Autodesk University 2012

Suite Pipes!

Seth Hall – Autodesk, Inc.

CI2214 This class will explore the workflows for dealing with storm and sanitary networks using Autodesk® Infrastructure Design Suite—from the planning phases in AutoCAD® Map 3D and AutoCAD® Civil 3D® software, the conceptual visualization in Autodesk® Infrastructure Modeler software, design in AutoCAD Civil 3D, and finally virtual construction in Autodesk® Navisworks® software. We will work our way through each product, covering basic introductions, file formats, import and export, and how to work with the objects in each format.

Learning Objectives

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

- Basic knowledge of each product in the Suite that works with pipes
- Import and export data from each product.
- Understand a potential workflow between the products.
- Understand the file formats the products can exchange with one another.

About the Speaker

Seth Hall has been a product support specialist with Autodesk since the summer of 2008. His industry background consists of working for a local land survey firm as a member of a field crew, a draftsman, and a New Hampshire State licensed subsurface systems designer. For education, Seth went to the University of New Hampshire -Thompson School of Applied Science, studying in their Land Survey program. He also had an internship with the New Hampshire Fish and Game Department, doing boundary identification surveys of their conservation land. Seth currently lives in Manchester, New Hampshire, with his wife and five kids. When he has free time, he enjoys spending time with family, running, music, and any kind of gadget or new technology.

Suite Pipes!

Importing the Data

Let's get the data into all products in the Suite, building a separate model for each. We'll discuss how to get import the data into each product, so as the design progresses each model can be updated as we move along.

File Types

Throughput the Infrastructure Design Suite there are many different file types that can be imported into the individual applications, but we will focus on the files types that you would typically encounter.

A few of these file types are able to be brought into each application individually, and some require a "visit" to a certain application prior to being imported. Here is a list of the files types we will be discussing and using throughout the course of this paper in order to move our data through the suite:

SHP: One of the most common GIS file types. Will allow us to get readily and publically available data into AIM, Civil 3D, and Map 3D.

DWG: Autodesk drawing files. Used as the base for Map 3D and Civil 3D drawings.

NWC: Navisworks NWC files. Allows Navisworks to read and import exported Civil objects.

IMX: Autodesk output file from Civil 3D. Allows export of Civil Objects to AIM.

SDF: Autodesk Spatial Data File (SDF). SDF supports spatial indexing and can store geometric and non-geometric data with minimum overhead. Can export Civil object and import into Map 3D and AIM.

STM: Hydraflow and Storm & Sanitary Analysis files.

XML: LandXML files that can transfer Civil data between in Suite products and 3rd party products alike.

Infrastructure Modeler

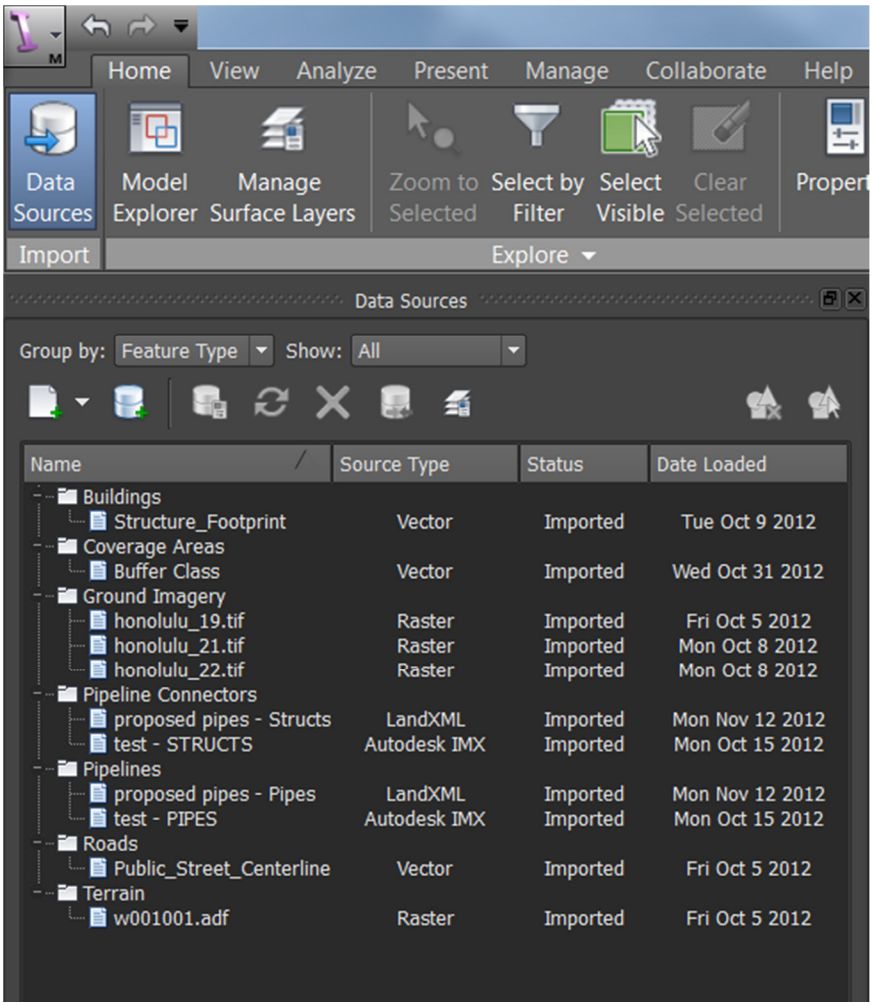
Relatively new to the Infrastructure Suite is Autodesk Infrastructure Modeler (AIM). This is a powerful new tool that allows you to bring a life like model to realization in a matter of minutes, depending on the data you have access to. Mostly seen in road conceptual design, this tool can also be used to work with and showcase any existing conditions or improvements to your sanitary and storm networks.

Using AIM is really quite simple, and an impressive model is only a few clicks away. Using readily available GIS data such as SHP files, various different image file, and AutoCAD & Civil 3D data you can have a realistic model to present to colleagues and clients. Here the goal is to quickly create a "pretty picture" and not focus on the details as you would in a design-to-build environment.

Data Sources

In order to create a realistic looking model to get a good "feel" for where your existing pipes are located and where the new lines will go you will need to obtain the following types of files:

- Image files
- Surface or Terrain
- Pipes and structures (SHP)
- Roadway centerlines (SHP)
- Building outlines (SHP)

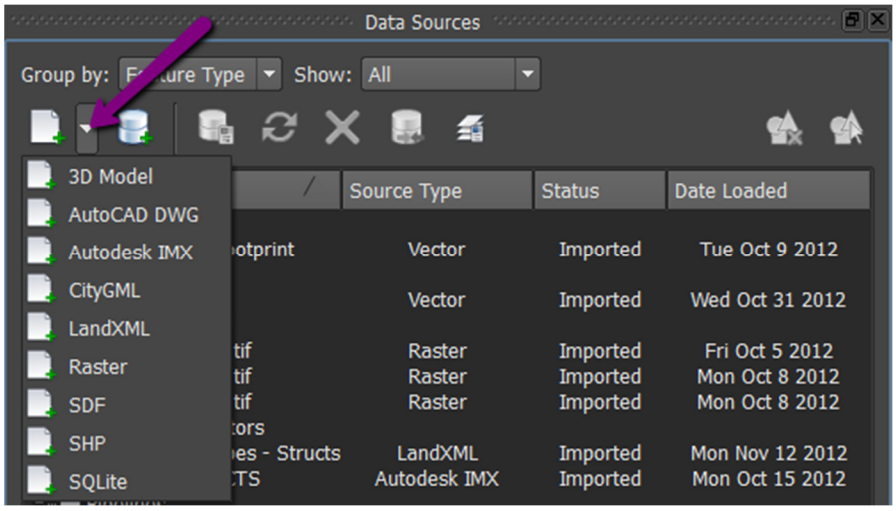


As mentioned before a lot of this data is provided free for the public and can be downloaded if needed. Please check with your local city/town or do some research online to find what is available in your area.

Bringing in data is much like working with data in the FDO connection of Map 3D/Civil 3D. You will select a data source and connect to it. The available data sources are as follows:

- 3D Model
- AutoCAD DWG
- Autodesk IMX
- CityGML
- LandXML

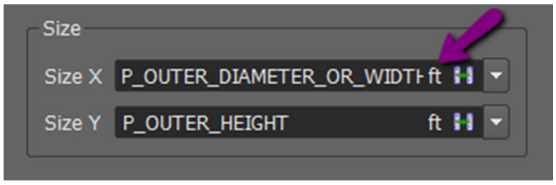
- Raster
- SDF
- SHP
- SQLite



When dealing with pipes we will be concerned mostly with SHP data as well as IMX and possibly LandXML depending where we are bringing data from.

The main difference from the FDO connection is the requirement to “Configure” the data after the connection has been made. Here you can set the invert elevations, rim elevations, and sizing from the data contained in the SHP files. This information needs to be matched up correctly in order to display the pipes and structures correctly. You will also need to set the proper coordinate system of your networks.

Something to keep in mind when bringing in the data is the Units. You may notice that you have huge pipes, with short, fat structures, and extremely tall buildings. By default the units could be set to Meters. You can easily change this to feet, but you should pay attention to what units you are working in to be sure you have the correct display of the features.



Civil 3D

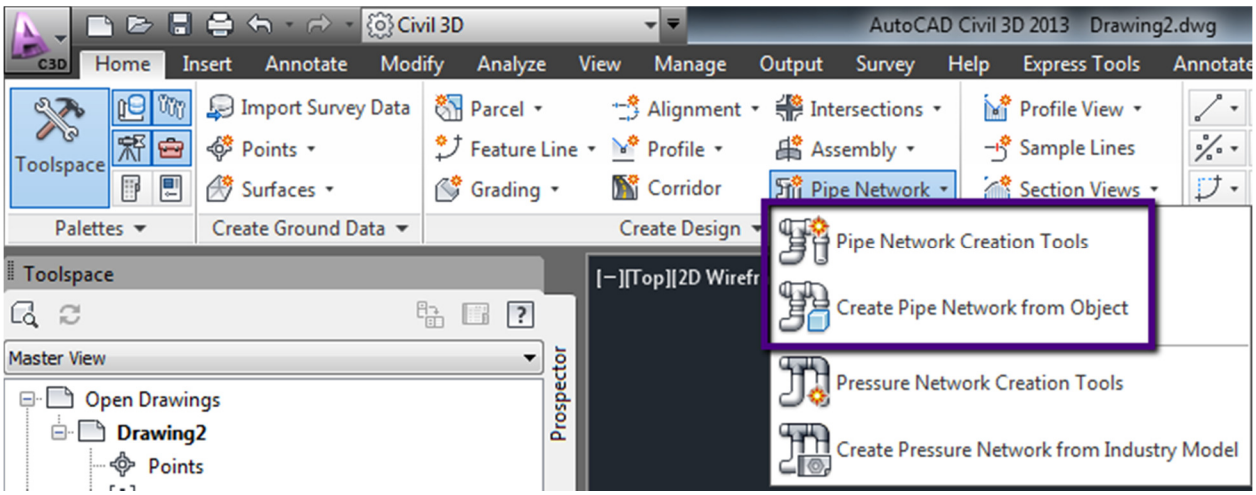
Civil 3D is one of, if not, the most powerful tools in the Suite to design your networks. Here you will find the ability to create and analyze your networks.

Bringing pipe data into Civil 3D probably has the most options out of all the products in the Suite. Of course Civil 3D is built on Map 3D so all the available Map tools such as MAPIMPORT and FDO are available. But since Civil has intelligent objects specifically for use in Civil 3D a lot more can be done design-wise when this data is converted. This can be accomplished with the IMPORTGISDATA command discussed more in depth in the Example Workflow section of this paper listed below.

Other options include LandXML imports which can take data from various different sources, including non-Autodesk products as it is an industry standard file format. LandXML also allows moving data back and forth between different versions of Civil 3D, which we all know can be a challenge sometimes. This can be achieved with the LANDXMLIN for import, and LANDXMLOUT for export.

Pipe Network Creation Tools

This option is best used when beginning a new design without any existing geometry already drawn. You will be able to select an alignment and surface, and more importantly any rules you have specified to apply to your network will be applied as drawn.



Create Pipe Network from Object

This option may be especially helpful if you already have the existing geometry, or are performing an as-built of existing conditions. The supported objects that you can create a pipe network from are as follows:

AutoCAD Objects:

- 2D Polyline
- 3D Polyline
- Line
- Arc
- Spline

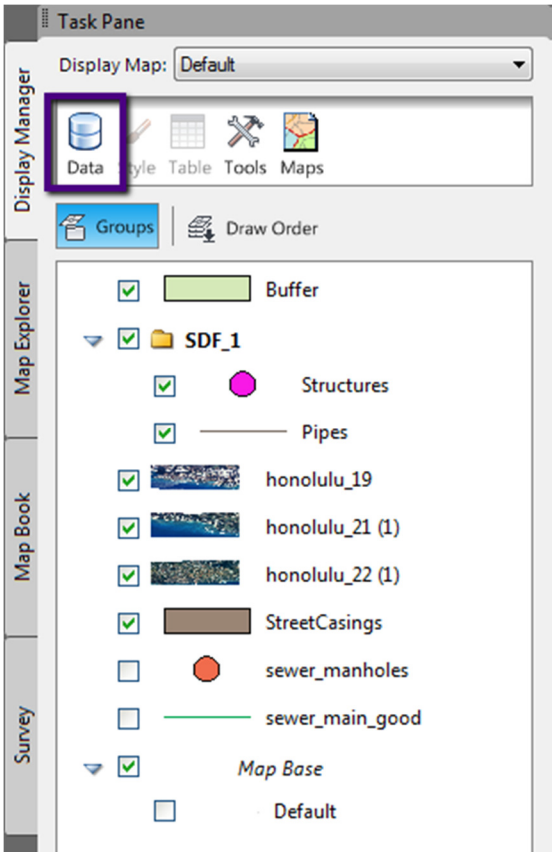
Civil Objects:

- Alignment
- Feature Line

This can be accessed from the Pipe Network dropdown in the Create Design Panel of the Home tab in the Ribbon, or by command line CreateNetworkFromObject.

Map 3D

Lending much of its functionality to connect to and edit GIS data to Civil 3D, Map 3D contains all the abilities to maintain and keep track of a specific areas pipe systems.



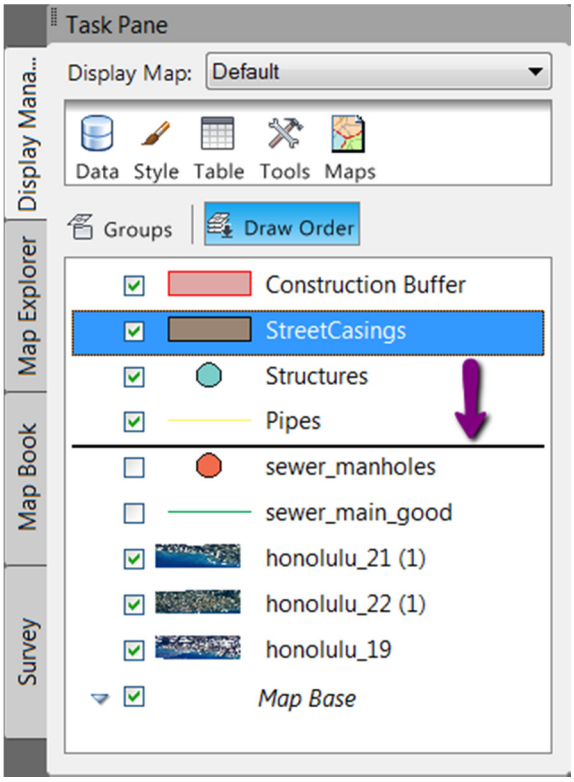
Much like was outlined above when discussing Infrastructure Modeler, Map 3D has the ability to connect to many different databases and also work with AutoCAD objects directly.

To get any sort of data into Map you can simply open a DWG file, use MAPIMPORT, and connect via a FDO connection through the MAPWORKSPACE.

By default the Task Pane should be loaded and docked on the side of the Map application window. It is here that most connections and control of display is made. From the Display Manager tab the little DATA button>CONNECT TO DATA will launch the FDO connections Data Connect dialog. There are many options available to connect to different types of data and databases.

To construct our model in Map 3D a series of connections will need to be made in order to get the model going. Ensuring that the raster files, SHP, SDF, and more are all set to the correct coordinate system will make quick work of constructing an accurate representation of what currently exists and what will be coming with new design.

Once all the connections have been made the styles can be controlled and draw order manipulated in order to display this data as intended. Considering there may be different layers of pipes, imagery, streets, etc. you will probably want them to display in the correct order so one can see all aspects. From the Display Manager tab>DRAW ORDER, this can be easily accomplished by simply dragging and dropping the different layers in the correct order.

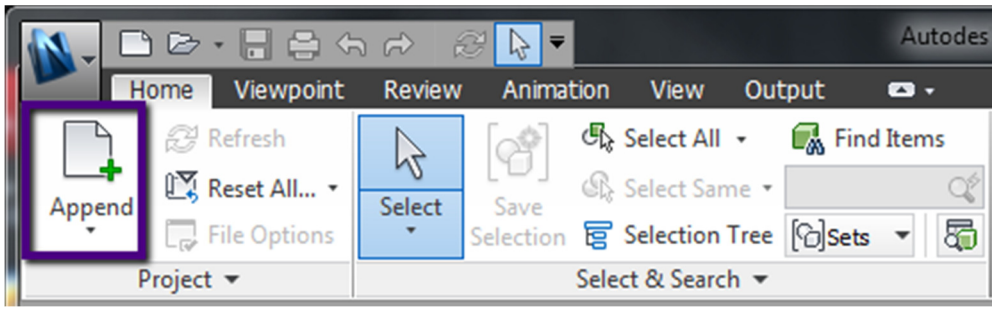


Also notice the check boxes by the different layers. Checking or unchecking these will also maintain the connection, but control whether or not they will be displayed.

Changing the styles and display of the individual elements is also rather simple. Double clicking on any one of the layers will launch the Style Editor, here the display color and other aspects of the object can be controlled. For example the Structures from a Civil 3D created SDF are displaying as circles, yet squares are desired with a color of red applied. Removing the circle and adding the square symbol, then changing the color selection to red will provide a preview of what it should look like in your model. This same procedure can be utilized for the pipes, roads, etc. to get the desired effect.

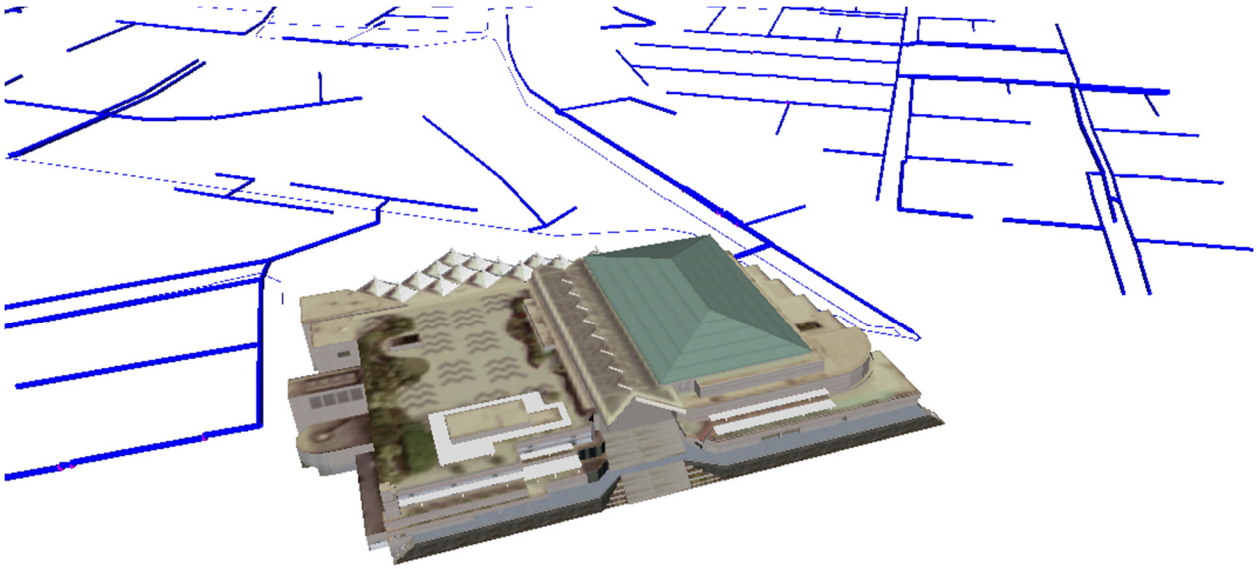
Navisworks

Although more popular with our Architectural applications such as Revit, Navisworks has the ability to import and perform some functions with exported data from Civil 3D. Navisworks allows you to bring all aspects of a project together in one and schedule accordingly.



Launching Navisworks you will be greeted with an “Append” option rather than a connection or DWG open found in the other products. Clicking APPEND will allow you to add a model from various different sources and file types. Anything from a RVT Revit model to a SKP SketchUp model, but we will concentrate of what can be exported out of Civil 3D and NWC. Exported out of Civil 3D with the command NWCOUT you can export most Civil objects to this format.

Once you have the NWC file you can append it into your Navisworks model. It will actually resemble what you had in Civil 3D. Panning and zooming around you can see the pipes and structures displayed. Now this is not as “pretty” as we had seen in AIM, but Navisworks really serves a different purpose. The key here is that you can import all aspects of your design for a complete view of the entire project. Have your building created in Revit, your site work and road design in Civil, your utilities in MEP, and so on.



Moving Data through the Suite

Example Scenario

Now that we have a good idea of how to get data in and out of the various products, let’s work together on a scenario that you may encounter when preparing data for a client.

We will assume that we have freely available data from local municipalities and have field checked the data for accuracy.

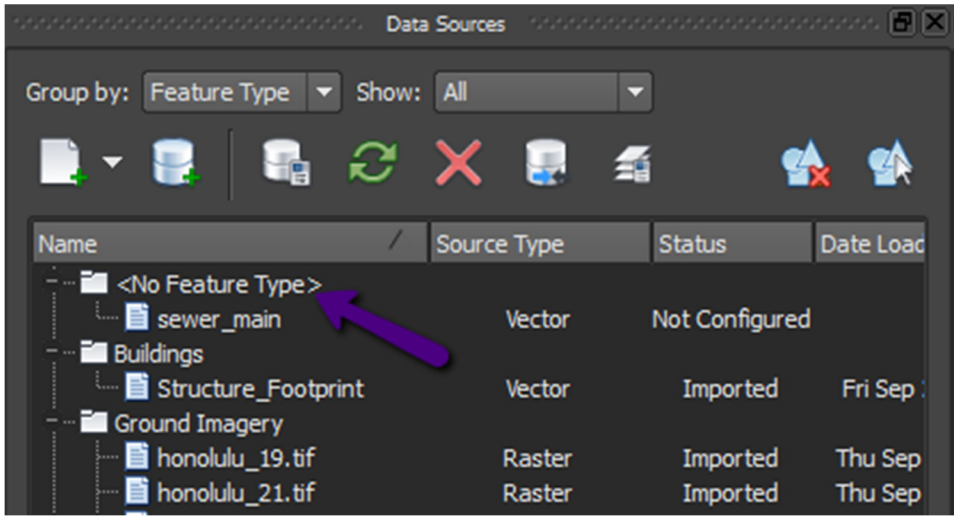
We have an open undeveloped city lot that needs a new storm sewer plan that will tie into existing infrastructure.

Proposal and Concept

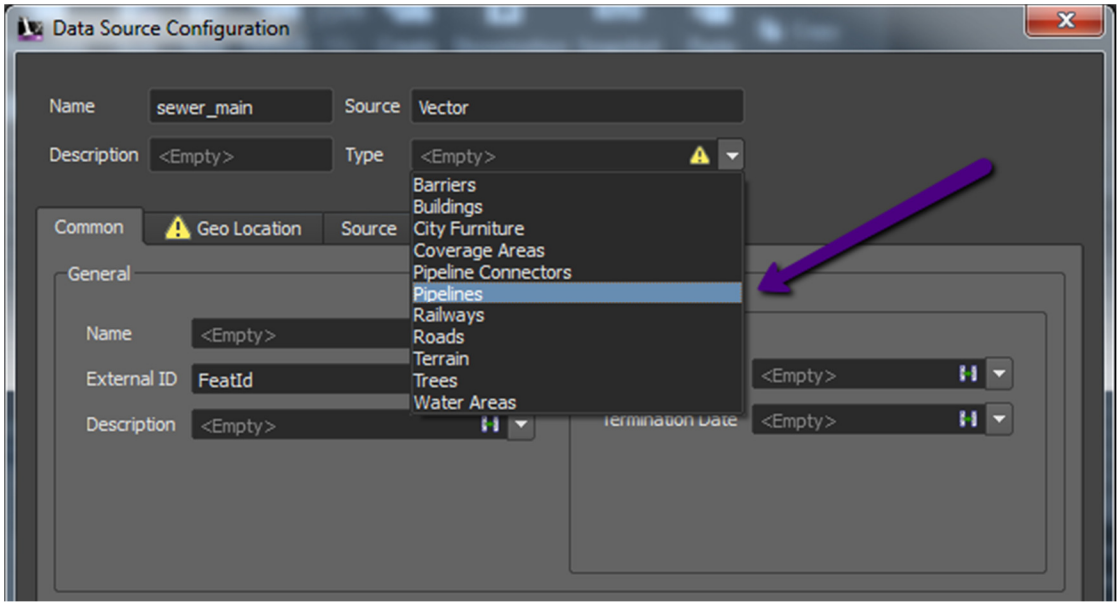
Beginning with AIM we will put together a great visually appealing presentation to the client by using free SHP data and imagery obtained from a State data warehouse.

Bringing in the surface first and draping the imagery next will give a good visual location of the new site. Next we can bring in the buildings and stylize them to get a good feel of how the surrounding area looks prior to the project beginning. Now that the base model has been established, the pipes and structures can be brought in. This is where the free SHP data comes in handy, with little to no investment and accurate model can be constructed.

First you will need to add a new data source, in this example we will select SHP. Browse to the appropriate file click OPEN. You will notice that the new data source will show as <No Feature Type> in the list along with the file name populated beneath. The pipe lines will also not appear in the model until it has been configured.

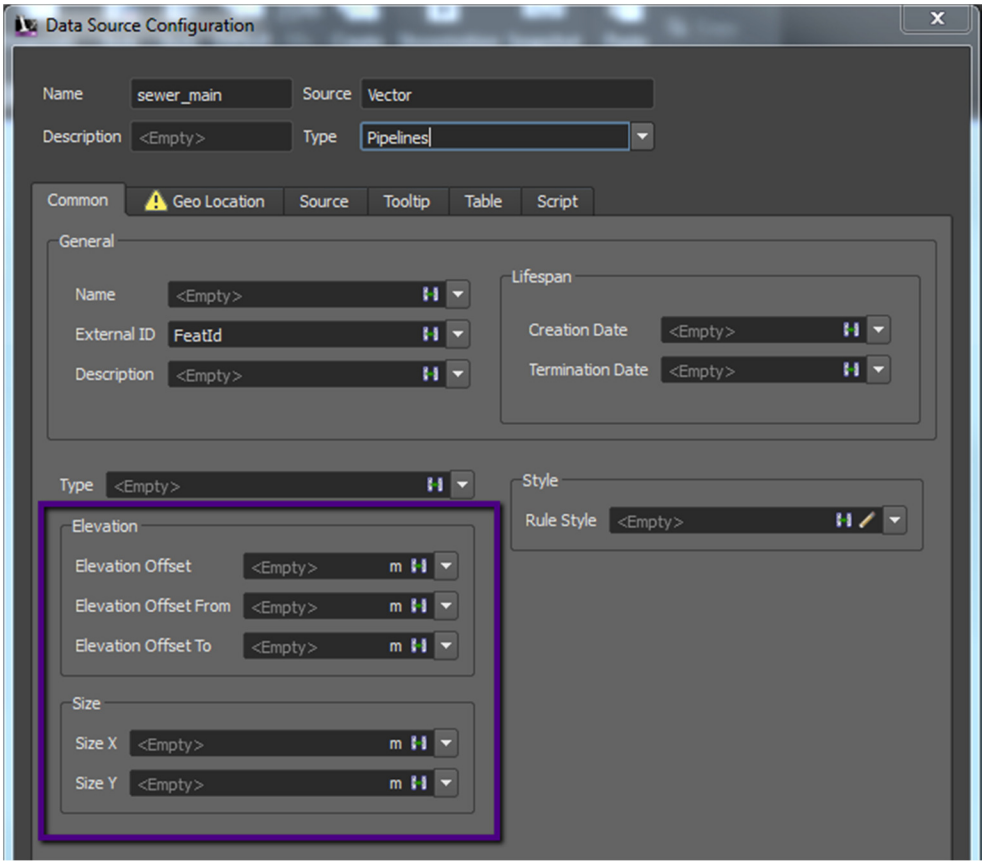


To configure the connection, simply double click on the entry and a dialog will populate. At the top of this dialog is where you can choose what type of feature this is, in this case select pipelines.



*This is very important regarding what type of feature that is selected, due to the fact that the following options in the Configure dialog will change based on this selection.

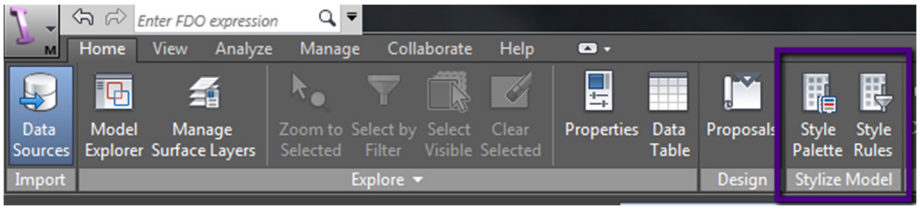
Once selected, you will notice all the new entries available under the COMMON tab. This is where we will assign the elevations to accurately represent our invert elevations. For the data displayed here, I found the best results where when I set the Draping Elevations (under SOURCE tab) to SET ELEVATION and the object data to UPINVERT. This seemed to provide the most accurate results. Working with other data I found that setting the “UPINVERT” field to the “ELEVATION_OFFSET_FROM” field and “DOWNINVERT” to “ELEVATION_OFFSET_TO” on the common tab, so this may require a little playing with the data in order to get the desired results.



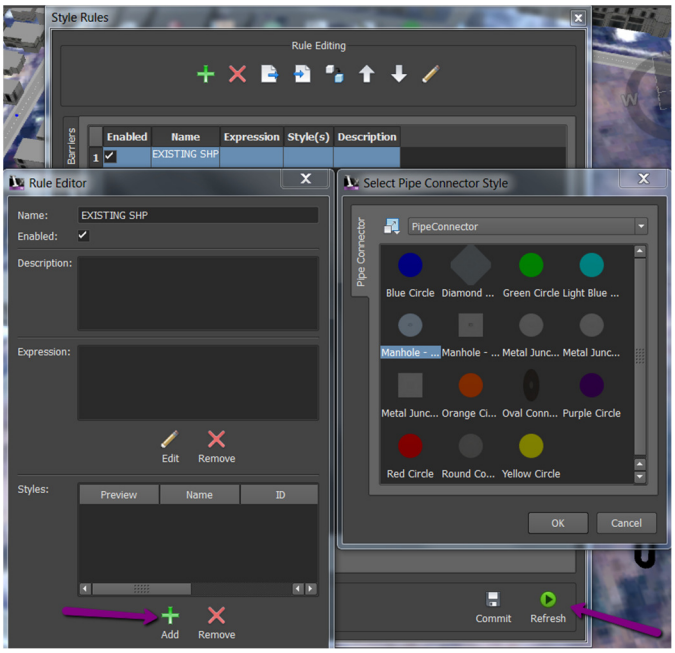
Next you will have to specific the correct coordinate system, in this case HARN/HI.HI-3Fa. All that needs to be done now is click Close & Refresh. The data will now process for a moment, and before you know it your pipes will display below ground.

Now that your pipe lines are in the model, now time to bring in the structures, or as AIM refers to them Pipeline Connectors, which we will select when configuring the connection. Following the same steps as above, will make the connection for the structures. Again we will need to specify the coordinate system and also map some of the object data from the SHP file to the appropriate settings in AIM. In the case of this sample data, the structures appear at the correct elevations when the Draping Options under the Source tab in the Configuration dialog are set to drape at object data INVERTELEV. Again, same as the pipes above, this took some testing to determine the best visual results.

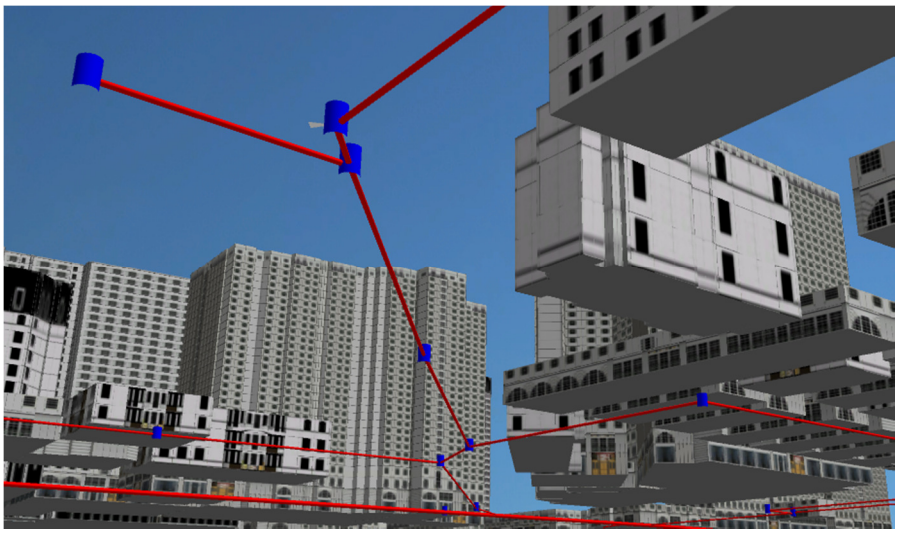
Once the pipes and structure have been brought in they can be stylized to represent how we want them to appear in the model. Since this is going to be the existing pipes, we will select a more “muted” display of the pipes and structures.

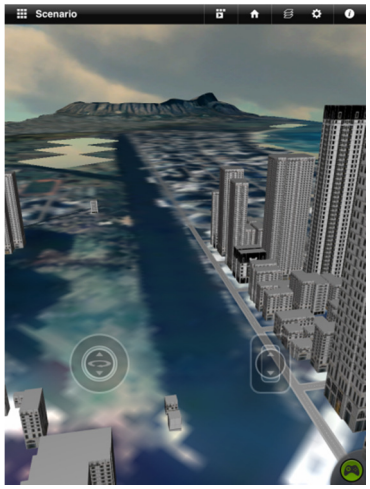


Starting from the HOME tab, under the STYLIZE MODEL panel, we will select the Style Rules button. Up pops the Style Rules dialog box. Here each feature will have its own tab to assign options to stylize. Since we are concerned with the pipes and pipeline connectors we will select these tabs.



Clicking the green “+” will allow the selection of a Style Rule, and assign a name for this new rule. In this case “existing” should be appropriate. Double clicking the new style will populate another dialog at which point we will be presented with another green “+” which will allow a selection of one of the stock styles. Here you are presented with the stock style available, and the closest to what is in the ground on site is the Manhole – Round. Clicking OK send the selection to the Rule Editor, OK again gets back to the Style Rules. To apply the Style click the little green Refresh. Do the same thing to the pipes or pipeline connectors and the pipes will display as desired.





Now that the pipes and pipeline connectors have been added to the model, you navigate through the model, moving through the streets and dipping below and above ground to see where the existing network lies. A quick scenario can also be created to illustrate the locations and uploaded for mobile viewing.

Although the first step of the workflow is complete, the model can be revisited down further down the design process to get a real world feel of potential locations and impacts to the surrounding areas.

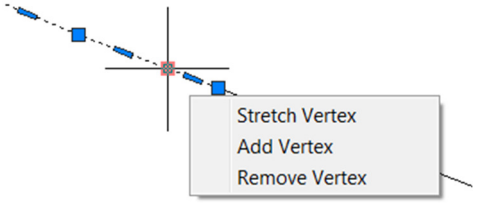
Planning and Design

Now that a realistic model has been constructed, the same data used to create that model can also be used to plan and design the proposed drainage lines that are necessary for this new construction.

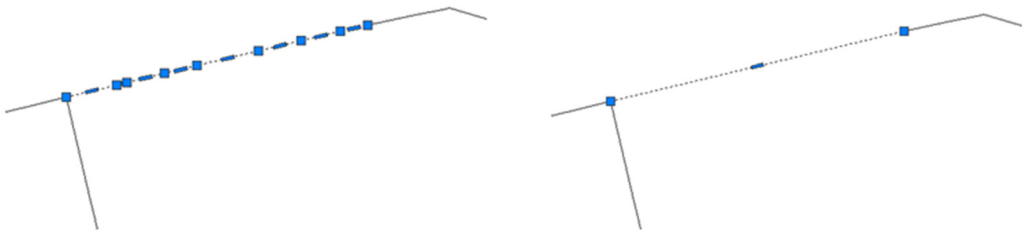
First let's get that GIS SHP data into Civil 3D so we can design the new network that will tie into the existing infrastructure. Introduced in the 2012 release of Civil 3D is the ability to directly import a SHP file into Civil 3D and create a pipe network out of the data. Previously to do this you would have needed to do a lot of handle drafting and editing of invert elevations after the fact to accomplish this.

First let's begin with the data. As with anything, the end result is only as good as what you put in. If the original GIS data has the correct object data associated with it, (inverts, pipe size, materials, etc.) you are going to get a better end result. Additionally you will also need to take into consideration the amount of vertices that these pipe lines have in them. If the pipes have many vertices between actual pipe start and end, Civil 3D will place a null structure at each one of these vertices. This may be acceptable if the pipe really does end there, but edits may need to be made prior to import as well as after the fact.

If the data has excessive amounts of vertices, you can easily edit these with a few different options. Beginning with the new AutoCAD functions in which you can hover over the vertex and it gives an option to remove the vertex. Next is the most efficient option, using the Map Cleanup functions of the MAPCLEAN command. The Simplify Objects option will make quick work of the extra vertices. Finally you have the option of using the WEED command, which you may recall using with feature lines, but it works with polylines as well.

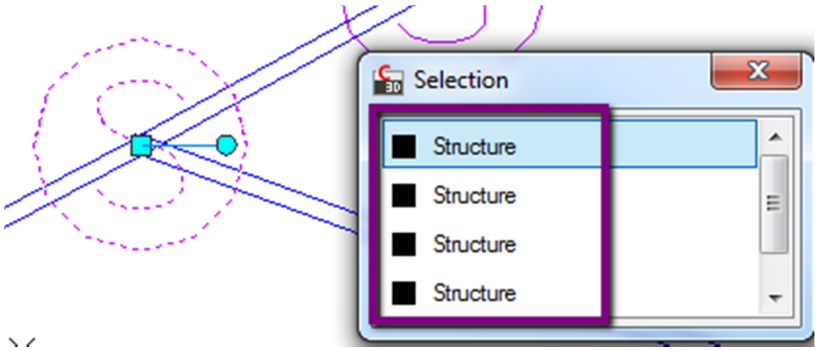


These options make quick and easy work of the vertexes and will preserve the proper inverts per the original object data. If these are really unnecessary vertexes, then removing them will not alter the slope or invert object data attached to the objects, everything will remain intact and correctly import. Please note that to edit this data in one of the above options; it will need to be imported via MAPIMPORT, cleaned up, and then MAPEXPORT back to SHP.



As mentioned earlier we created the model in each separate product so connections have been made for various other features for these city blocks. Also added through the Map Task Pane is the sewer main and manholes for reference. Beginning from the IMPORTGISDATA command or from the Ribbon INSERT tab>IMPORT pull down you can initialize the command. This launches the Import GIS Data Wizard/dialog. Much like the CREATESURFACEFROMGISDATA command or connecting to the data through Map Task Pane you will be asked to connect to either a single SHP or a folder containing SHP files. This is where you need to start thinking about what edits you will be making after the import.

If the folder is selected that contains both the pipes and structures SHP file, the structure will be created at every pipe ending in addition to the actual structure being added. So in most instances there will be duplicate and sometimes more (depending on the amount of pipes coming into the structure) structures created. This could cause quite the headache to determine the correct structure, created from the actual SHP data, and the one that was put there by Civil 3D on account of the pipe start or end.



This can be addressed with one of two options. First, if the pipe and structure SHP files are selected and imported separately, then you can address these duplicate structures prior to importing the structure SHP file. Upon importing the pipe SHP, the pipe start and end structures will be automatically created. These can be deleted all at once by selecting the network>EDIT PIPE NETWORK then selecting the Pipe Network Vistas (Panorama) option. In Panorama simply select the Structures tab, then select all of the structures in the drawing, right click>DELETE. This will leave the import with nothing but pipes, and no structures.

Moving on to import the Structures SHP, it can now be done without the pipes included so this will strictly import the structures only. When the structures are in the drawing, you will notice that you cannot import

into the same network. The Civil 3D command MERGEPIPENETWORKS will make quick work of this issue; and after merging you will be left with a single pipe network containing both pipes and structures with no duplicates.

> ***IMPORTANT NOTE**: If imported separately these pipes and structures will not be connected entities. The connections will need to be made manually if this is what is desired.

The second option would be to select the folder that contains both the structure and pipe SHP files. As mentioned, the "good" structures and the duplicate null structures will be imported into the drawing. A benefit of using this method is that the pipes and "good" structures will be automatically connected, and not require the extra steps of merging the two networks and connecting the pipes and structures together.

To address these null structures, you have the option of setting the null structure style to a "no display" so they will not be visible in the drawing or design, or simply select and delete them from the Pipe Network Vistas (Panorama) much like the single file import method described above. This method will require some shift selecting of the null structures in order to preserve the "good" structures created directly from the SHP data. After the null structures have all been removed from the network (or hidden) the end result will be a complete pipe network with connected parts, ready for the design.

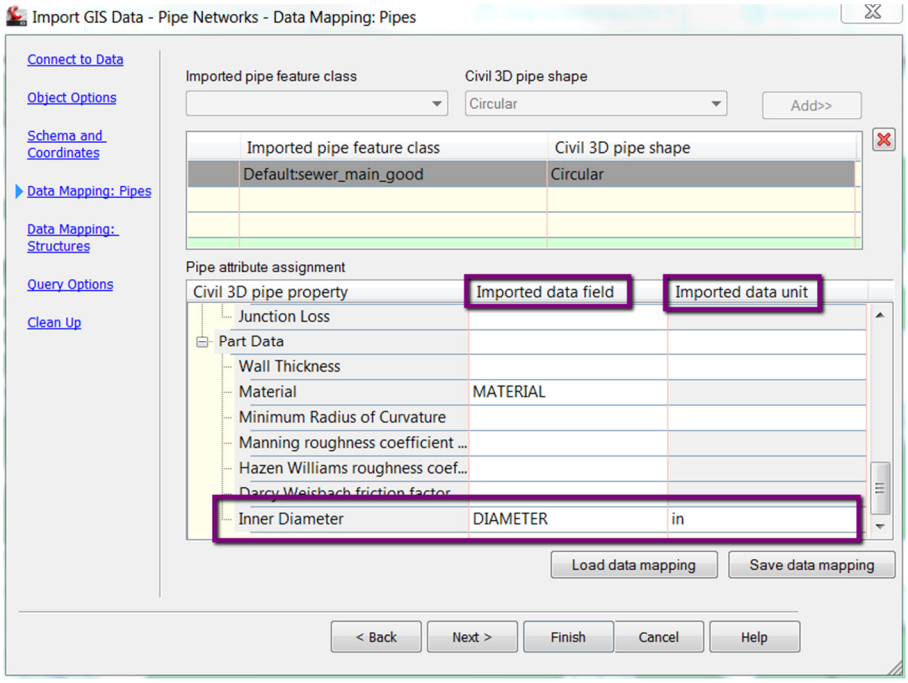
After the connection has been established, the ability to move throughout the wizard has been enabled. Moving on to the Object Options, the network name, parts list, surface, alignment, and labels can be selected.

> ***IMPORTANT NOTE**: Regarding the Parts List selection, you are going to want to ensure you have parts created and/or modified to properly represent what information in contained in the SHP file. For example the SHP contains Ductile Iron pipes. You are going to want to ensure you have Ductile Iron pipes added to the parts list to ensure the parts will match up.

In the Schema and Coordinates section, the ability to select which coordinate system and schema is used, per the Civil 3D HELP:

- Schema: Specifies a GIS schema, a metadata file that contains descriptions of data types found in a datastore.
- Feature Class: Specifies the GIS feature class.
- Coordinate System: Specifies the coordinate system for each feature class.
- Restore the Original Coordinate System: Click to restore the feature class coordinate system to the setting specified in the SHP file.
- Drawing Coordinate System: Displays the coordinate zone assigned to the current drawing.

Now onto the Data Mapping of both the pipes and the structures (which arguably could be the most important step of the process). Here the object data associated with the SHP objects is matched up with parameters from the Civil 3D parts. Depending on the original SHP data, you may have a lot of available Imported Data Fields or there may only be a few available. The most important ones would obviously be the field that actually will be drawing the pipe networks. Fields like inverts, materials, slope, inner diameter, rim elevation, sump elevation, etc. will be critical to the successful import of this data.



Beginning with selecting the Imported Pipe Feature Class, then the Civil 3D Pipe Shape. The pipe shape selected here will correspond with the parts lists selected in the Object Options. Now the properties from the object data must be matched up with the part properties from the Civil 3D Parts List.

At this point it is helpful to connect to the same SHP files you will be importing so the object data can be viewed through either the Properties palette or the Map Data Table as this will ease the process of mapping the data. This will only need to be done once, since the mapping data can be saved and loaded for later use as a XML file.

***IMPORTANT NOTE**: If you are going to be saving your Data Mapping for later use, you must save an XML file for both pipes and structures. They will not be combined into one XML file to be loaded at a later date. These files should also be named appropriately as to not cause any confusion.

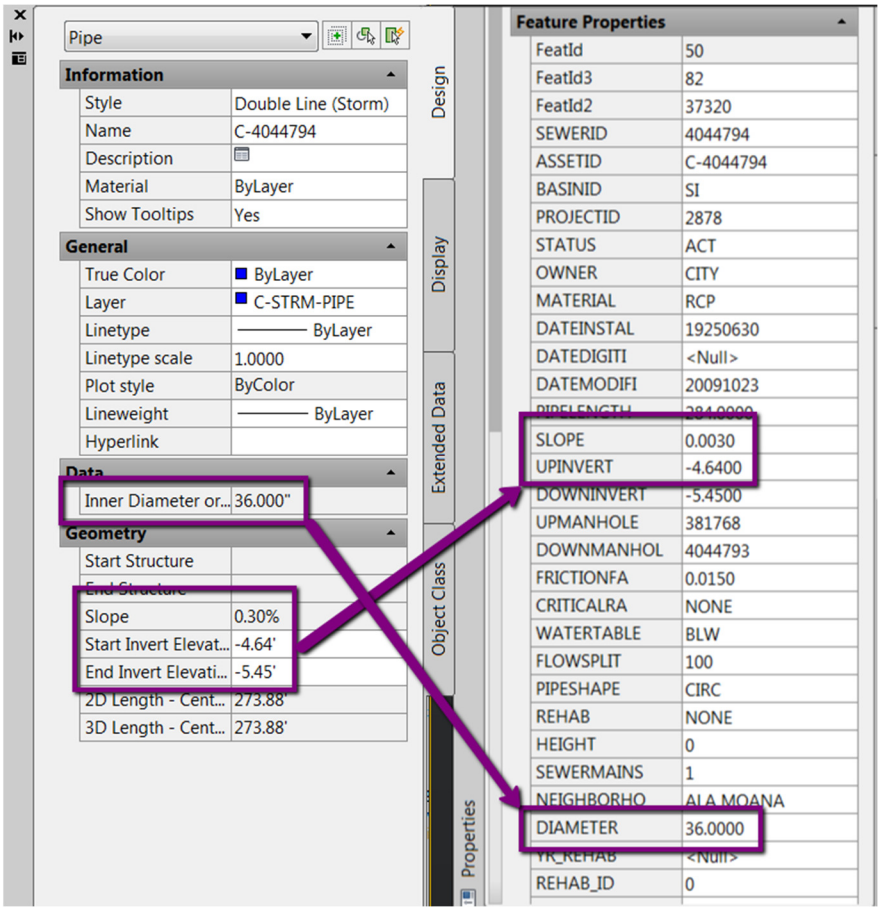
The same process will need to be followed for both the pipes and structures. However along with matching the properties, the units will also have to be set as well. This is an important step in the process as if this unit is not set here than the Civil 3D will take the first pipe size in the specified parts list and assign that to all the parts.

After all attributes have been assigned to the appropriate object data, move on to the Query Options. If you are prompted by the “No Shape Attributes Assigned” dialog, this may be due to the fact that a necessary attribute was not matched up and you may need to go back and make the correction. Moving through this dialog; next is the Query Options. The Query Options add the ability to filter the imported GIS data to a specified area in the current drawing. The options are Import All, Basic Query, and Advanced Query. The Import All option is exactly what it implies (and will be used in this example), however the Basic Query provides a few options to filter the exact data to import, by using either a boundary type or selection type. Advanced Query definition dialog is used to create a custom query from mathematical expressions.

Lastly is the Clean Up option, which will attempt to clean up the SHP data upon final import, and is best described by the Civil 3D HELP:

- Snap Pipe and Structure Tolerance: Specifies the tolerance value for snapping the end of a disconnected pipe to the nearest structure. If the end point of a disconnected pipe is less than or equal to the tolerance distance from a structure, the pipe will be connected to the structure automatically.
- Discard Unlinked Pipes: Specifies that disconnected pipes are not imported.
- Discard Unlinked Structures: Specifies that disconnected structures are not imported.

Upon making all of these selections, the last step is to click FINISH to import the pipes. A status dialog will display the progress of the command, then the pipes will display per the options selected in the wizard. After the pipes have been imported a quick view of the properties palette reveals that the new Civil 3D pipe network has been imported successfully and correctly.



Now that the pipes are in the drawing and have been converted to Civil 3D pipes and structures, the actual layout and design can begin. Again connections can be made through FDO to connect to the SHP files that represent the existing roads and buildings, and even connect to the imagery to best understand where the new pipes are going.

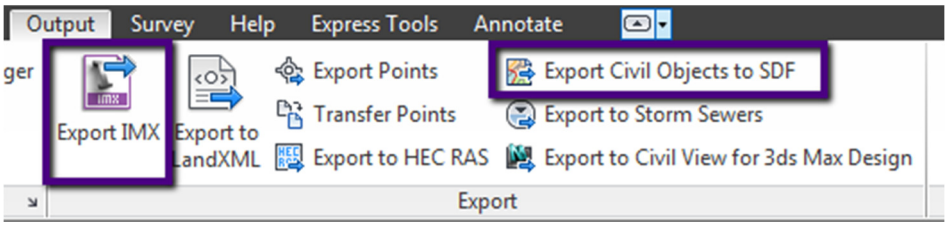
There are two options to start designing the new network, one create a new “propsed” network, and the other being add to the existing network. Selecting a pipe or structure from the existing network will populate the contextual ribbon and the EDIT PIPE NETWORK option will be available for selection. Selecting this will launch the Network Creation Tools toolbar and from here you can select from the specified parts list what type of pipe and structures you would like to draw.

Now assuming there has been an onsite topographic survey or something comparable, there most likely will be a surface that can be used to design your network using pipe and structure rules. If not the network can easily be drawn in at which point things like inverts, rim, and sump elevations can be tweaked after the fact to accurately represent the desired design.

Simply clicking and placing structures will draw pipes as the design requires. After the pipes have been drawn, selecting the individual pipes and structures will allow you to bring up the objects properties in which the various elevations can be edited to reflect the desired output.

Now that the new proposed site’s drainage system has been drawn, it can now be moved on for some additional planning and analysis. But first, let’s export the new pipes out to other usable formats later on doen the design line.

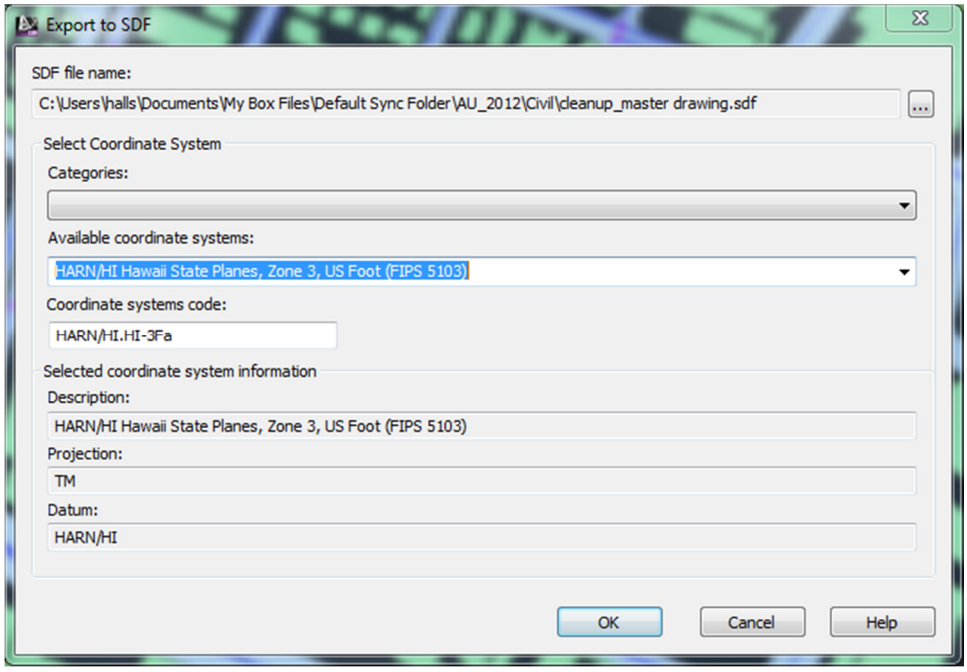
From Civil 3D we can export to many different products within the Suite. NWCOUT will get the Civil objects out for use in Navisworks. Simply typing the command will launch a “saveas” type dialog in which will export a NWC file which later in the process we will be importing into Navisworks.



Next we will want to export out the pipe networks via IMX. This is found within Civil 3D via the OUTPUT tab>EXPORT panel or the IMX_EXPORT command. Again running this command will populate a dialog that will write out a IMX file for import into AIM.

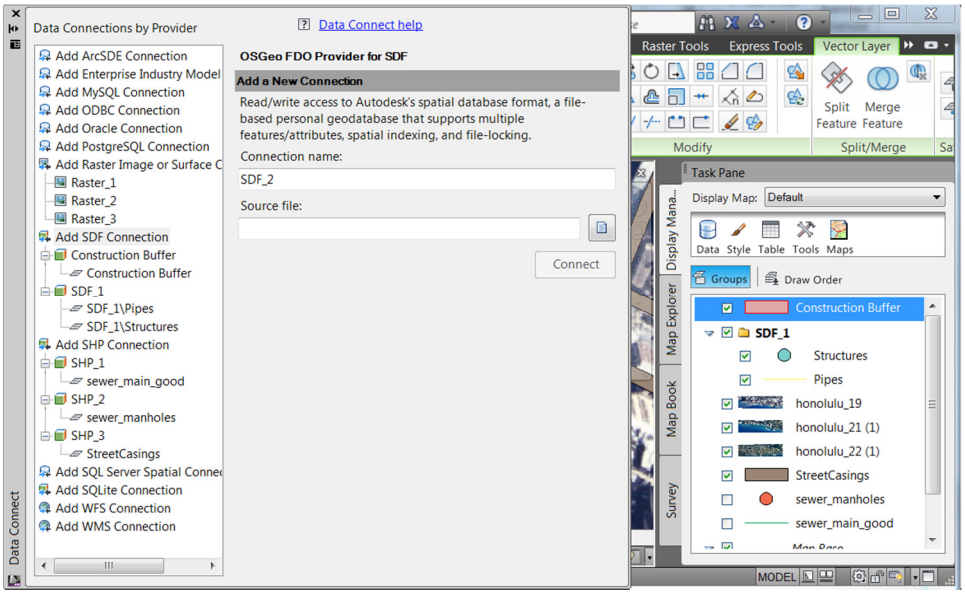
> **NOTE**: I found that this file format presents the best results in AIM when dealing with pipes. All settings are pre-populated in the configure dialog and the pipes and structures come in very accurate. When working with pipes specifically it may be better to bring them into Civil 3D via GISIMPORT and “clean them up” prior to importing them into AIM.

Also creating a SDF will be useful for use in Map 3D. From the same panel and tab as the IMX_EXPORT you will find the Export Civil Objects to SDF or EXPORTTOSDF. Running this command will populate a different dialog. Specify the coordinate system and file name location here, OK will write out the SDF file.

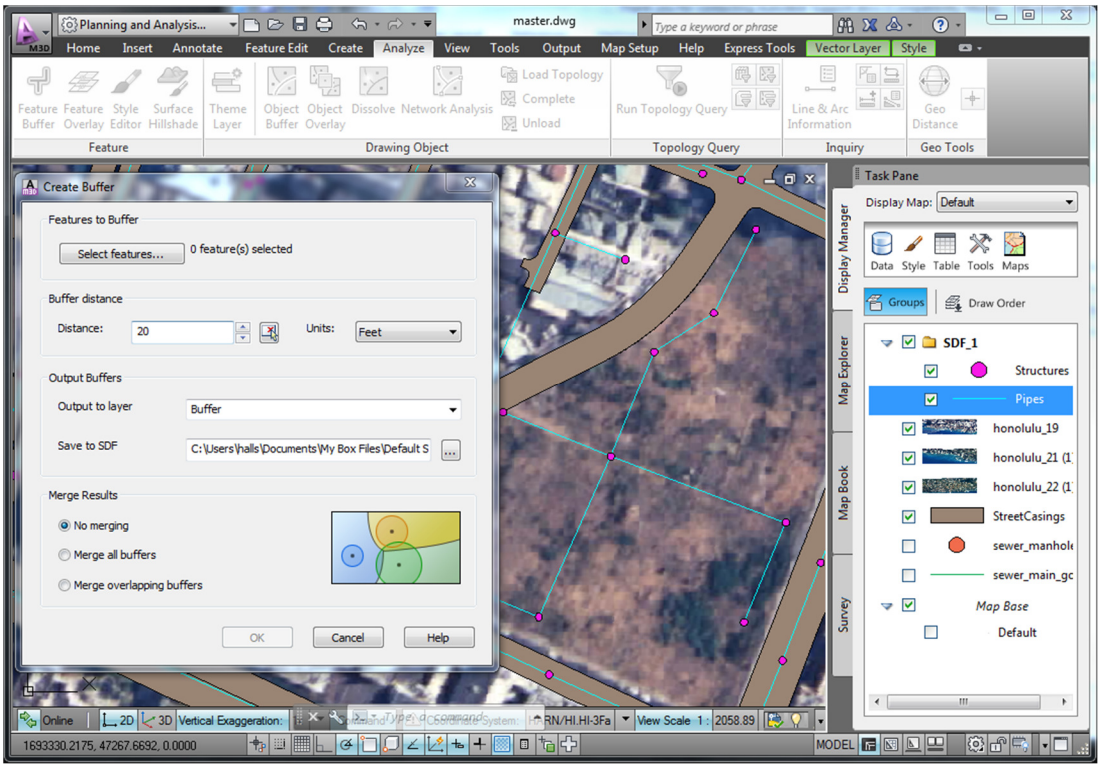


If further analysis of the network is needed it can now be exported to either Storm and Sanitary Analysis or the Hydraflow applications via STM, which are also on the OUTPUT tab>EXPORT panel.

Opening Map 3D we will again make all the connections as we did in AIM. Beginning from the HOME tab> DATA panel> CONNECT button, or from the DATA button within the Map Task Pane Display Manager tab will launch the Data Connect dialog with the FDO providers. Here we can reconstruct our entire model for use in Map. Adding the SHP connections for the pipes, structures, buildings, road casements, and images will give a complete picture of the site with SHP data. Remember, we also have our pipes in SDF form from the Civil 3D export as well.



Now that we have our pipes in Map 3D we can illustrate an example of an analysis to make sure we have the desired setbacks around the proposed pipes in order to start construction. Using Map 3D's buffer tools will make quick work of this.

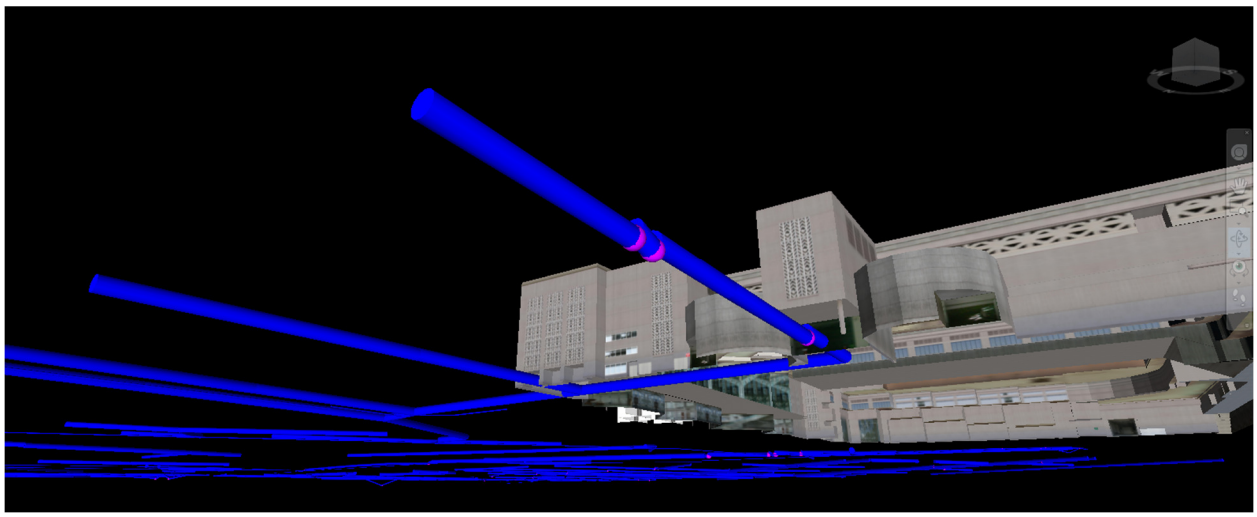


Starting at the ANALYZE tab and the first button available on the FEATURE panel is the FEATURE BUFFER. Clicking this will launch the dialog so the parameters of the construction buffer can be defined and later visualized. Selecting the individual feature, all of the proposed pipes, then specifying the distance of the buffer. Next we can specify what layer it gets created on, and then the path to save to SDF. This makes especially useful for a Suite based workflow because this SDF can them be imported into Civil 3D and also into AIM for visualization. Moving on, select the Merge All Buffers option as we want this to be one fluid object as a result. Clicking OK generates the SDF and the new layer populated in the Display Manager. At this point changes can be made to the style to get the desired display.

Since we have models built in all products this new buffer now in SDF form can be easily imported directly into Civil 3D to see how it impacts surrounding utility locations and new design. It can also be attached in AIM and sent to the cloud to use on site as well as to get a real world feel on your desktop.

Pulling it all together

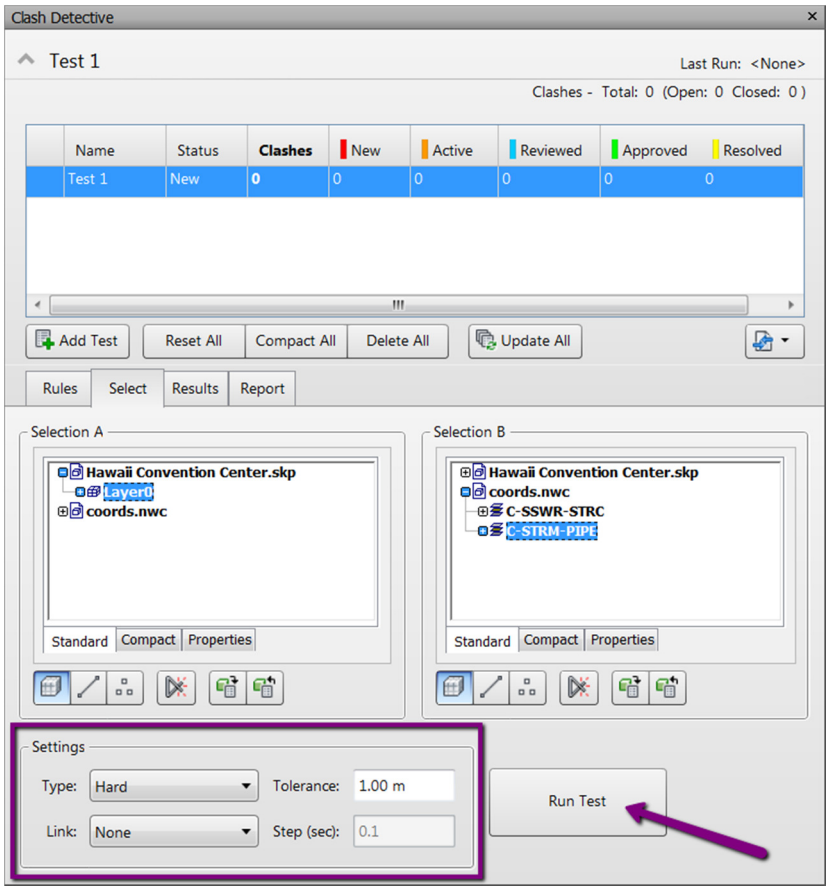
Now that a design has been completed, and any analysis has been done, all aspects of propsed construction can be pulled together in Navisworks. The AIM model started earlier can also be updated to include all proposed designs.



This leads on to something that is particularly useful in Navisworks, the Clash Detective. Although a type of clash detection is available in Civil 3D via rules and Interference Checking (discussed above), this will allow you to check your pipes and structures against other models imported into your Navisworks model. For example you wouldn't want your sewer line being built going straight through your buildings concrete footing, Clash Detector can help identify the issue so you can address it in your designs.

I pulled in a model of the Hawaii Convention Center and made sure it was placed correctly to help demonstrate this functionality. The original pipes have been brought into Map, cleaned up, then imported into Civil 3D using IMPORTGISDATA as discussed in the Civil 3D section discussed above. Although this is not a likely real world scenario, it uses readily available data to illustrate this function quite well.

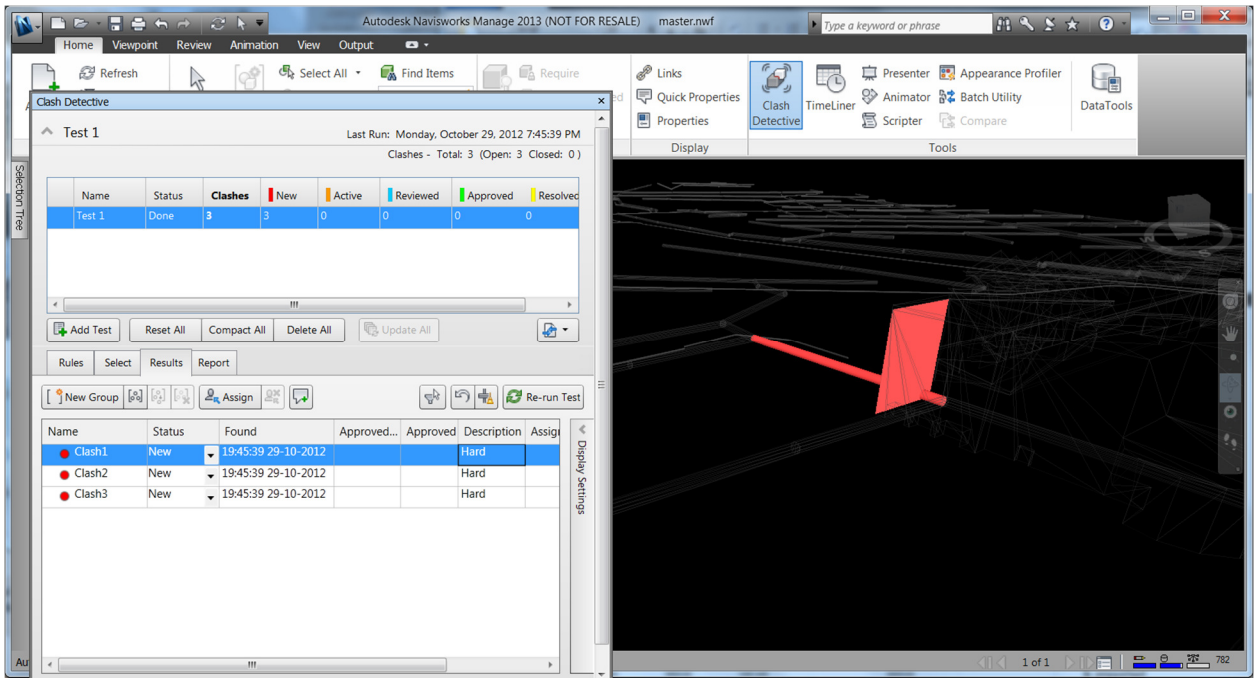
After appending both the SKP and NWC from Civil 3D you can see the pipes and model fit quite nicely together, except for a portion of the rear building. To get a closer look at this conflict, we can quickly run a clash detection test to pinpoint the points that need to be addressed. This is very useful considering you could be pulling in data from multiple different programs.



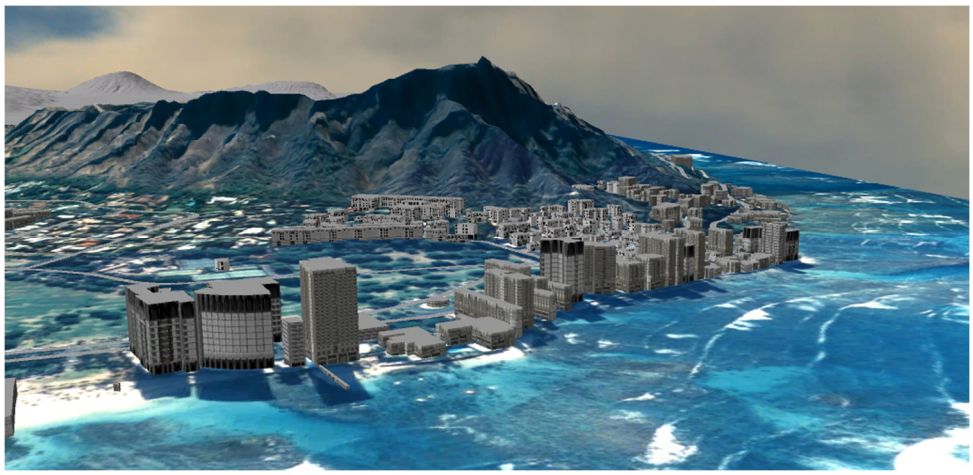
Launched from your Home tab under the Tools panel it will be your first option. A dialog will populate and in the upper right corner you will find ADD TEST. Clicking this will now move us onto entering the parameters of this test. All objects in the model will display with the Civil 3D objects displaying a subset of layers, then the objects listed below them. If other objects such as a SKP SketchUp file will also display layer with a subset of Face Set and Components. In this example we will select the entire pipe layer and the entire SKP layer.

After selecting this you can review some options under the Rules tab in which you can specify what items can be ignored in the test. Under Select tab, besides the comparing layers we already selected, there are some settings to specify. Specifically the tolerance, this can be fine-tuned to either ignore or included items that may or may not want to be included into the overall test. The Results tab will be populated after the RUN TEST button has been pressed, and lastly the Reports tab allows an output report for documentation.

Selecting the RUN TEST button will reveal the found clashes based on the selections made as noted above. In this example we find 3 separate clashes. Selecting each one will zoom to the clash to visually inspect it. There are also options to update the status, date found, approved/disapproved, and also can assign the task to someone. This can be very useful to keep track as most likely the person that built the Revit model did not also design the pipes or corridor. Assigning these tasks and keeping track can help streamline the entire process so it is known who owns the task and can be addressed accordingly.



Now that everything has been designed, analyzed, checked against surrounding designs, we can come full circle and move everything into the original AIM model. Specifically with pipes and most Civil 3D objects, I have found that IMX files work best when importing them into AIM. Since we already created an IMX of the proposed design when the pipes were originally drawn, simply creating a new data source will make quick work of this. The great thing about IMX data is all the information is already mapped out and ready to go. Once this is imported the model will now be complete and ready to show off!



Links and Additional Resources:

Blogs:

http://atlandsend.typepad.com/

http://beingcivil.typepad.com/

http://bimontherocks.typepad.com/

GIS data used in this paper:

http://hawaii.wr.usgs.gov/oahu/earthdata.html

http://www.soest.hawaii.edu/coasts/data/oahu/pdcimagery.html

http://gis.hicentral.com/