CI500006

Create a 3D Model of your City for Free

Gordon Luckett
Arrow Geomatics Inc.

Learning Objectives

- Learn how to create an InfraWorks project
- Learn about downloading free data
- Learn how to prepare data for presentation
- Learn how to share the 3D model with others

Description

Imagine building a complex model of your own city without having to go out and survey or buy data? This class will examine all the free sources of geographic information system (GIS) and BIM (Building Information Modeling) data available for download, and explore how it can be used in InfraWorks software to make a compelling 3D model of a city.

Speaker(s)

Gordon is president of Arrow Geomatics Inc., a GIS consulting, training, and development company. Oracle Spatial and Microsoft SQL Server Spatial are part of Gordon's specialities, especially when they are combined with Autodesk, ESRI and Open Source GIS products.

What is InfraWorks?

Infraworks combines all your 2D and 3D spatial data into one location and into a model. Each model can be as small as a single building, or as large as a whole city.

What can it do?

With InfraWorks you can **import** existing data such as AutoCAD, Revit, LIDAR and GIS data to create your model. Typically the spatial data is in "real-world" coordinates so the features can be drawn in the correct location in the world. For example, when importing a DWG with the Curbs, the coordinate system may be in State Plane or Universal Transverse Mercator (UTM), so that InfraWorks can draw the curbs in the correct location.

Alternatively, you can **create** features from scratch within InfraWorks.

Available Features to Create or Import:

Transportation:
- Component Road (Engineering)
- Planning Road (simple GIS)
- Barriers
- Railway
- Right of Way

Structures:
- Bridge
- Tunnel
- Building
- Generic Object

Drainage:
- Culvert
- Pipeline
- Pipeline Connector
- Drainage Network

Environment:
- City Furniture
- Linear Decoration
- Points of Interest
- Coverage
- Grading Area
- River
- Water Area
- Row of Trees
- Stand of Trees
- Parcel
- Easement

Once there is data in your model, there are many ways to **analyse** the data.

Transportation:

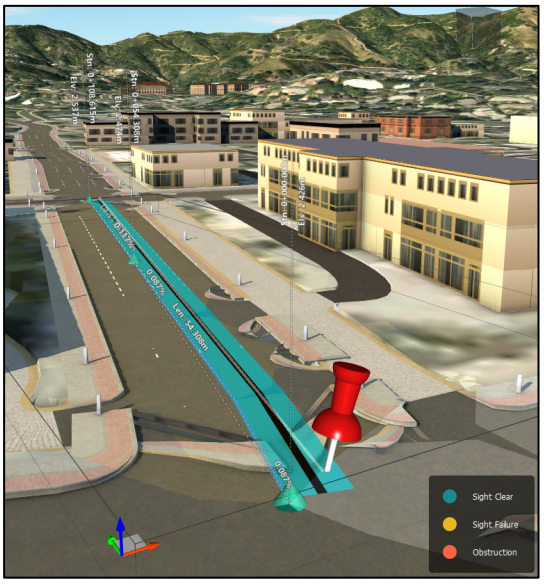
- Profile Optimization
- Corridor Optimization
- Traffic Simulation
- Sight Distance
- Mobility Simulation

Structures:

- Line Girder Analysis
- Refined Analysis
- Quantities

Drainage:

- Watershed
- Size drainage network
- Inspect Performance
- Rainfall Content



Example Site Distance Analysis on Road

Finally, InfraWorks can **Present** or **Share** the model once completed. Using the Present tools, videos of the 'fly through' of your model can be created and saved as AVI files or a single image in TIF, JPEG or PNG formats.

Using the Share tools, the model can be exported to an FBX model, an ESRI File Geodatabase (FGDB) or directly to ArcGIS Enterprise or ArcGIS Online.

Using GIS Data

GIS files can be downloaded from many sites and are often easily distributed. These formats are great if you need to email or store them on the cloud.

The main GIS file formats you can use include:

- DWG (AutoCAD 2D, 3D, Civil)
- DGN (Microstation files)
- IMX (Import/Export for InfraWorks)
- RVT (Revit Models)
- IFC (Industry Foundation Classes)
- CityGML (Geographic Markup Language)
- LandXML (Civil XML format)
- Point Cloud (LAS, LAZ, RCP, RCS)
- SDF/SHP/SQL Lite
- Sketchup

Enterprise GIS data is usually stored in large databases. Those databases include:

- MySQL Database
- SQL Server Database
- PostgreSQL Database
- Oracle Database

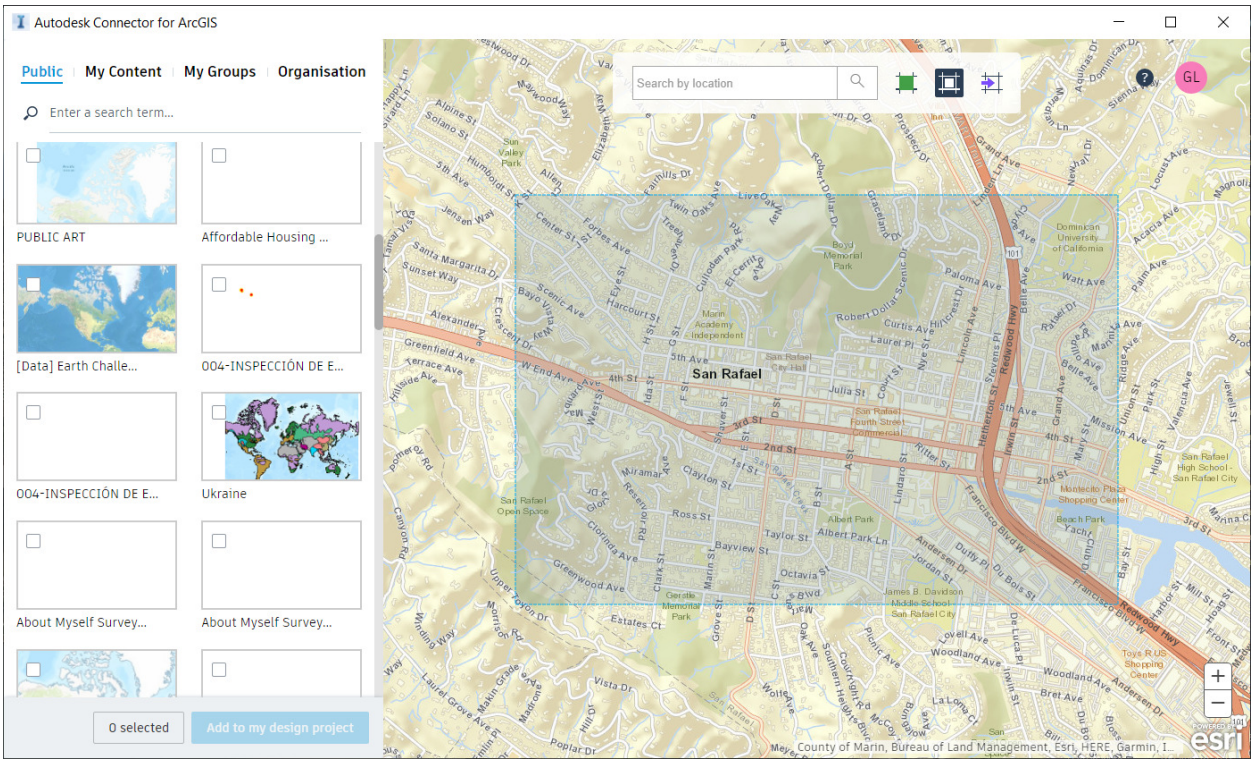
Web Feature Service (WFS) is an open data format that streams vector data directly from a URL. InfraWorks supports this format for all of its types.

For background maps including satellite images, BING Maps are available free of charge within InfraWorks, but only as a Raster background and no vector data is available.

BING IMAGE IN INFRAWORKS

The Generic connector to InfraWorks is the OGR connection. OGR is the OpenGIS Simple Features Reference Implementation and is part of the GDAL library. https://gdal.org/
This is a way of connecting to data using the open GIS protocols and enables most standard GIS vector datatypes including Shapefiles and GPX. https://gdal.org/drivers/vector/index.html

One of the newest connectors to GIS data is the ArcGIS data source. Using this connection, you can connect to **ArcGIS** Enterprise (Portal) or ArcGIS online (arcgis.com).

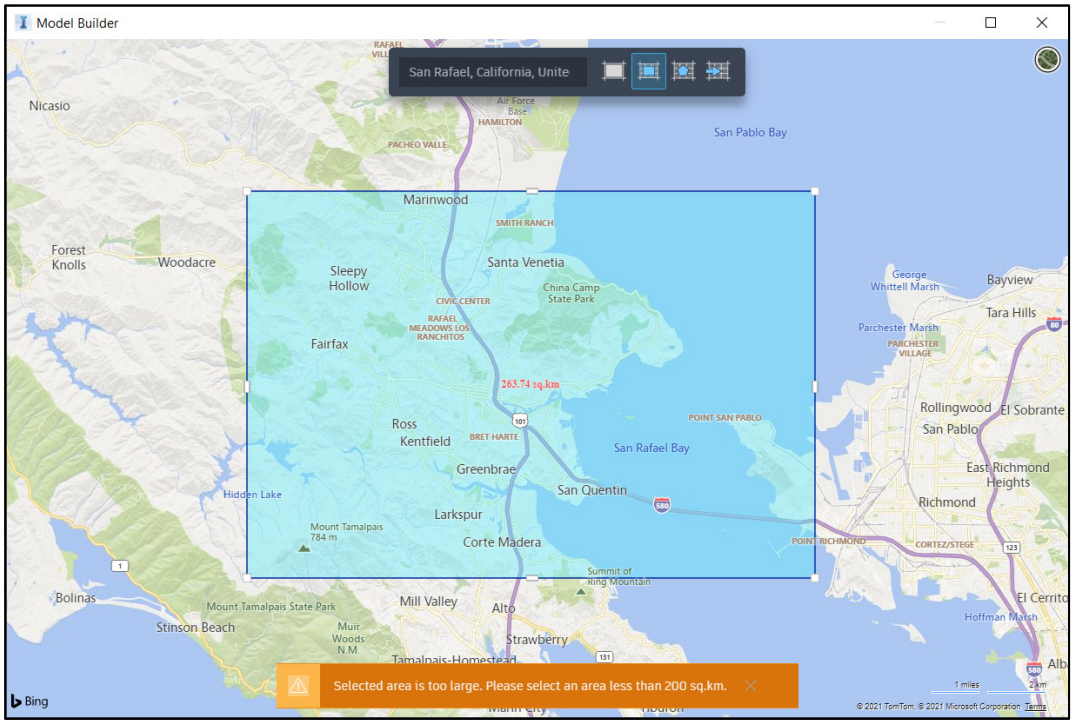


ARCGIS DATA CONNECTOR FOR INFRAWORKS

If you have data stored in ArcGIS Online or your organizations' enterprise server, you can use the vector data to generate models within InfraWorks.

Free Data with Model Builder

The InfraWorks Model Builder is the fastest way to create a model. As long as the area of interest is less than 200 sq km, you can create a 3D model using the Model Builder.



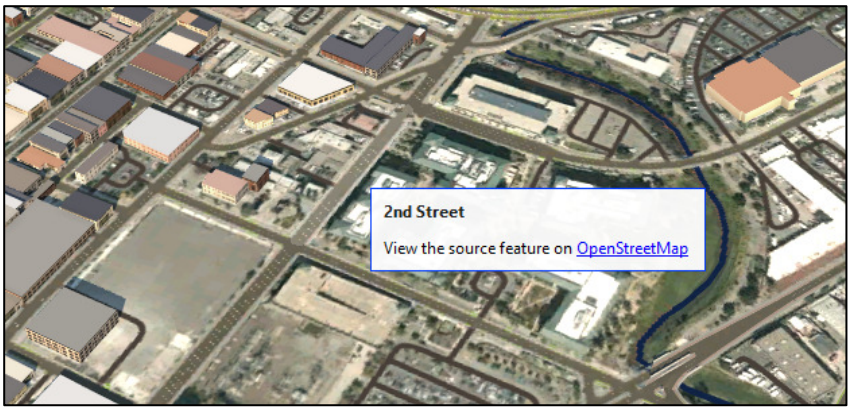
MODEL BUILDER AREA GREATER THAN 200 SQ KM

Four ways to define area:
1. Current Map Extent
2. Draw Rectangle
3. Draw Polygon
4. Use Shapefile (*.shp) and associated Projection file (*.prj)

Coordinate System can be any localized one but recommended to use EPSG:3857 aka WGS84.PseudoMercator which is used in Google maps, ESRI Basemaps and OpenStreetMaps.

Model Builder downloads and creates the following data:
- Buildings (shapefile)
- Landuse (shapefile)
- Satellite Images (BING)
- Railways (shapefile)
- Road (shapefile)
- Terrain (GeoTIFF)
- Water Areas (shapefile)

Most of the vector data is downloaded from OpenStreetMap.



OPENSTREETMAP VECTORS IN INFRAWORKS

Downloading Free Geospatial Data

Usually, the local government body such as county or city GIS site offers most of the data for download. For example, Marin County has an Open Data Portal at: https://gisopendata.marincounty.org/

From Marin County, buildings, city limits, roads and water bodies can be downloaded:
https://gisopendata.marincounty.org/datasets/MarinCounty::building-footprint/
https://gisopendata.marincounty.org/datasets/MarinCounty::marin-county-boundary-2/
https://gisopendata.marincounty.org/datasets/MarinCounty::road/
https://gisopendata.marincounty.org/datasets/MarinCounty::nhd-waterbody

For the terrain or Digital Elevation Model (DEM) elevations, Stanford University has an open portal for 30m resolution:
https://earthworks.stanford.edu/catalog/stanford-nh236hj3673

Alternatively, you could download from the US Geological Survey (USGS):
https://apps.nationalmap.gov/downloader/#/

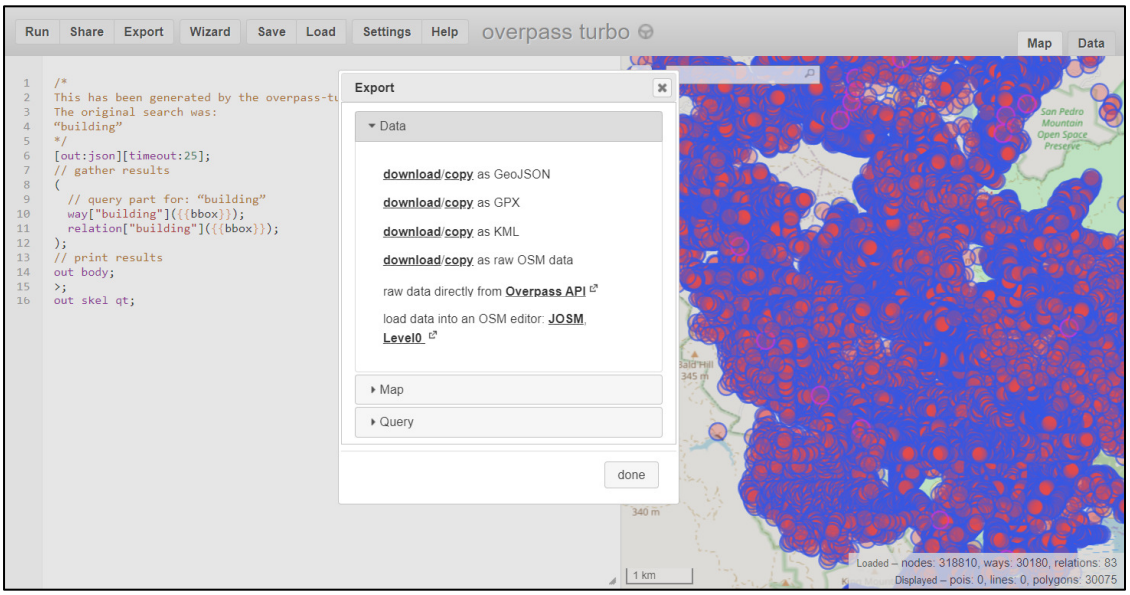
Also, check out GIS Geography's list of Free Global DEM Data Sources here:
https://gisgeography.com/free-global-dem-data-sources/

OpenStreetMap Vector Data Download

A free API wizard to download vector data from OpenStreetMap can be found here:
https://overpass-turbo.eu/

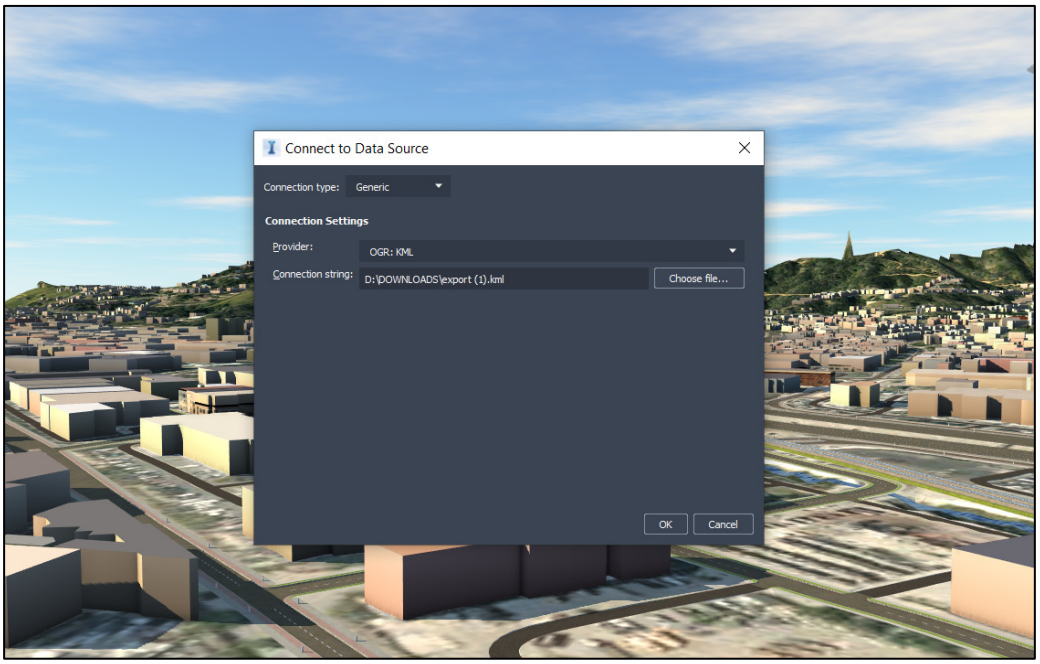
Searching for a topic such as 'building' using the wizard, you can retrieve all the associated data that is available.

Once you have performed the query, the Export button enables formats such as GeoJSON, GPX or KML formats.



EXPORT BUILDINGS TO KML FROM OPENSTREETMAP

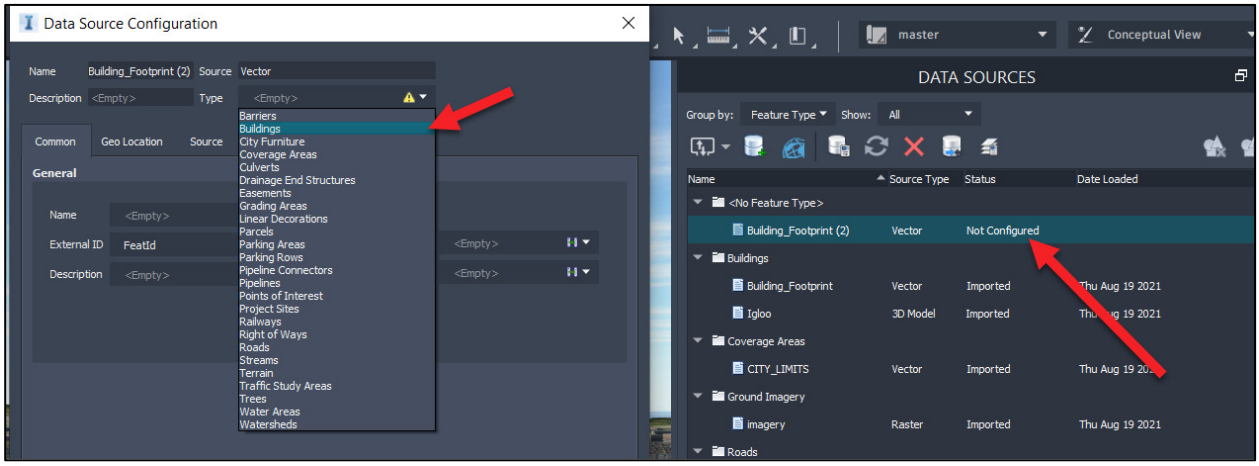
Since InfraWorks can import KML using the OGR Generic tool, you can import the Buildings directly from KML that was exported from the overpass-turbo.eu site.



IMPORT BUILDINGS KML INTO INFRAWORKS WITH GENERIC CONNECTION

Configure Data in InfraWorks

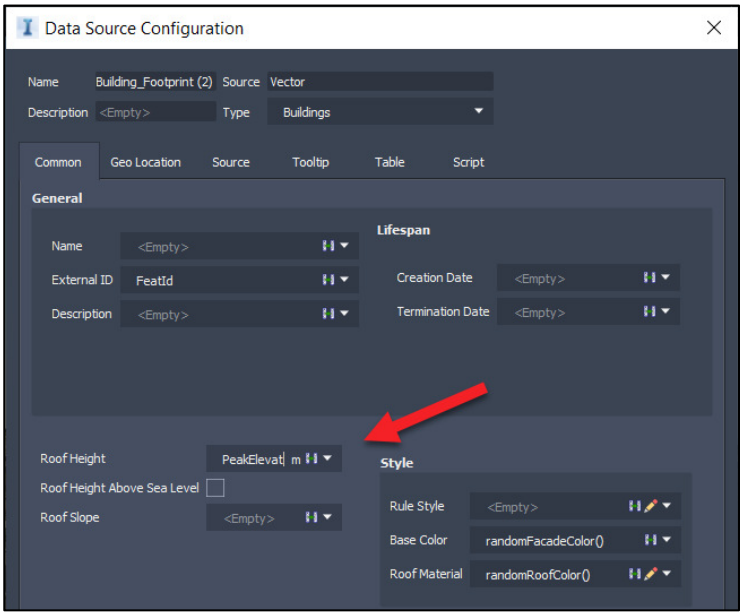
Regardless of the type of data being brought into InfraWorks, they must be assigned a type or the data will not appear in the model. For example, if you wish to display buildings from a Shapefile or KML file, once the data is attached as a Data Source, the Type must be assigned.



CONFIGURE BUILDINGS IN INFRAWORKS

All the vector data can be dragged and dropped into your model but until you assign a type from the Data Sources pane, you will not see any of the data in the model.

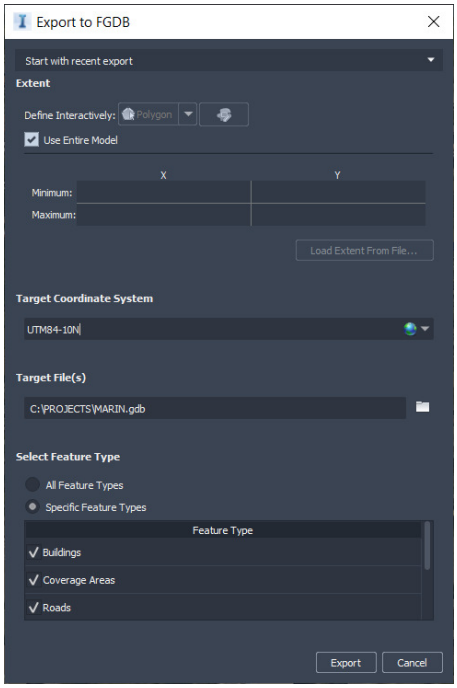
If the attributes of the GIS data have important information, you can use that information to modify your features. For example, if you have a column called “Peak Elevation” you can assign that data to the Roof Height property of the buildings.



MAPPING GIS FIELDS TO BUILDING PROPERTIES

Sharing Data

You can share a video of your Model using the StoryBoard. Zoom in, fly by or follow a path and save the AVI to share. Using the Snapshot, you can save an image (Ctrl – Shift – L) at many resolutions.
Also, you can export your whole model as an IMX, FBX, or ESRI File Geodatabase.
The vector data can be exported to ArcGIS Online or ArcGIS Enterprise as well.

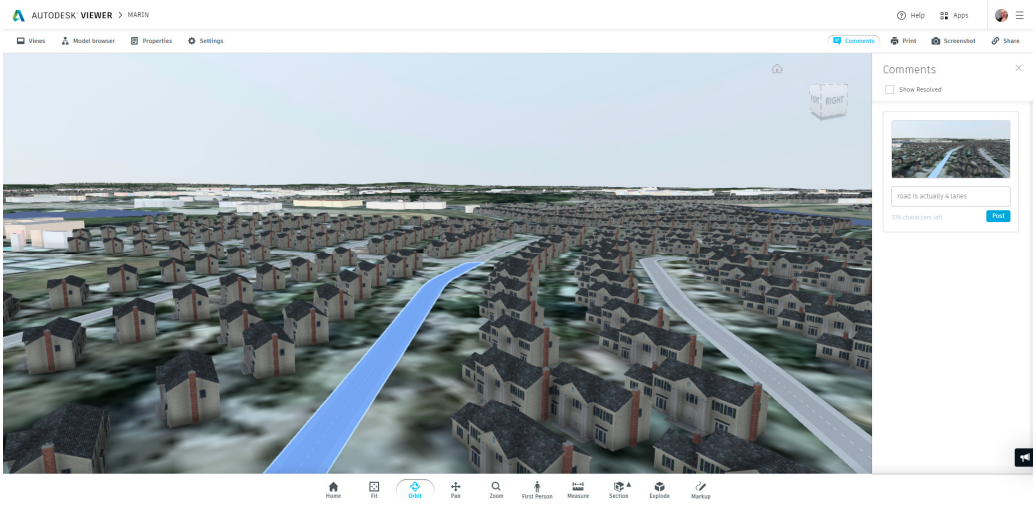


EXPORT TO ESRI FILE GEODATABASE

Shared Views

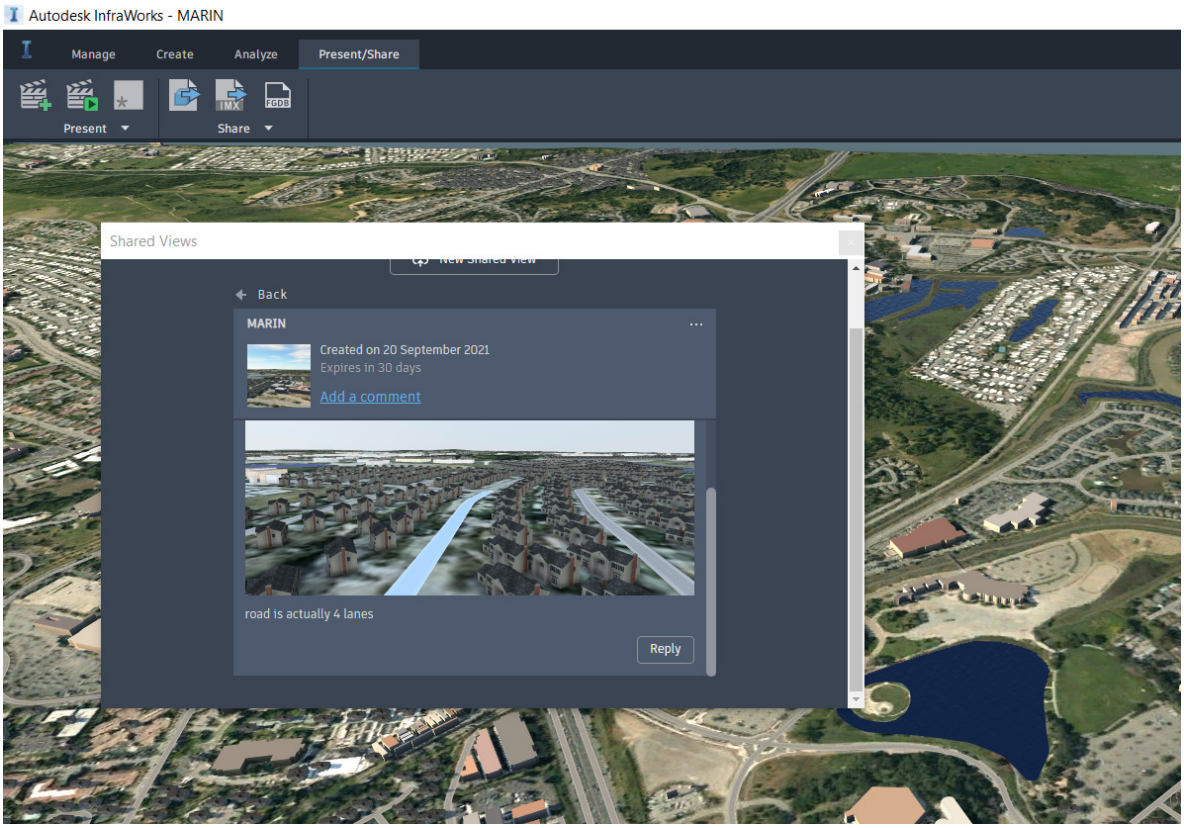
One of the most dynamic ways (and free!) is to share the whole model online using the "Shared Views" tool. This tool enables you to publish the whole model to Autodesk's online viewer and gives you a URL to share with other users to view the model, comment and create markups.

Many Shared Views can be created and managed with your account and the comments and markups are visible both online and within your existing model within InfraWorks.



CREATING A COMMENT IN SHARED VIEWS

Once a comment or markup is saved, the changes, if necessary, can be viewed and edited within InfraWorks itself.



SHARED VIEWS COMMENTS SEEN WITHIN INFRWORKS

How to get InfraWorks

Download a free trial of Autodesk InfraWorks from:
https://www.autodesk.co.uk/products/infraworks/free-trial