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CES323212

The Road Less Traveled—Integrating VISSIM Traffic Data into 3ds Max with Civil View

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Learning Objectives

- Learn how to bring in VISSIM traffic data to 3ds Max using the Civil View extension
- Know how to work with traffic engineers to get the required files and data for Civil View
- Learn how to track vehicles to roadway surfaces, bridges, and ramps
- Learn how to update and revise traffic data automatically using 3ds Max Xref files

Description

Adding vehicles to any large-scale highway or roadway visualization animations can be a daunting and laborious task. Representing accurate traffic patterns and vehicle movements would often be impossible without hand-animating hundreds or thousands of cars (not usually a viable solution). Using VISSIM traffic data and 3ds Max Civil View extension, it's possible to automate much of the process, as well as to have an accurate and visually correct simulation that's easy to update as changes to the model or traffic data occur. This class will cover the basic steps of integrating the traffic data; provide some tips and tricks for the vehicles; and pass on efficient workflows for animating, rendering, and revising during the lifecycle of a project.

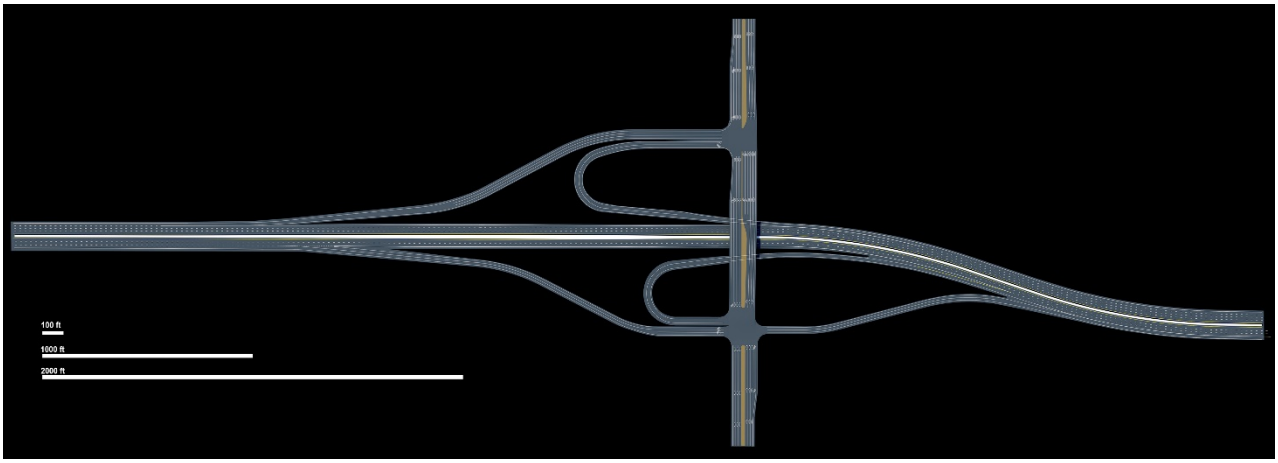
VISSIM is developed by the PTV Group and used very commonly by traffic engineers and planners to create a realistically modeled vehicle simulations to represent traffic flow and volume for different scenarios. Using the 3ds Max Civil View plugin it's relatively easy to bring the vehicle data into Max to manipulate and use for all types of visualizations

Export .fzp File from VISSIM for Civil View import in 3ds MAX

For setting up the data to import from VISSIM, the necessary parameters must be set. The 3ds Max help file lists the following for the easiest way for Civil View to read the data depending on VISSIM software version:

Files generated from Vissim 5.4 and earlier	
Vissim Attribute Short Name	Description
t	Simulation Time [s]
VehNr	Number of Vehicle
Type	Number of the Vehicle Type
VehTypeName	Name of the Vehicle Type
WorldX	World coordinate X (vehicle front end at the end of the simulation step)
WorldY	World coordinate Y (vehicle front end at the end of the simulation step)
WorldZ	World coordinate Z (vehicle front end at the end of the simulation step)
RWorldX	World coordinate X (vehicle rear end at the end of the time step)
RWorldY	World coordinate Y (vehicle rear end at the end of the time step)
RWorldZ	World coordinate Z (vehicle rear end at the end of the time step)
Files generated from Vissim 6.0 and later	
Vissim Attribute Short Name	Description
SIMSEC	Simulation Time [s]
NO	Number of Vehicle
VEHTYPE\NAME	Name of the Vehicle Type (indirect attribute)
VEHTYPE\NO	Number of the Vehicle Type (indirect attribute)
VEHTYPE	Number of the Vehicle Type (direct attribute)
COORDFRONT	World coordinate XYZ (vehicle front end at the end of the simulation step)
COORDREAR	World coordinate XYZ (vehicle rear end at the end of the time step)

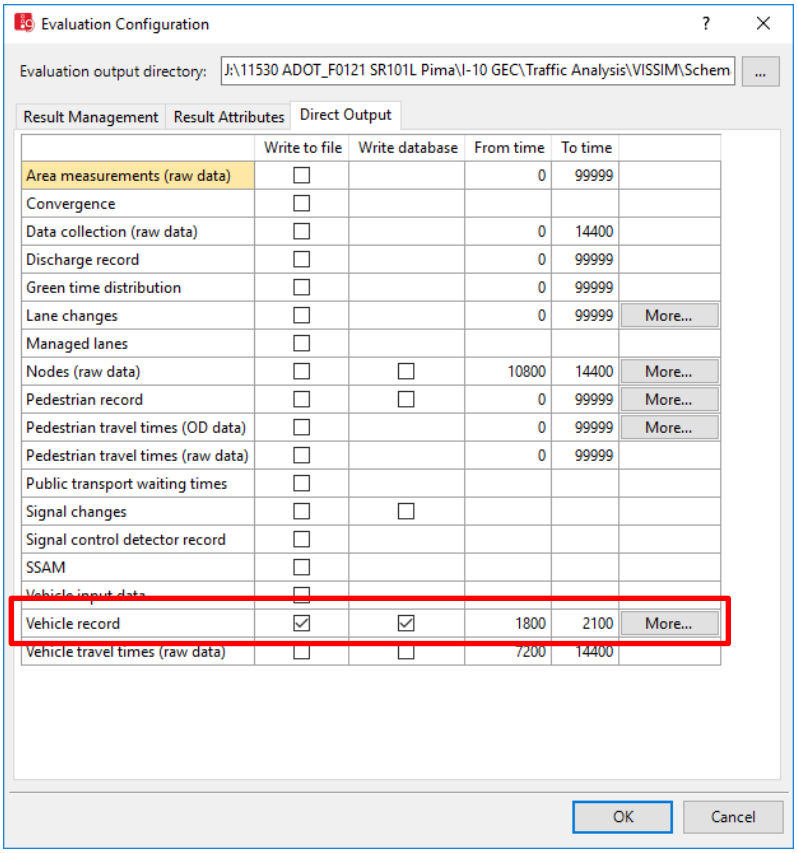
I find it's easiest to either work from the same set of CAD data as the person creating the traffic data, or provide a high-resolution rendering in plan view of the project with a scale provided for them to layout the traffic network on:

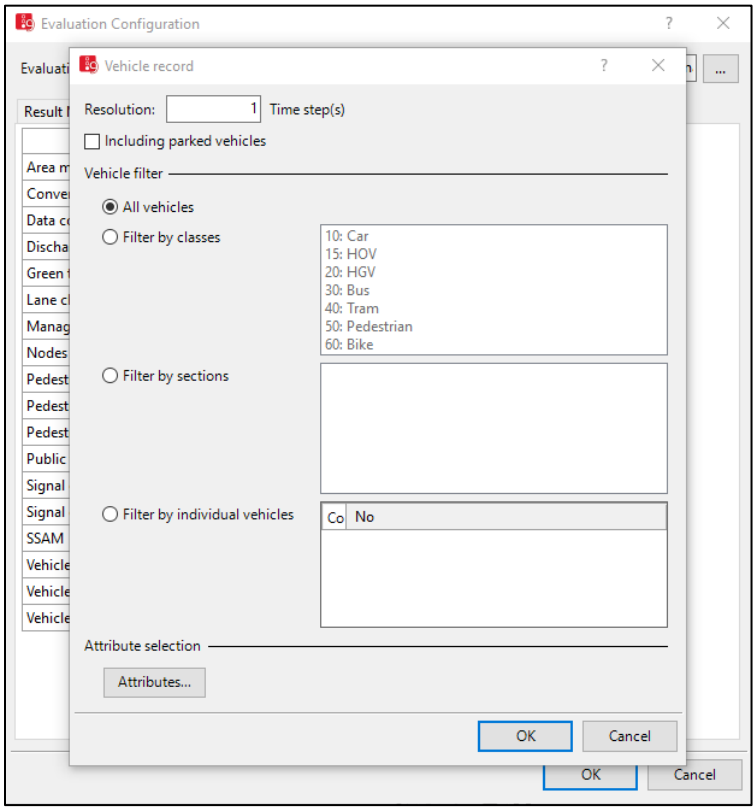


For a more specific tutorial, Ivan Yordanov of the WSP traffic group created the following step by step process.

After you have the network created for your model you need to set up the .fzp file export options. On the main Menu bar under the Evaluation/Configuration/Direct output select *Vehicle Record* and check the "write to file" and "write to database" select the desired time frame that you need the data (keep in mind 5 min data will be approximately 0.5/1GB)

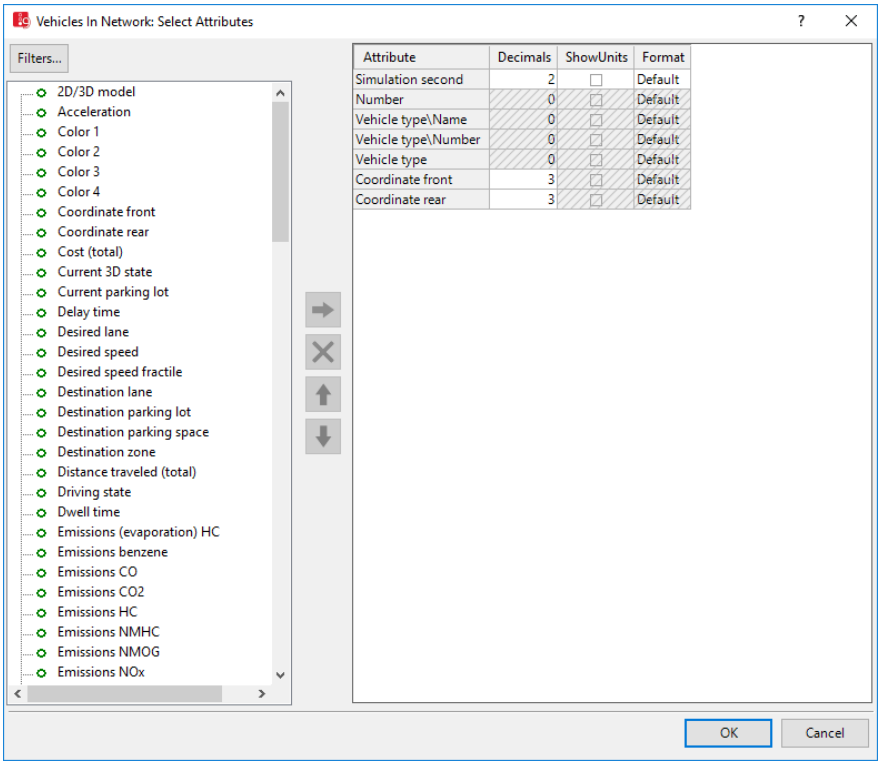
Select "More…" new window will pop up from where you need to go add Attributes





Find the attributes that are in the window below – they need to be the exact same attributes in the exact order otherwise the import will fail in 3ds max:

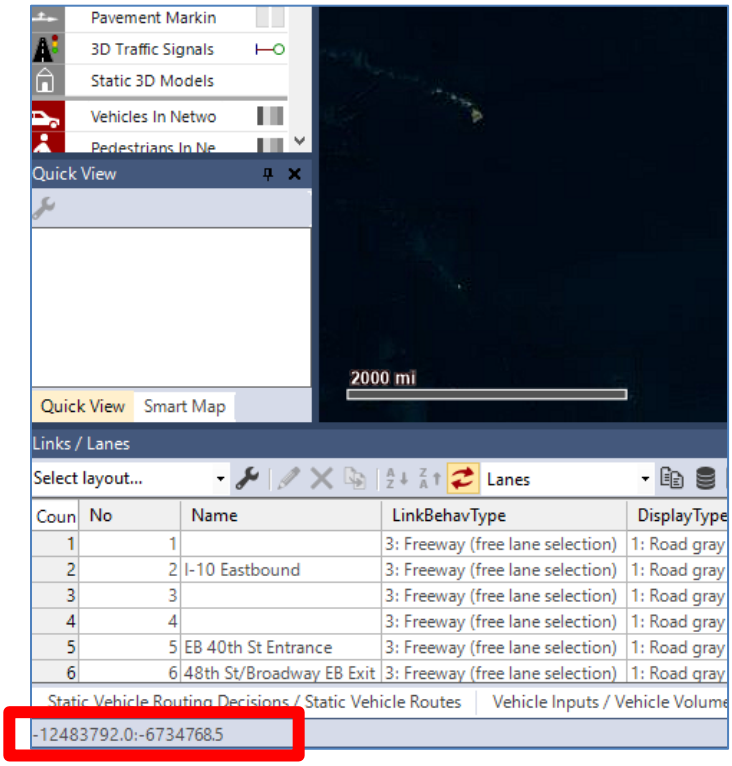
With that step you are done with creating the. fzp file. You need to run the simulation and after you run the simulation the .fzp file will be recorded in the specified location in the Evaluation output directory.



Adjusting the network

Import the High-resolution background map that you received from the rendering in 3ds Max. Make sure that you have scale diagram and that the scale diagram is with the best quality possible (scaling the image is 95% of the work you need to do). Use the lock and unlock key to make sure the map does not move when you are adjusting the network links.

When you open you VISSIM file in the lower left corner is your coordinate system. (typically in the millions)



Zoom out until you see the map of the area – on that map move your mouse and you will be able to find where the coordinate is from + to – in both horizontally and vertically. When you find that point zoom in and move your network with the background picture to as close as possible to the (0,0) coordinates which is crucial for 3ds max.

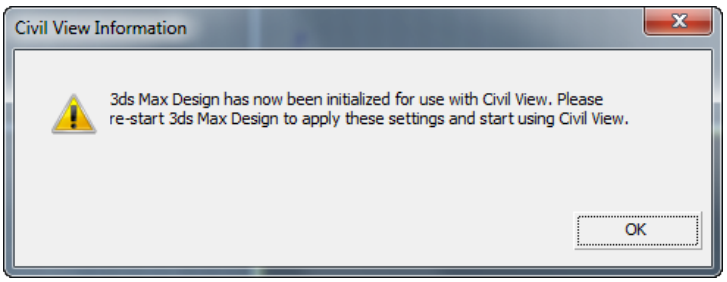
After proper scaling on VISSIM end. Create/adjust the links in couple of areas and make sure when you import them to 3ds Max that the vehicles are where they are supposed to be.

After the spot checking, adjust the rest of the network links and connectors to match and follow the background map

VISSIM data to Civil View for 3dsMax

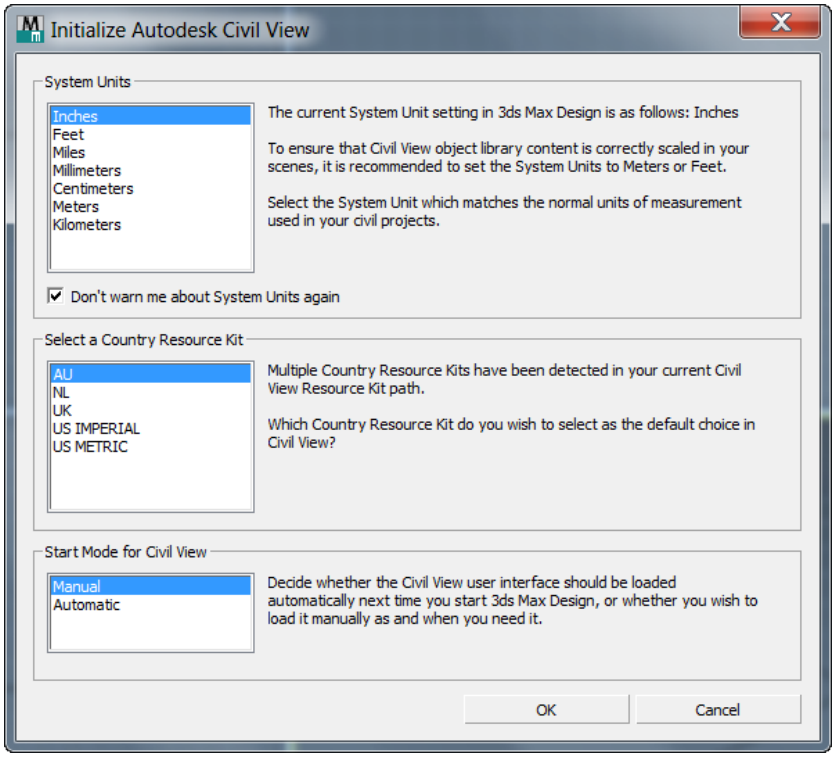
The first step to bringing in VISSIM traffic data to 3ds Max is to make sure the Civil View extension is set-up. The first time running the plugin will bring up a short sequence of steps to initialize the tool.

To start Civil View after you install 3ds Max, choose *Civil View menu* ➤ *Initialize Civil View*. 3ds Max displays an initialization dialog. After you choose the initialization settings and click OK, a dialog warns you to restart 3ds Max.



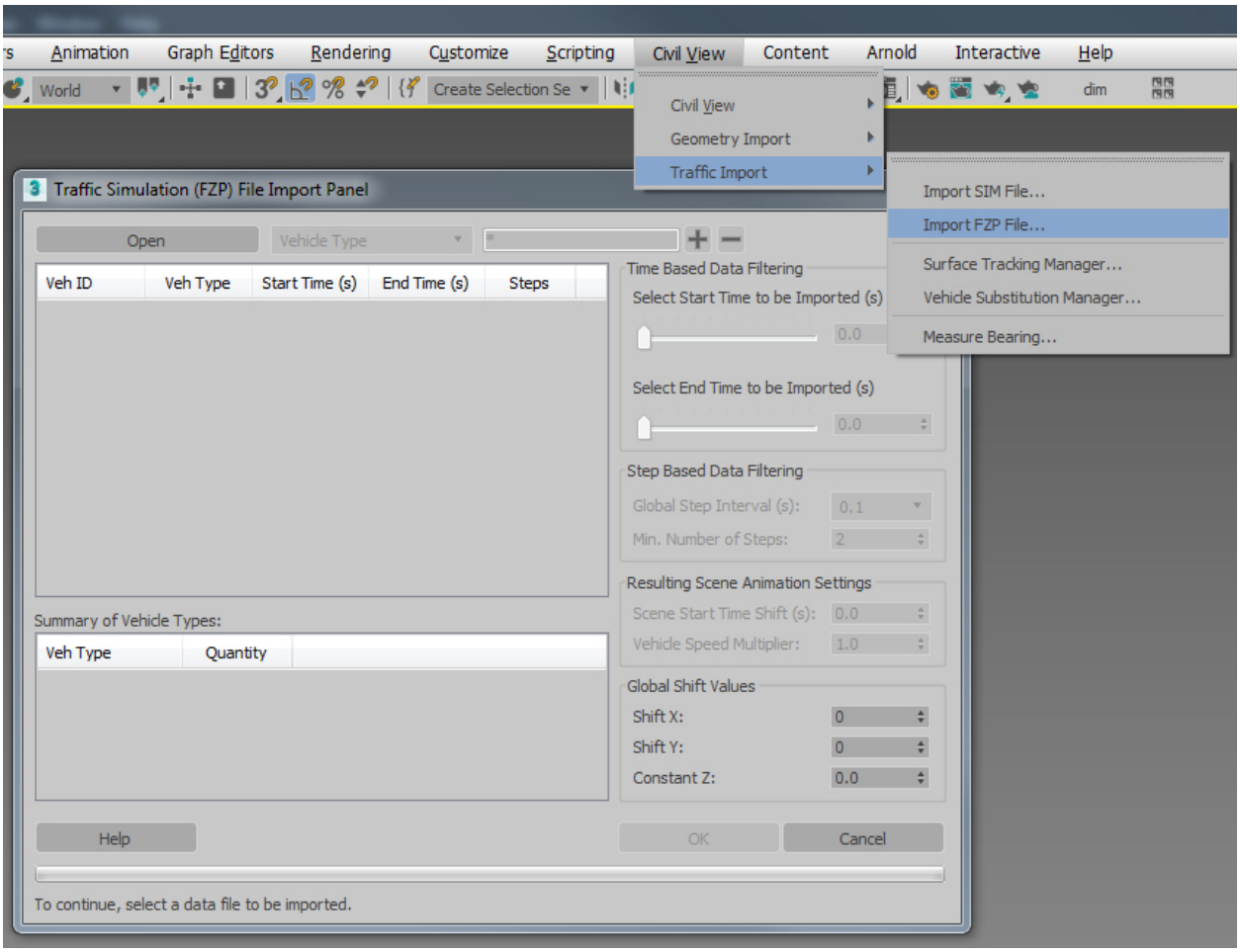
Click OK to close the warning, then close and restart 3ds Max to begin using the Civil View features.

Choose the System Units to use while working with Civil View models. Civil View projects usually use Meters or Feet. For VISSIM projects I typically use meters because the traffic data often seems to be metric. This can obviously vary between projects.

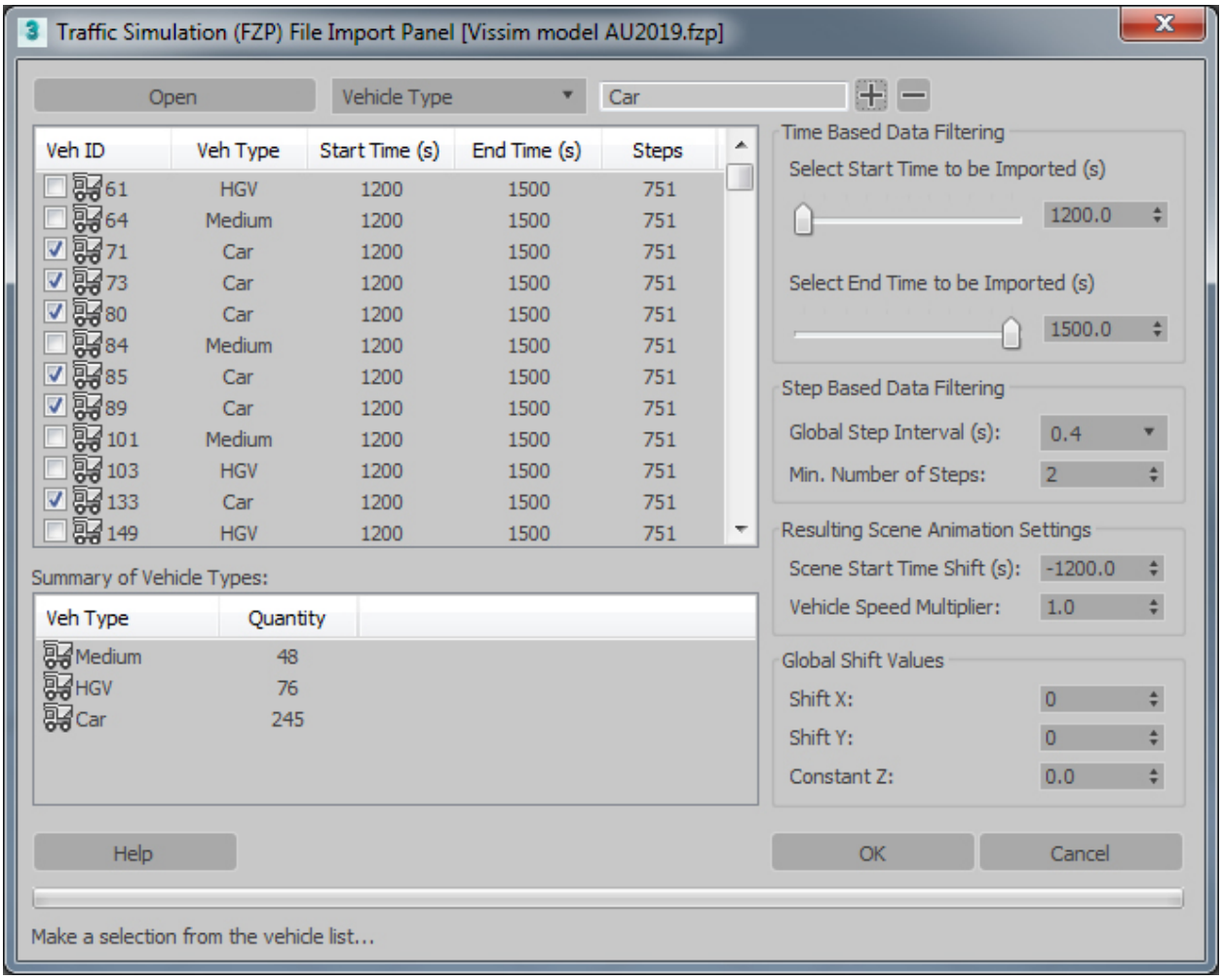


Importing VISSIM/FZP data via Civil View

After initializing Civil View, the traffic data can be brought in by going to *Civil View* → *Traffic Import* → *Import FZP file* which brings up the import dialog.



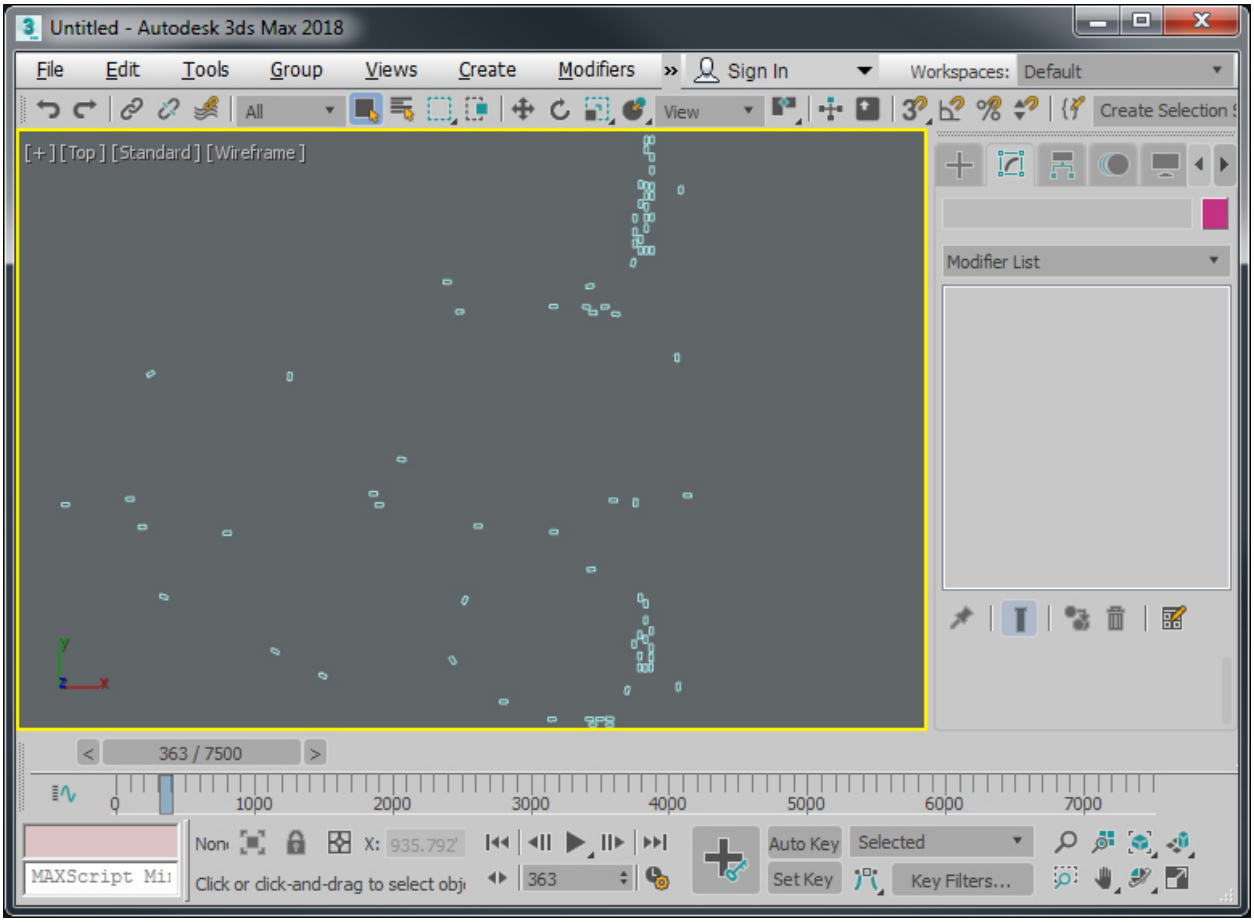
Opening the FZP file brings up the time resolution file dialog which is reading the time steps from the source data. Shorter steps will increase the number of keyframes generated in 3ds Max, but will also greatly increase the overall file size and time needed to import, track, and replace vehicles. A value of 1 would be approximately one keyframe per second based on Max's current timelines framerate and VISSIM's generated framerate, a value of 0.5 would be 2 keyframes per second, etc. Typically a value of around 0.4 – 0.8 is a good tradeoff to turn accuracy vs. file size and scene management.



Once the FZP file is analyzed and opened, the list of vehicles within the file will be shown. Information such as the animation length, vehicle type, step sampling, etc, is displayed. Clicking the + will add all the vehicles to the import, or wildcards can be used for example to bring in different types of vehicles in separately. This is nice to use if you want to have cars on one layer, trucks on another layer, etc.

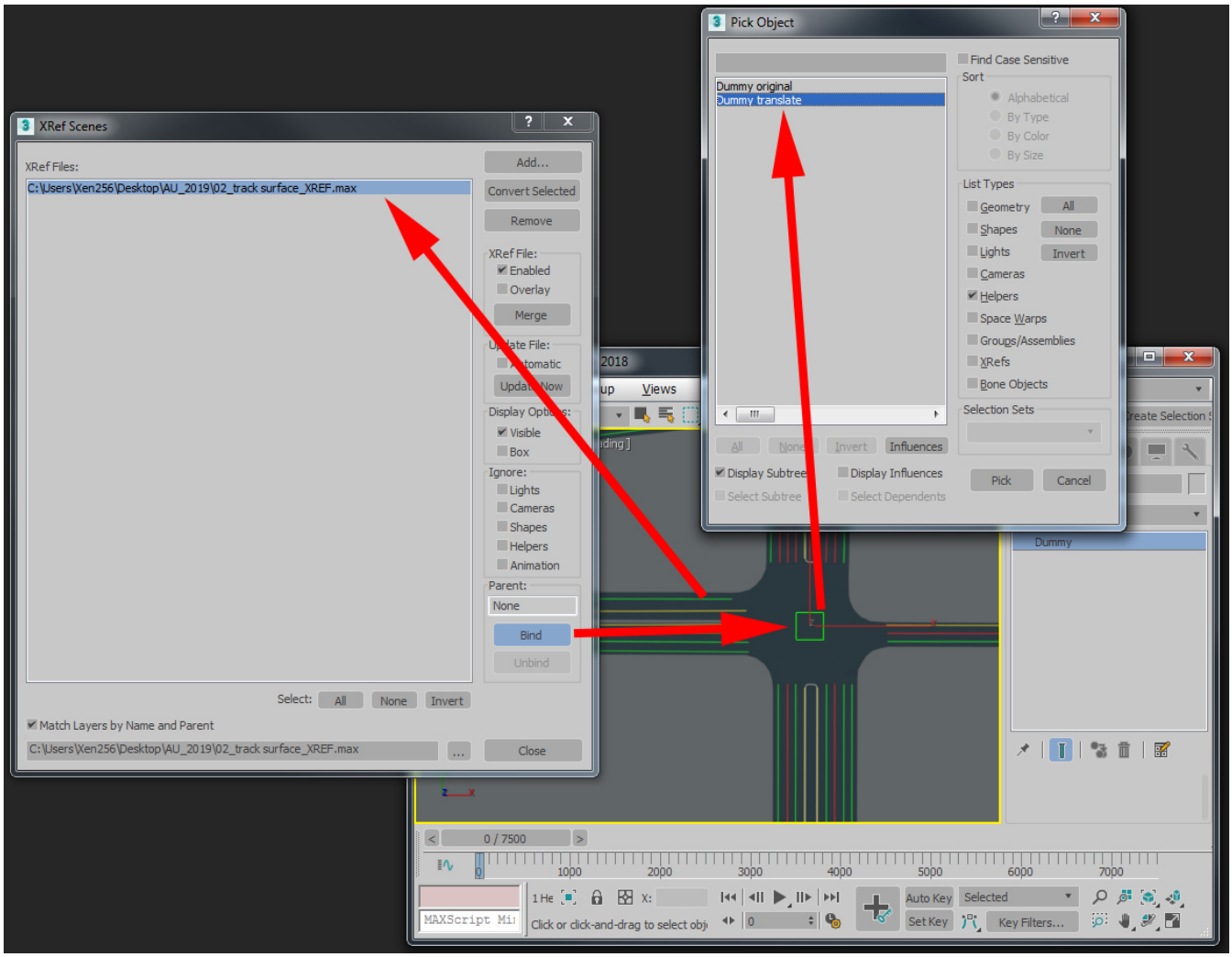
After the vehicles you want to import are selected, clicking OK will bring up an information panel asking if you want to extend the vehicle animation timeline length to match the overall animation. Clicking Yes extends the timeline and imports the vehicles. This step can often take a while depending on file size and computer speed.

Aligning VISSIM traffic to 3ds Max Model Surface



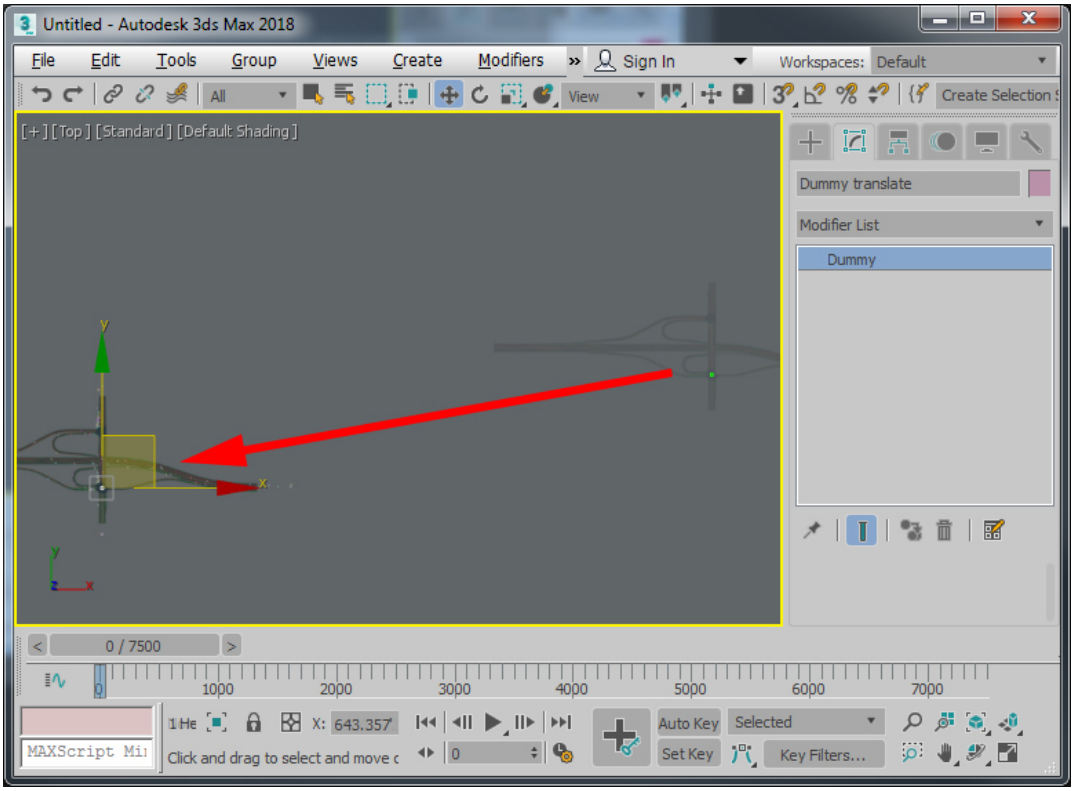
Once the vehicles are imported, they will show as basic boxes animated in 2D. The next step is to align the traffic with the surface of the 3ds Max model roadway. In an ideal world, the vehicles would come in aligned to the model, but I have found this to never be quite the case. My preferred method of aligning the models involves a couple of dummy objects linked to XREF files so that aligning the vehicles to the model never actually changes the absolute position of either file's geometry, just it's linked location. This allows you to easily update either the vehicles or roadway files without having to worry about translating the entire scene(s) and having to do it again. Once the correct translations are set updating the files in place retains alignment.

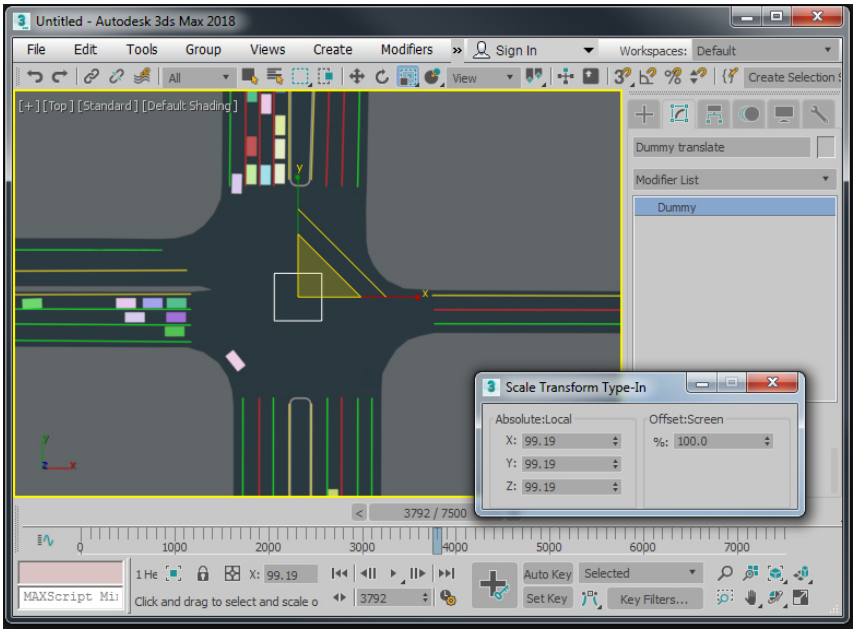
XREF in the scene to use to align and track the vehicles. Usually a simplified version of your source file with just the roadway surface and lane lines is needed. Place 2 identical dummy objects at the same place somewhere within the XREF'ed geometry and bind it to one of the dummy objects:



Tip - An intersection or end of a long straight-away is generally a good reference point to use. A couple of tries might be needed to find a good spot where a lot of cars come together and can be used to 'hold' the alignment of the vehicles while adjusting the extents via move/rotate/scale.

Once the roadway XREF is bound to the helper object, translate, rotate, and scale as needed to align to the vehicles. Ideally very little rotation or scale will be needed, but is nice to be able to adjust the model a few 10^{ths} of percent for fine adjustments without having to rerun the VISSIM simulation.





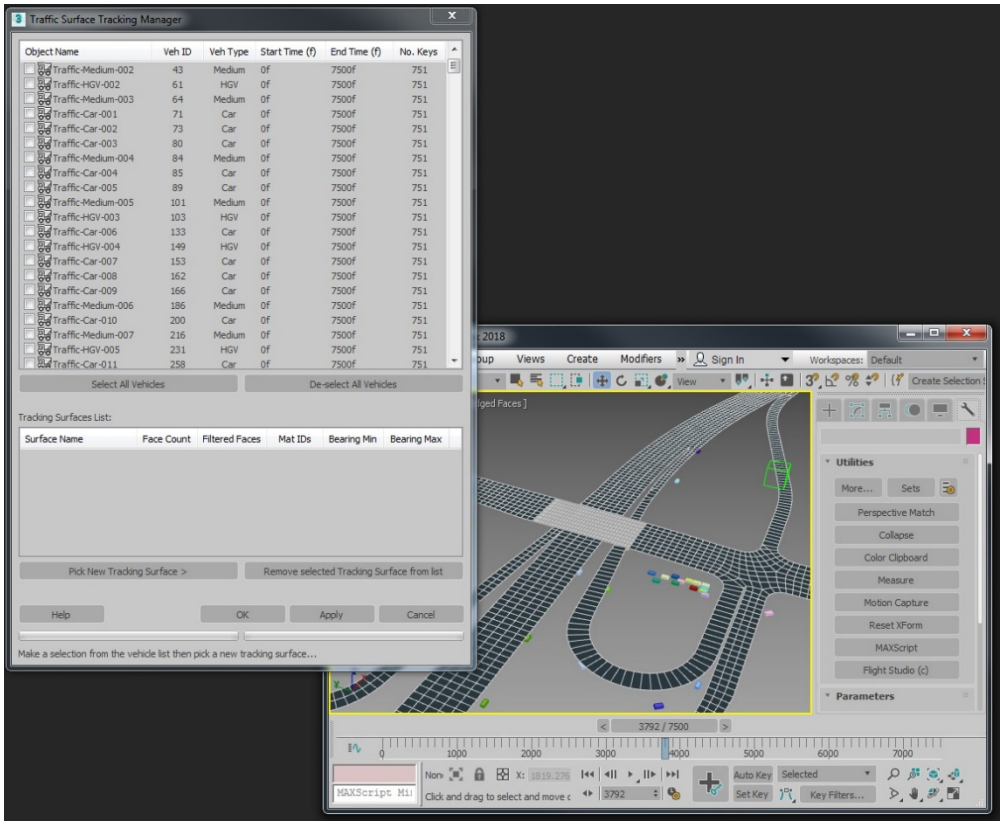
In this example I was able to scale the XREF'ed geometry by 0.81% with a slight rotation to get the vehicles lines up perfectly. Using the linked dummy objects, both the original roadway scene file and the VISSIM vehicle scene will stay at their original transforms, we'll just use the ratio between the scenes as reference to translate between them.

Tracking VISSIM Vehicles to the Roadway Surface

Once you're happy with the alignment of the vehicles, the next step is to track the objects to the surface of the roadway. This can often be a bit frustrating as VISSIM cars seem to have a mind of their own on occasion, but here are several methods for tracking.

Tip – Move the XREF'ed roadway model above *the VISSIM vehicle models. If there is a 1 or 2 frame error in the vehicle tracking the VISSIM object will 'pop' back to its default location. If the vehicles start above the roadway you can have a situation where you don't notice an errant car until rendering out an animation that pops up to the sky from an error or driving off the edge of the model. If the cars start below the roadway it will pop below the main scene geometry and less likely to be noticed. VISSIM doesn't care if it's tracking from above or below, so just as easy to start the vehicles from below the scene.*

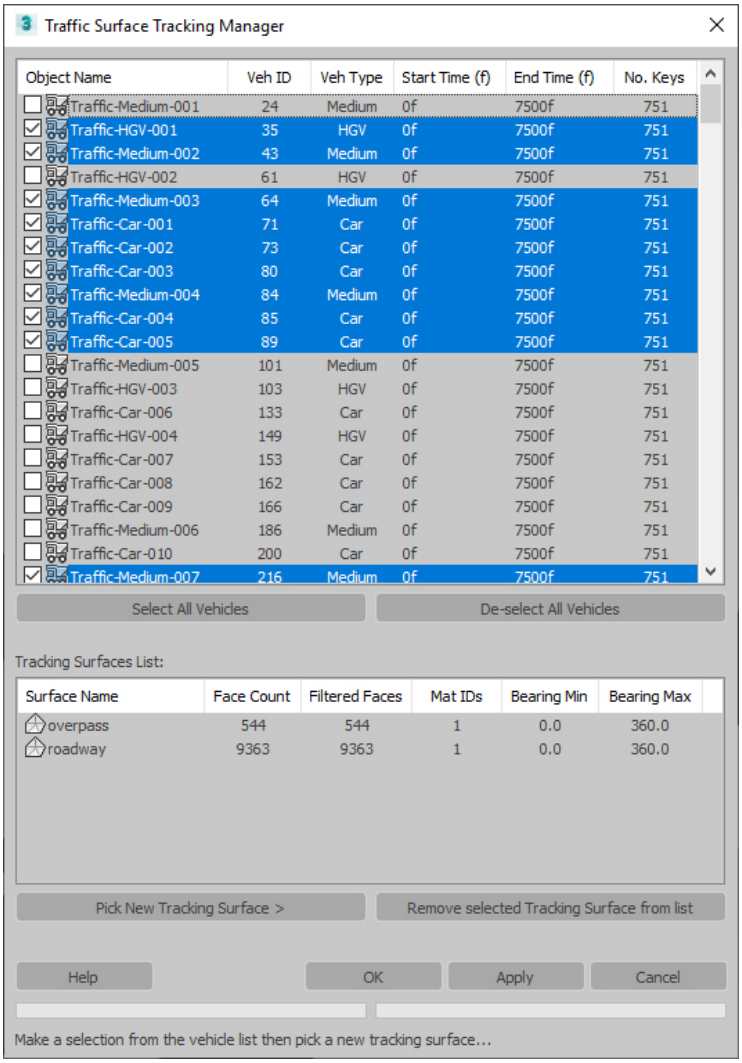
In the XREF dialog box, merge in the roadway object that was previously aligned to the vehicles. I like to keep all this geometry on one layer so that it can be easily turned off for saving out the tracked vehicles later. The roadway model can be simplified even further at this point with lane lines, curbs, etc, not really needed. Just a good cleanly modeled surface is ideal.



The basic procedure is to go to *Civil View* → *Traffic Import* → *Surface Tracking Manager* which brings up the Surface Tracking dialog.

Either select vehicles directly from the list, or it's also possible to select vehicles from the scene and they will highlight in the list, which is useful if different vehicle types are split by layer, or just need to track a specific vehicle.

Pick the surface to track the vehicles to by hitting the Pick New Tracking Surface and click the object in your scene. This will prompt for the object ID to use for that object, again useful if your object is split by material type (grass, terrain, roadway, etc)



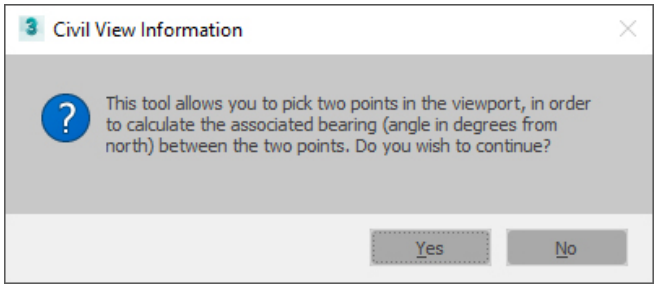
As many objects can be added to the list as needed for surface tracking. Clicking either OK or Apply at this point will process the data and place each VISSIM vehicle onto the surface of the roadway. Simple or lower polygon surfaces will process faster, and often is useful to create an optimized copy of the roadway geometry just for the tracking. Also deleting unneeded geometry helps, such as attached terrain or other context.

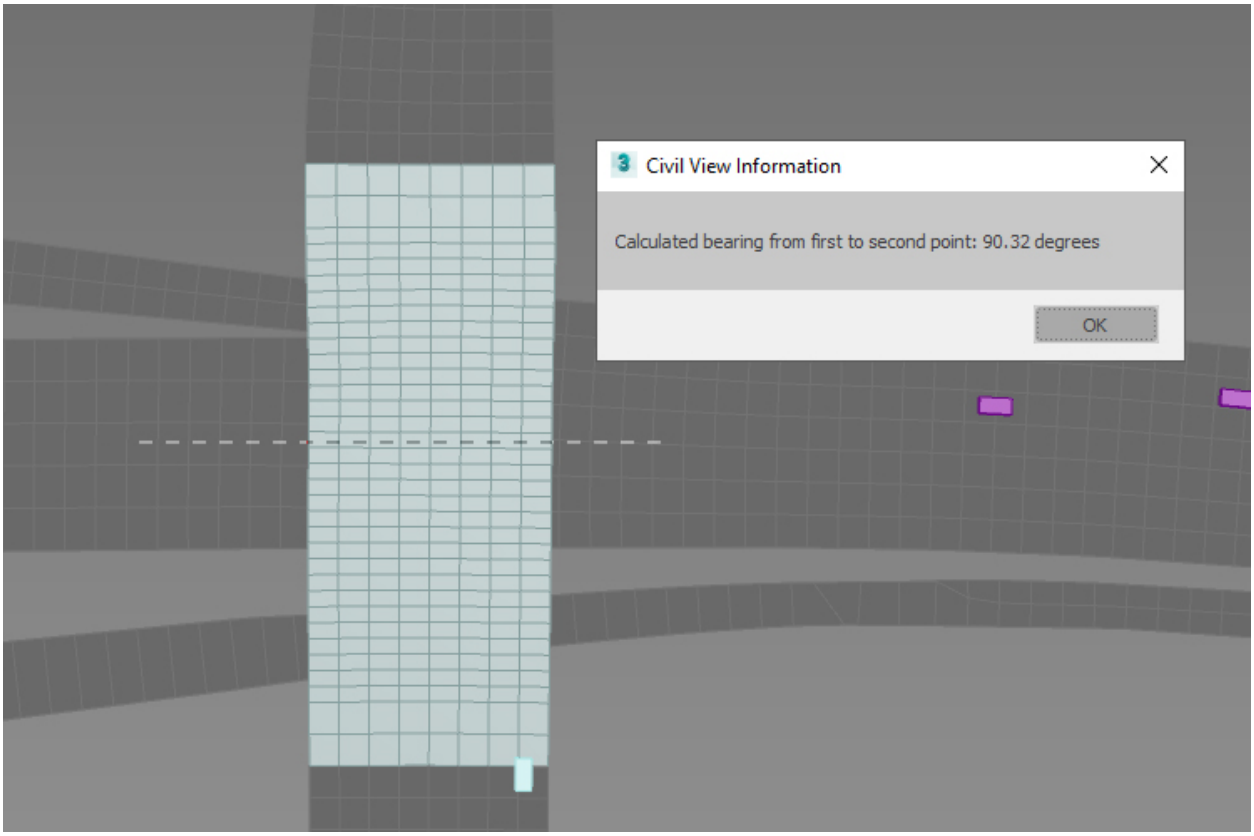
If the roadway model contains overpasses or sections where the roadway crosses over itself or another portion of the road some additional steps are needed so the vehicles know when they should be driving above or below the other traffic. Often a combination of techniques can be used to get everything driving where it's supposed to.

Tip - The animation key type currently selected will be what type of keys are created for the tracked vehicles. Generally, Auto or Smooth will create good results.

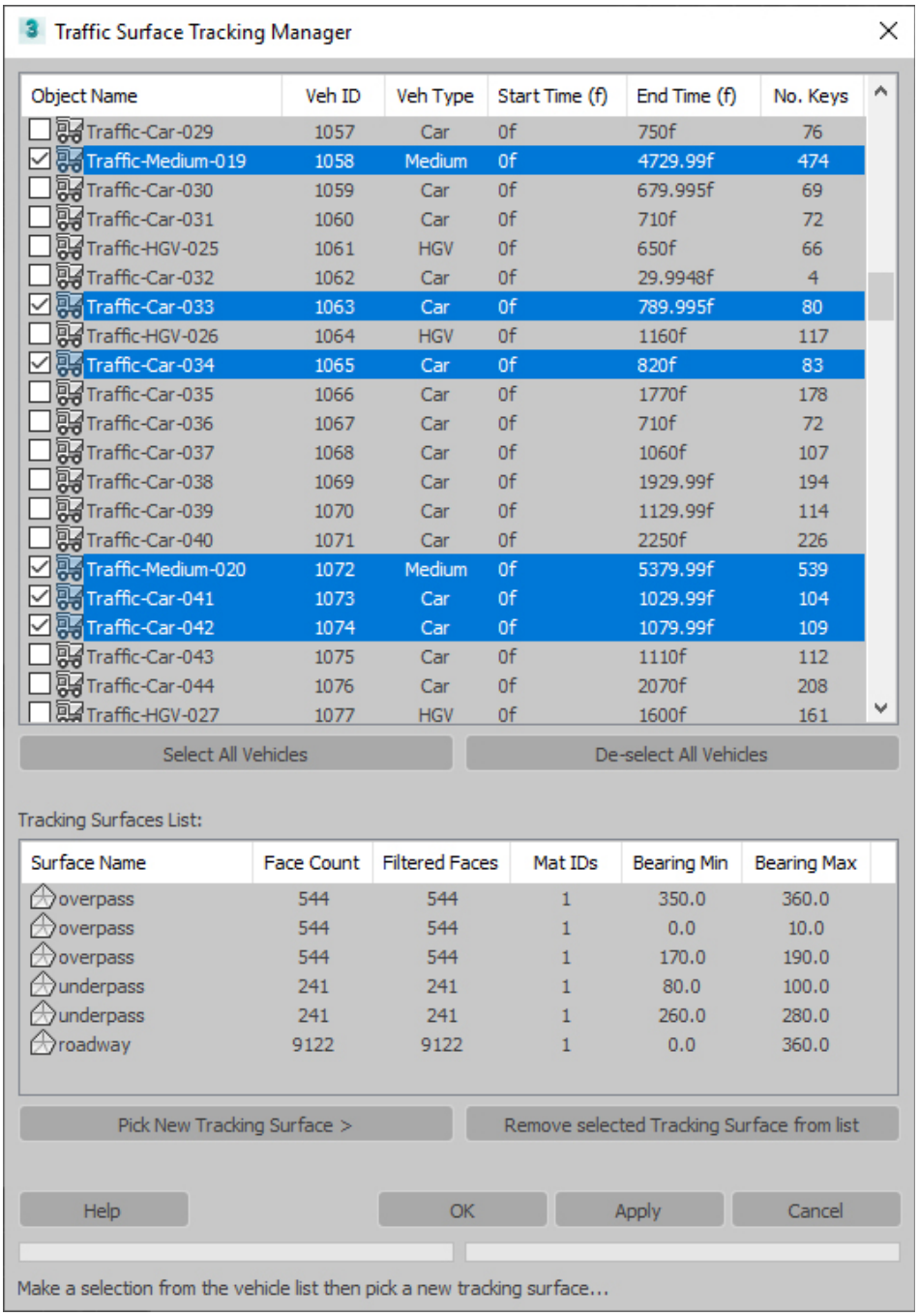
Tracking VISSIM Vehicles to the Roadway Surface with Overpass/Underpass

The first method to track vehicles that cross over each other is to use the *Measure Bearing* tool within the Civil View plugin. Going to Civil View → Traffic Import → Measure Bearing brings up a simple dialog that lets you see a vehicles direction and angle as VISSIM will interpret it for the tracking process. Click between 2 points to get the bearing direction as selected. In the example file, traveling under the bridge is a bearing of around 90° one way and 270° the other. Traveling over the bridge is 0° one way and 180° the other.





In the case of this scene, anytime a vehicle has a bearing of around 0° or 180°, and at the bridge geometry, it should be driving on the bridge. If the heading is around 90° or 270° it should be below the bridge. Breaking the surface into separate pieces helps keep track, and in this case we have a bridge, underpass, and roadway surfaces available for tracking.

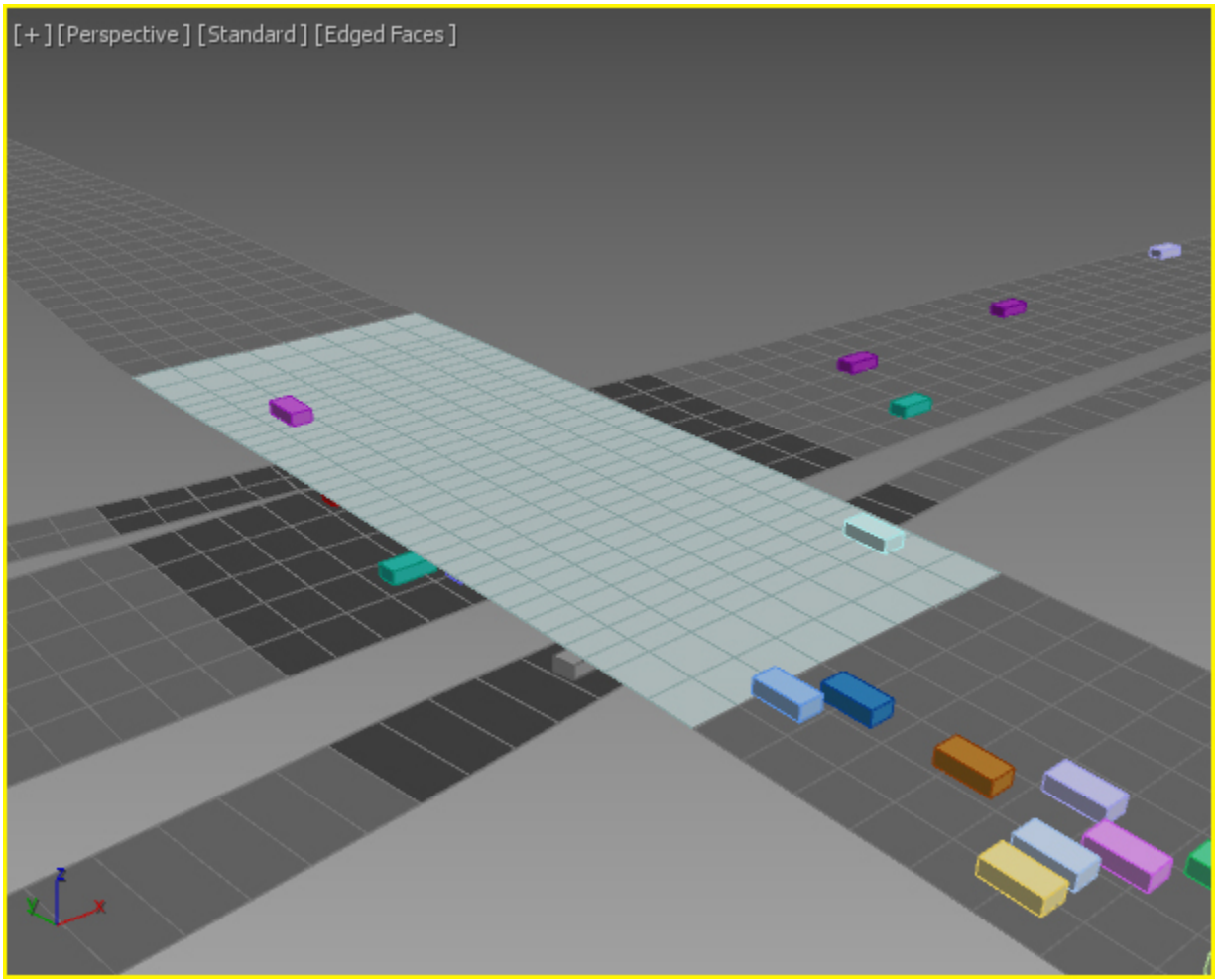


An additional caveat to the surface tracking dialog: it doesn't seem to recognize 'wrap-around' bearing measurements. For example, if our cars on the bridge have a bearing heading of 0° and we want to add a 10° buffer range to the left and right, you will need to add the surface twice, once for 350-360°, and again for 0-10°.

*Tip – When using the bearing setting in the tracking dialog to add surfaces, add them from the **top (highest) driving surface first**. The order in which Civil View checks the surfaces for vehicle track does matter, and will not work correctly if added in a different order.*

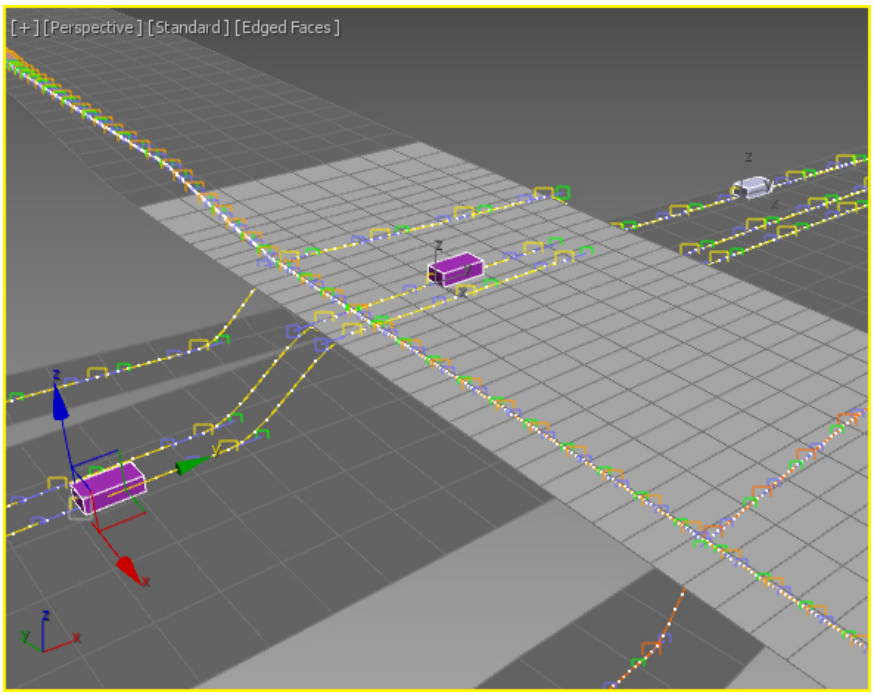
Configured Tracking Dialog shown with bearing information shown for all three pieces.

Tracked VISSIM vehicles correctly driving on the primary roadway surface, overpass, and underpass geometries:



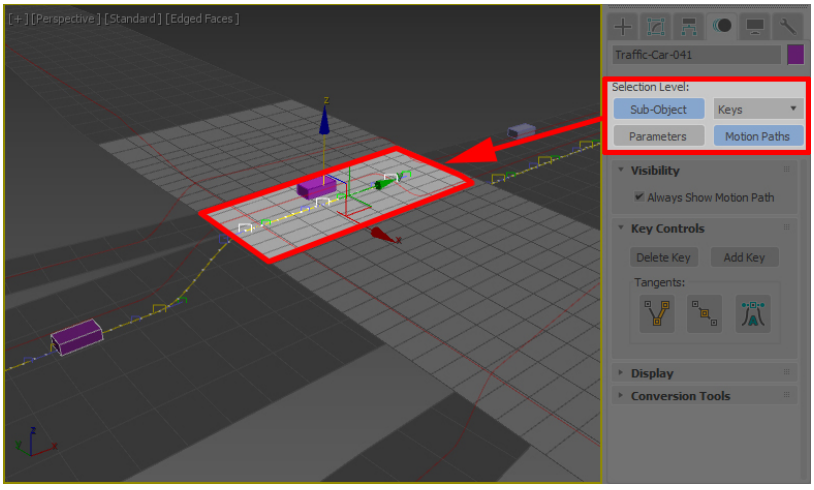
A second way to deal with an overpass/underpass tracking situation is to track the individual pieces of geometry separately. It is possible to track the entire simulation to the surface(s) of the scene, then select sets of vehicles that need to travel on different height and **re-track** just those vehicles just for those specific locations and surfaces. **The tracking manager does not alter the keys of the animated vehicles if there is no geometry to track to** for a given position, so it is possible to re-track a vehicle a number of times for different portions of roadway as they are sliced apart for different layers.

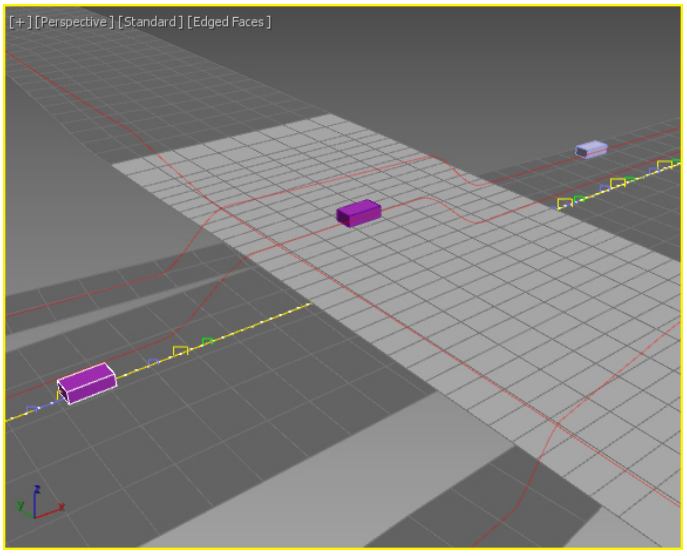
A third way to deal with vehicles not quite tracking correctly is to deal with them on a case by case basis and directly edit the vehicles keyframes. Often a vehicle will pop up or down to a roadway above or below where it should be tracking to:



Since the Tracking Manager creates standard 3ds Max animation keyframes, it is possible to manipulate the path after the fact by hand. While not recommended for large numbers of vehicles or numerous surface locations, it can be a quick and easy way to deal with a troublesome vehicle that otherwise would be fine.

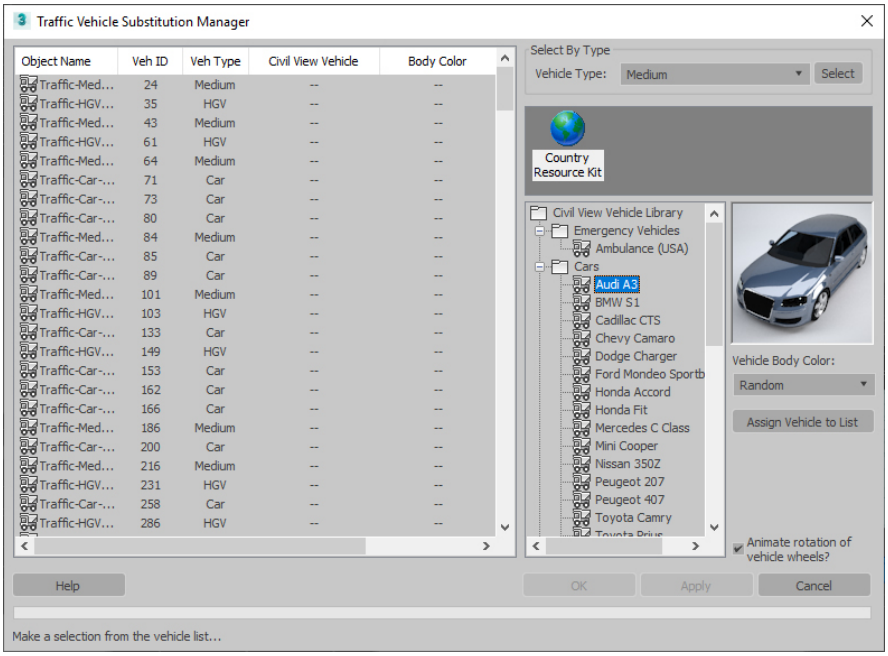
Under the Motion panel in the Command Panel, select the vehicle and activate its Sub-object mode with Keys selected. It is then possible to simply select and delete the offending keys and the vehicles path will re-interpolate between the keys at the correct location:





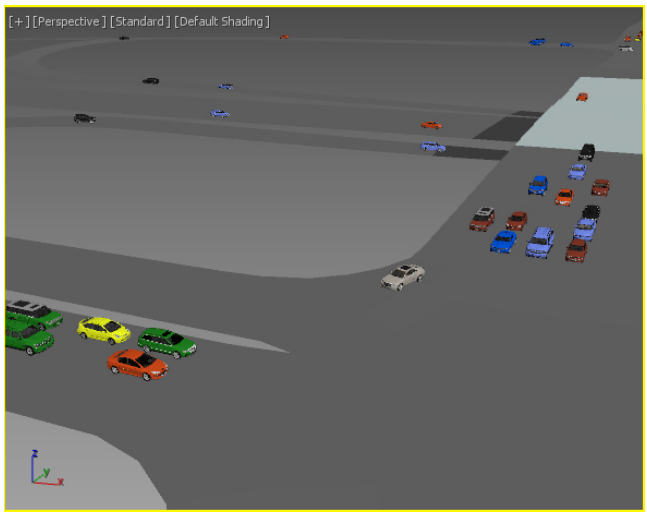
Substituting VISSIM boxes for high-poly vehicle models

To replace the standard VISSIM boxes with vehicles for high quality renderings, Civil View uses the Substitution Manager tool. Clicking *Civil View → Traffic Import → Vehicle Substitution Manager* brings ups the vehicle replacement dialog



Either select vehicles directly from the scene, or use the *Select by Type* dialog dropdown. This will highlight the selected vehicles in the dialog list. The vehicles can then be individually assigned from the list, or simply select the rot folder (i.e. Cars) and press the *Assign Vehicle to List* button. This will prepare the boxes to be swapped with the higher resolution car models. An option for having the wheels rotate is available. Selecting this will create additional keyframes for the vehicles wheels objects, and can create a significantly larger 3ds Max file, but adds nice detail if renders will have closer views and shots. After the desired parameters are set, clicking OK starts the replacement process.

The default Civil View library comes with a good assortment of modern cars and trucks, as well as other vehicles, but is relatively easy to create custom libraries for models based on different renderers and materials. See the 3ds Max help file for additional detail on creating custom Civil View libraries.



After the vehicles are tracked and VISSIM boxes swapped for vehicle models, the scene is ready to be referenced back into the primary rendering file with the full roadway model.

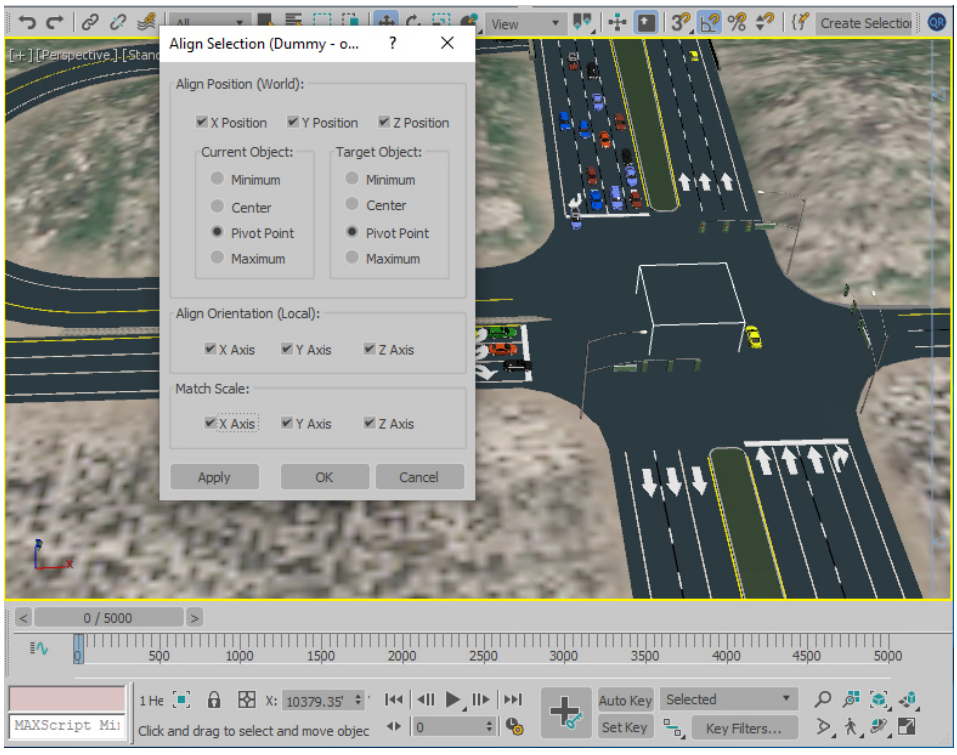
Rendering the Final Scene

The final step in getting the replaced VISSIM vehicles back to the main scene file to be used for rendering output is to use the 2 dummy objects set-up in the first step to reverse translate the vehicle scene back to where the roadway scene file geometry is.

Save out the vehicle models only by selecting all of them (vehicles only) and doing a *Save Selected*. This is the file that will be XREF'ed back into the main file.

In the primary render scene that has the original location roadway surface, go to *File* → *Import* → *Merge* and select the working scene that was used to track and replace the vehicles (not the scene that's the cars only). Select the 2 dummy objects and merge them into the scene.

Next, goto the XREF dialog and XREF in the vehicles only scene that was saved out of the tracking file. This geometry should come into the scene referenced around the just merged in translation dummy object. Link the XREF'ed vehicle scene to the translation dummy, then align (Alt + A) that dummy object to the original location dummy object, being sure to maintain the Orientation and Scale options. If all went well, the vehicle scene should now be perfectly aligned to the original roadway scene.



With this last step, the process of reverse translating the vehicle scene back into the primary scene allows both source files to remain untouched as far as any translation, rotation, or scale that was needed to perfectly align the vehicles. If a new FZP file is generated to reflect different traffic conditions, importing the FZP into the vehicle tracking scene means that everything will still be aligned to the roadway layout. Saving the vehicles out from the updated vehicle scene means just updating the XREF in the main file and the offsets and translations are automatically maintained.