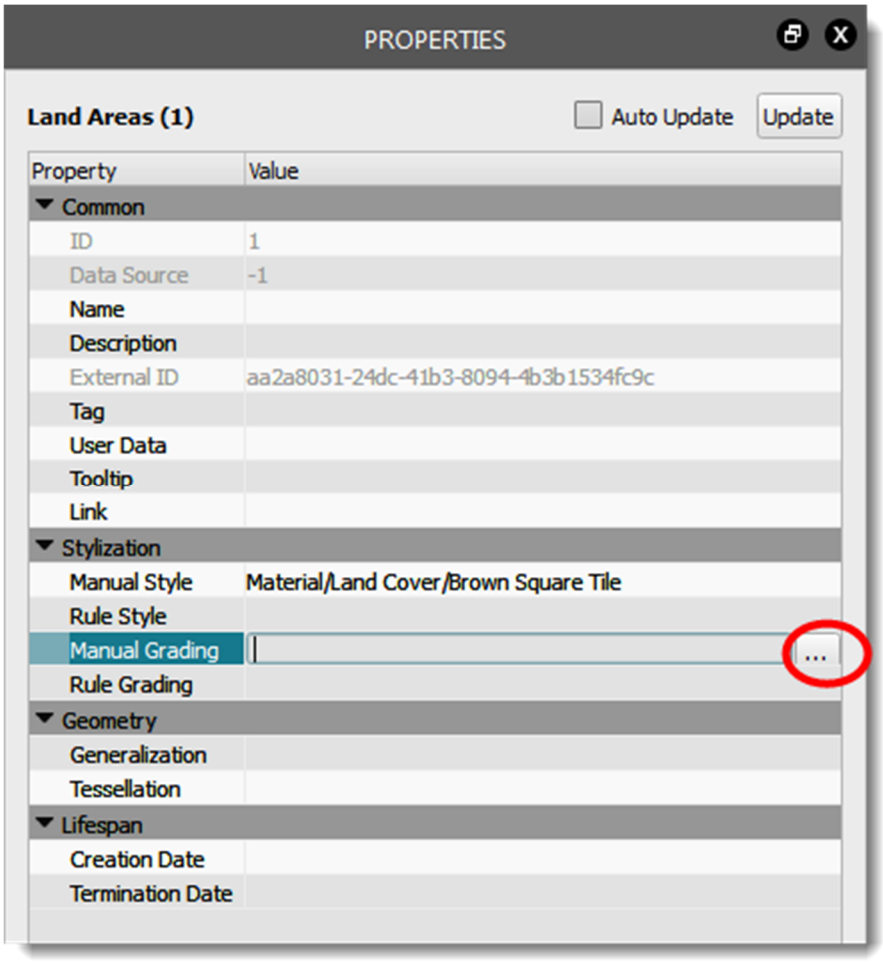
Action	Result	Visual
Click the starting point for the land area and click again for each corner. Double-click to finish the area.	The boundary is filled by the land area style you selected.	

To add or modify a grading in a land area

1. Select the desired land area and right-click.

2. Click on Properties.

3. Click the Manual Grading field in the Properties Palette, and click the browse button.



4. Select a grading style from the dialog that displays, and press OK.

5. Click update in the Properties Palette.

Alternatively, you can also apply a style to a Land Area by dragging the style from the Style Palette and dropping it onto the desired land area.

Additional info

Land areas are a Surface layer in the Model Explorer, and information about them appears on the Properties Palette. The number of land areas, as well as information (such as area) appears in the Land Areas section of the Proposals Manager.

To add or modify trees or vegetation

Add an individual tree, stands of trees, or rows of trees in a model or proposal. Any type of 3D model object , such as street lights, cars, vegetation, or safety cones can be added instead of trees.

Trees are a Vegetation layer in the Model Explorer, and information about them appears on the Properties Palette. The number of 3D model objects that you add, and the area they occupy, appear in the Trees section of the Proposals Manager.

To add trees

1. Click  .
2. Do either:

- Click  to add a stand of trees.
- Click  to add a row of trees.
- Click a 3D model object style in the catalog that displays to select it.

Note: Adaptive tree styles are located in 3D Model > Vegetation > Adaptive Trees. With these styles, the geometry automatically adapts to the camera distance, improving model visualization and performance at different levels of detail.

Your initial selection becomes the default for adding trees until you change it again.

To add a single tree

Double-click a point. A single tree is placed at that point.

To add a stand of trees

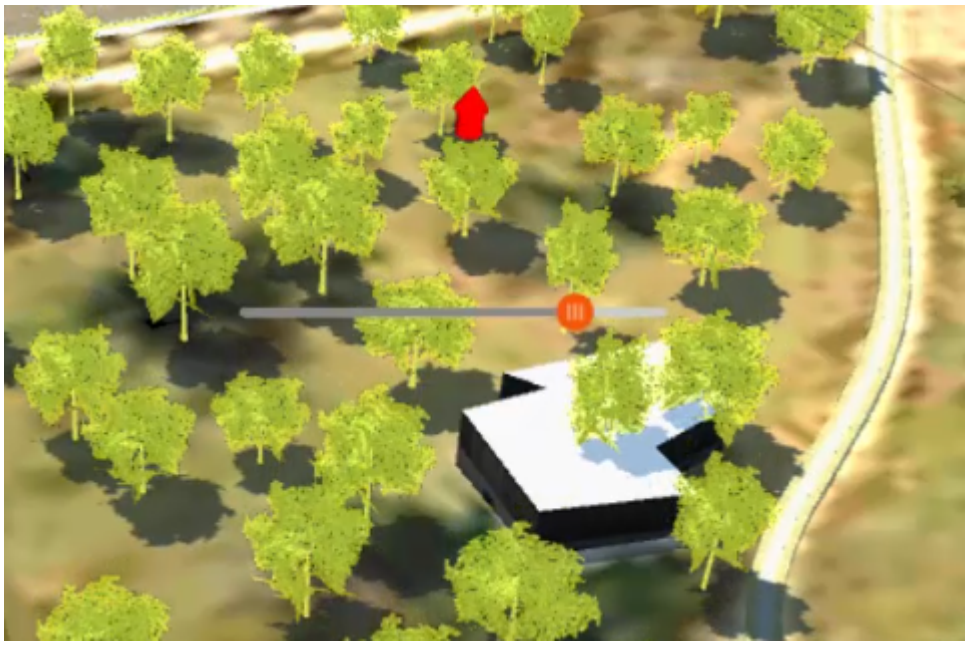
A stand of trees is a group of trees that resemble a grove or forest.

1. Click  .

2. Select a draw style.

3. Draw a polygonal area for the stand of trees. Single-click to place individual points. Double-click to finish. A group of tree is randomly placed inside the region.

4. Use the density slider to adjust the number of trees in the stand.



You can double-click a tree within a stand to re-display the density slider. It is important to modify the density before adjusting other features, such as height, so that you don't lose your edits.

Note: You can also increase the number of trees in the stands-of-trees in the model by moving the Display Detail slider toward High on the 3D Graphics tab of the Application Options dialog. Keep in mind that increasing the number of trees either with the density slider or the display detail option may affect performance.

To add a row of trees

A row of trees places the 3D model objects that you choose along a linear path that you define.

- Click  .
- Single-click to place individual points. Double-click to finish.

To modify trees

1. Double-click a tree in the stand or row to select all of the trees within the boundary.

2. Use the Density slider to adjust the number of trees in the stand or row.

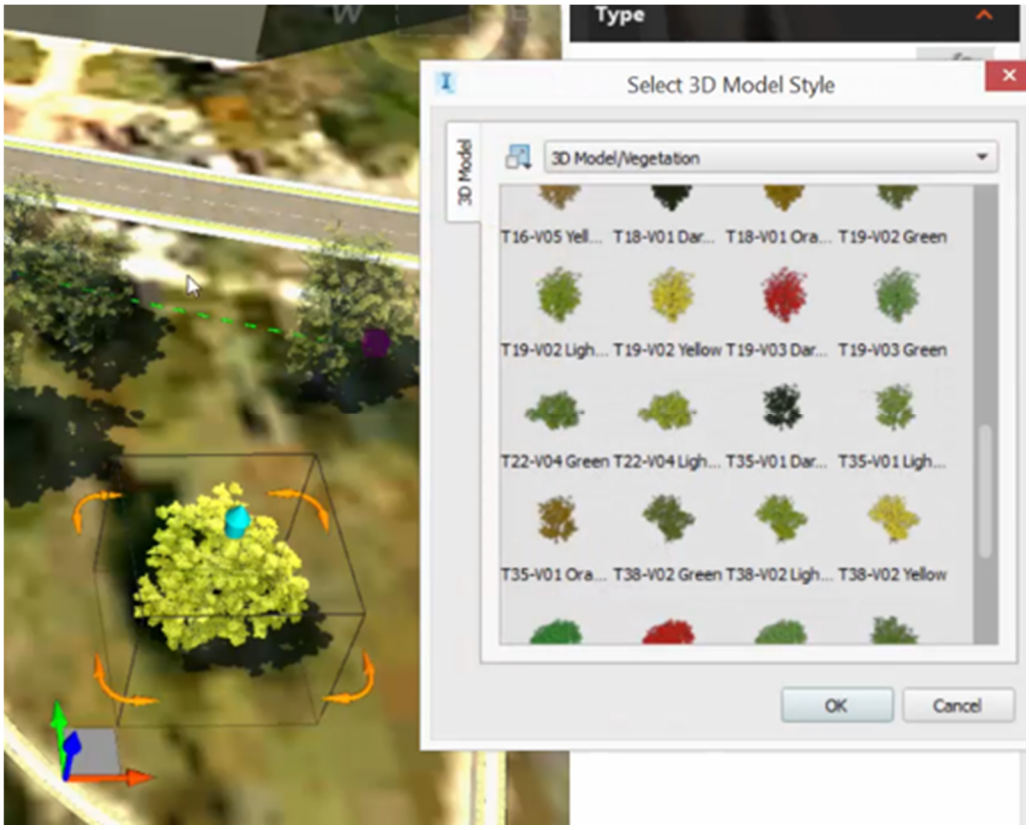
3. Use the elevation gizmo to adjust the height of the plants.

4. Once you add a tree, or a row of trees, you can move individual trees or groups of trees to different locations and scale them as needed.

Note:

- If you want to use different tree or vegetation styles than what are shown in the Select Draw Style catalog, you can add or modify tree vegetation styles using the Style Palette. See About editing styles for more information.

- Drag a style from the 3D model tab of the Style Palette and drop it on to an existing tree to modify its style. See To apply styles to individual features for more information.



Learning Objective 4 - Produce presentation material such as storyboards, images and VR models

About Presentations

For Site logistics, we use the proposals tab to show different phases of the project. Existing conditions, Excavation, Foundations, Structure etc. The master proposal should act as your existing conditions model that you can use as a starting point. From there you make additional proposals to

create snapshots in time of the project. Bookmarks can be used to save camera views. They are not proposal specific. Therefore, you can see the same camera view from different phases or proposals.

Autodesk InfraWorks provides tools to create simple or sophisticated presentations. You can share your presentations with collaborators by uploading your Autodesk InfraWorks models to a BIM 360 project.

For simple presentations, you can take snapshots with the snapshot tool. For more sophisticated presentations, you can create and direct sophisticated full motion animations.

Note: When an Autodesk InfraWorks model is uploaded to BIM 360, you can view your model in your web browser with the Viewer. However, storyboards are not supported in the Viewer.

Storyboards	Create and direct sophisticated motion-presentations. A storyboard can feature full-motion-animations with titles and captions. As a storyboard director, take viewers on a tour of key parts of a model or proposal. You can manually define keyframe locations for your storyboard, or even associate a camera path animation with a road to automatically generate keyframes along the road alignment. See About Storyboards.
Snapshots	Take a still picture of your current view of a model. Optionally, you can save the view as a high-definition quality image. See To create a snapshot.

About Storyboards

A storyboard is a dynamic presentation of key parts of a model that guides viewers on a prepared tour of specified features.

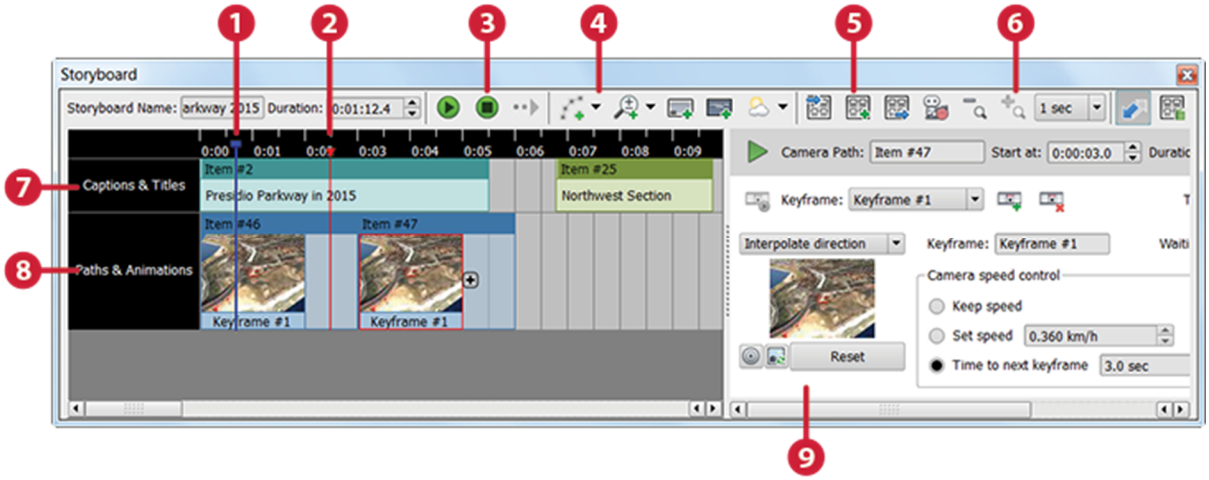
A storyboard can be a series of snapshot views or a dynamic, video pathway through parts of a model. It can display titles and captions and use a variety of camera angles to create sophisticated visual effects.

- Use Storyboard Creator to create and edit the visual sequence.

To access Storyboard Creator:

1. Open the model.
2. Click  .

Storyboard Creator opens in the bottom portion of the model window. You can adjust the size and position of the panel window.



1. Play head indicator (the blue line) sets the starting point for playback.
2. Marker (red arrow) indicates the insertion point for new elements.
3. Playback controls play the entire storyboard, starting from the play head indicator (blue line). Individual elements have their own playback controls.
4. Storyboard tool bar contains controls to create elements and manage storyboards.
5. Import and export storyboards.

6. Zoom in and out of the storyboard, and specify the zoom resolution. You can also zoom the storyboard extents.

7. Captions and tiles appear in the top track.

8. Camera paths and animations appear in the bottom track.

9. Settings for the selected item appear to the right.

For details, see To create a storyboard.

See also the video tutorials on how to create a storyboard.

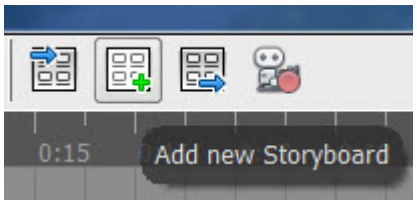
To create a storyboard

Create a new storyboard, give it a name, and specify a duration. Optionally, add titles, captions, camera paths, or animations. Any points of interest or watermarks and you defined in your model will be included in the storyboard unless you hide them.

Open the model.

Click ➤ .

Click Add New Storyboard.



Storyboard Name panel suggests a new storyboard name. Accept or supply a name of your choice.

Storyboard Name side panel lists all storyboards created from this model.

Specify a duration for the storyboard in the Duration field.

By default, duration is set at zero and increases as you add items. If you make the duration longer than the sum of the storyboard contents, blank space will appear at the end of the storyboard.

Add any of the following; see help topics for each:

Titles

Captions

Camera_Path

Animations

Note: To delete an item from within storyboard, select the item in the storyboard and press Delete.

About Virtual Reality

We use virtual reality because of the sense of presence you get when you are inside. Looking at a model is one thing, being able to stand in the site and see the layout of the jobsite fence or the truck entrance is another. Our use of VR has mostly been viewing of composite Navisworks models, but we have started to use it to review site logistic as well. We use a program called Fuzor by Kalloc Studios. They are here at AU if you want to learn more. For us it has been the perfect tool. To get models into Fuzor requires a simple FBX export.

Conclusion

Using Infraworks has fundamentally changed how we approach site logistics. Using it in conjunction with other tools out there allows us to develop workflows that utilize the various strengths of each software. Model builder creates a blank canvas on to which we can create our site logistics. The future holds untold possibilities that will continue to adjust the status quo.

Additional Resources

BBC Florida Case Study

http://view.ceros.com/balfour-beatty/tech-landing-page-1/p/1

Similar Class Outline from 2016

http://aucache.autodesk.com/au2016/sessionsFiles/18357/12187/handout_18357_CS18357-Site%20Logistics%20Plans%20of%20the%20Future%20-%20Theyre%20Just%20InfraWorks.pdf

Terrain Overlays by Jerry Bartels

https://www.youtube.com/watch?v=nKXfhBp5Wrw

Importing High Resolution Aerial Imagery from ReCap Photo into InfraWorks

https://www.youtube.com/watch?v=anStzJoUlZE

How to import 2D Line-Work as Coverage Areas

https://knowledge.autodesk.com/support/infraworks/learn-explore/caas/sfdcarticles/sfdcarticles/Infraworks-How-to-import-2D-Line-Work-as-Coverage-Areas.html

How to Integrate infraworks to Fuzor

https://www.youtube.com/watch?v=60F2RMchtZU

Eric Chappel

https://autodesk.typepad.com/bimagination/2015/07/infraworks-360-advanced-custom-profiles-for-ski-lifts-power-lines-gondolas-cable-cars.html