Advanced Customization of Pipe Networks for AutoCAD Civil 3D

Joel O'Connell – Civil CAD Manager – Paradigm Design

CV5088   Do you wish you could make your pipe networks do everything you think they should be able to do? Are you frustrated with the confusing Part Builder interface? This class will dive head first into everything you need in order to create custom pipes and structures, including Part Builder, custom XML data, AutoCAD Civil 3D software parts lists and styles, and custom labels and tables. We will cover the intricate coordination between the different file types that are used, and we'll discuss what each one is specifically for and where to make the appropriate edits. We will go into setting up your templates to use custom parts lists, pipe and structure styles, and a multitude of labels and tables. This class is designed for advanced AutoCAD Civil 3D users who already have a fundamental understanding of the workings of pipe networks.

Learning Objectives

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

- Navigate the Part Builder interface efficiently

- Comfortably edit XML part and catalog files

- Build and utilize custom part lists for pipes and structures

- Add labels and tables using custom data

About the Speaker

Joel O'Connell has been using AutoCAD software products for over 15 years, and he has been using AutoCAD Civil 3D software from its inception. Joel has done production work for various civil engineers and surveyors, and this experience, coupled with his experience of being a self-employed provider of product technical support, means that he brings a unique perspective to the needs of the end user. Joel is currently an Autodesk Certified Professional in AutoCAD Civil 3D 2014 software, and he's a first-time presenter at Autodesk University. Currently working at a multidisciplinary architecture and engineering firm, Joel is responsible for the AutoCAD Civil 3D software standards and workflows, and he works with regional and national clients on a wide array of projects.

email: JOConnell@ParadigmAE.com

Autodesk forum ID: sirjoelsph

Introduction

What this class will cover:

- Examining the file structure and files that make up the parts catalog
- Examining the Out Of The Box (OOTB) pipes and structures
- Copying OOTB parts to make your own custom parts
- Adding custom parameters to pipes and structures
- Using custom parameters for labels and tables

What this class will *NOT* cover:

- Editing the geometry of existing parts in Part Builder
- Building custom structures with Part Builder

How to navigate this handout:

▲ When you see this symbol, it will include instructions where to find the specific feature in Civil 3D.

Italic text will show you file paths to select or navigate to: *"C:\ProgramData\Auto…"*

<u>Underlined text will be web addresses for important references.</u>

Disclaimer:

This is an advanced level class; it is assumed that you have a very good understanding of how the dynamic nature of Civil 3D works, and how to navigate around the interface. In order to cover the intended topic in enough depth, I will not have time to go into detail about peripheral topics. If you get lost at some point, please bear with me as we forge on, and we should have time for questions at the end of the class. If you are going over this material after Autodesk University and have questions, please feel free to contact me or to post your questions on the Autodesk forums. The forums are a great place to get your questions answered and to interact with other Civil 3D users.

<u>forums.autodesk.com/t5/AutoCAD-Civil-3D-General/bd-p/66</u>

Everything in this class will be done using AutoCAD Civil 3D 2014 SP2. In most cases, using an earlier version of Civil 3D should be fine. Unfortunately at the time of this writing, it is not possible to do some of the custom parameters and labels in Civil 3D 2015. Everything in this class will also be done using US Imperial parts and structures. If you are more accustomed to the Metric System (why can't we all just get along?) you should have no problem doing everything shown here with the Metric Pipes and Structures. I could not find any discernible difference between the two catalogs, other than the available part sizes.

Pipe Network Catalog within Civil 3D

Let's take a close look at what is provided for you to use with Civil 3D. There is quite a lot in Civil 3D if you start diving into it. There are also some discrepancies with the parts at which we will take a look.

First – where do you look? If you're using the default part catalog that came installed with Civil 3D (which we will be using as reference for this class) then it will be on your local C: drive. If your CAD Manager or Network Administrator has you set to use a company standard catalog, then it will most likely be on a network drive. In order to find out which one you are referencing, take a look at the path set in Civil 3D.

🔺 Home Tab – Create Design panel drop down arrow – Set Pipe Network Catalog
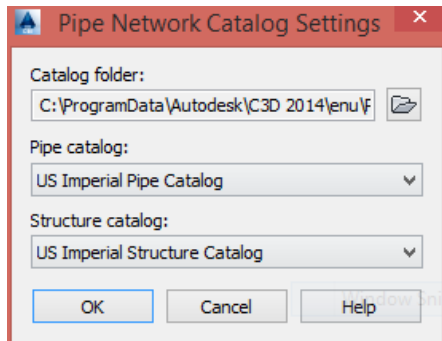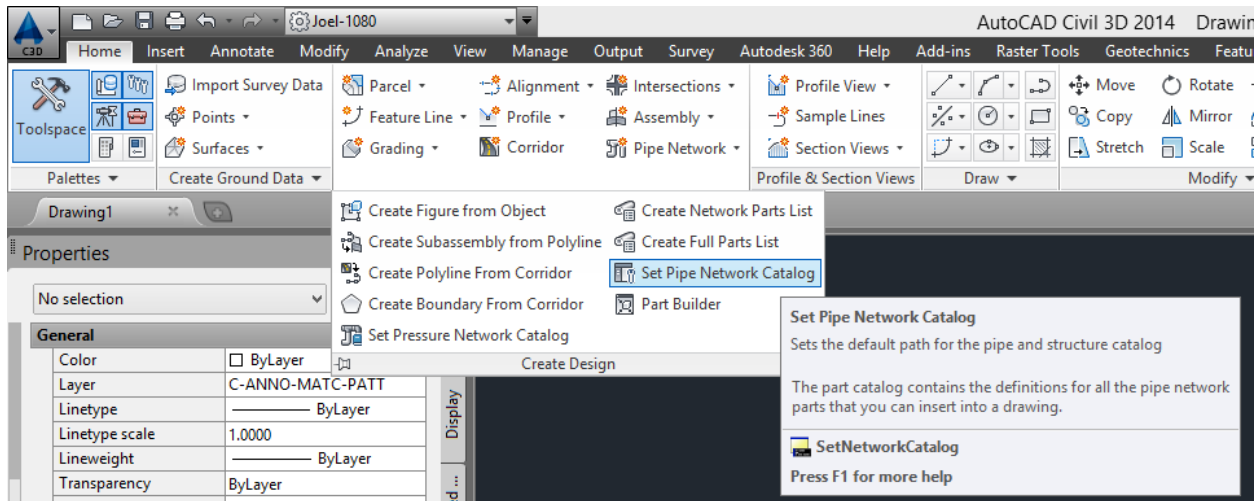
The Catalog folder path is where your part catalog is physically being stored. The default installation path for Civil 3D is located at *C:\ProgramData\Autodesk\C3D 2014\enu\Pipes Catalog*. When changing this directory, make sure you select Pipes Catalog and do not go one more folder deep into one of the US Imperial folders. The default only has US Imperial and Metric catalogs, so select the appropriate one. Once you get into customizing, you will want to have your catalogs at a network location where everyone in your company can access them. You can also create your own catalogs to access from this drop down, or simply add to one of the provided catalogs.

Part Builder

I am sure some of you have wandered into Part Builder at some point already and felt overwhelmed by how much you did not recognize. The Part Builder environment is set up very differently than regular AutoCAD. Instead of being able to just draw lines and circles to represent something, everything has to be modeled in a parametric manner using work planes, special geometry, specific constraints, and the applicable dimensions. This class will not go into any detail on how to model new parts or modify existing ones using Part Builder. I have included a reference section at the end of this handout that has some

very good resources from other people who have had some success in this type of work. For this class, we will only be using Part Builder to make some simple copies of parts to customize and to modify some Model and Size parameters in order to add more sizes to our available parts.

Let's go ahead and go into Part Builder just to get a look around and see what we will be working with later. Part Builder is right below where we clicked before to set our Pipe Network Catalog.

🔺　　Home Tab – Create Design Panel drop down arrow – Part Builder

The first thing that will come up is the Getting Started – Catalog Screen. You will want to pick which pipe or structure to work with from this screen and then click the
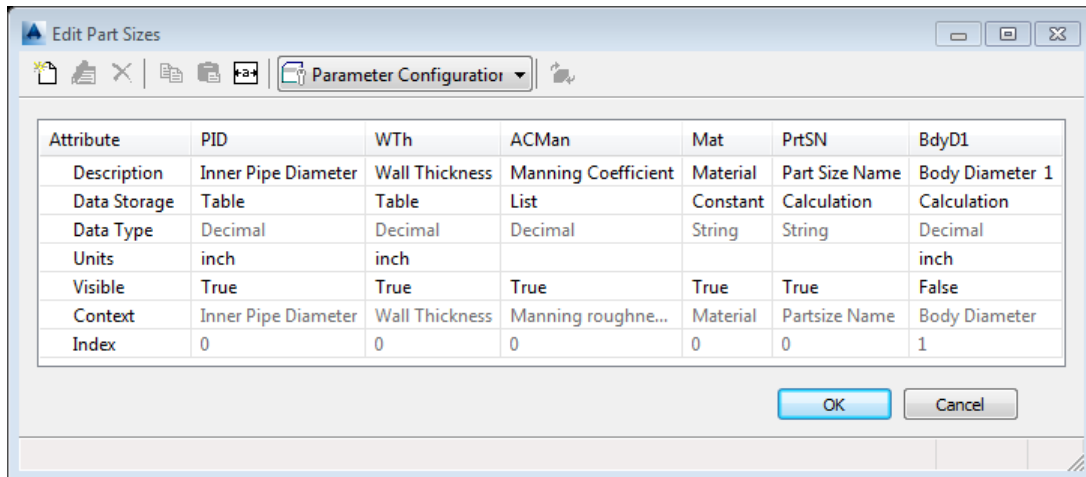
Modify Part Sizes button to launch Part Builder. This screen is also the place where you can create a new parametric part, regenerate your catalog, test your catalog, create a new part chapter, or delete a part. Also notice that your Part Catalog path is listed on the very bottom to remind you with which catalog you are working.
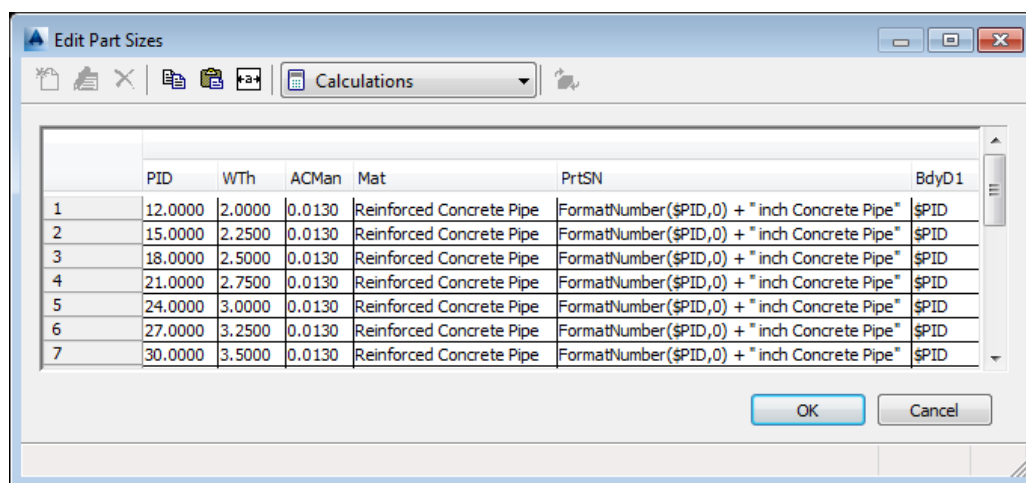
At the very top is the full part file name, which in this case is *AeccCircularConcretePipe_Imperial*. Below this, under Part Configuration, it will always have these five same items: Part Description, Part Domain, Part Type, Part Subtype, and Cross Sectional Shape (structures use Bounding Shape). Next is the Modeling information, which includes all of the work planes, geometry, constraints, and dimensions. Pipes are typically pretty simple and do not include much in this area, but structures can get much more involved here. For pipes, you only need to build the cross section shape in 2D, but a structure you need to model in 3 dimensions and that is where our Model Dimensions and Modifiers come in – they add depth to our model. Last is the Layout Data, which specifies the placement point of the part, and Model Parameters, which are the dimensional building blocks of the part. Below Modeling we have the last section which is Size Parameters. These are the built-in parameters that control how the part operates and that also bring information into Civil 3D to use in labels and tables.

4
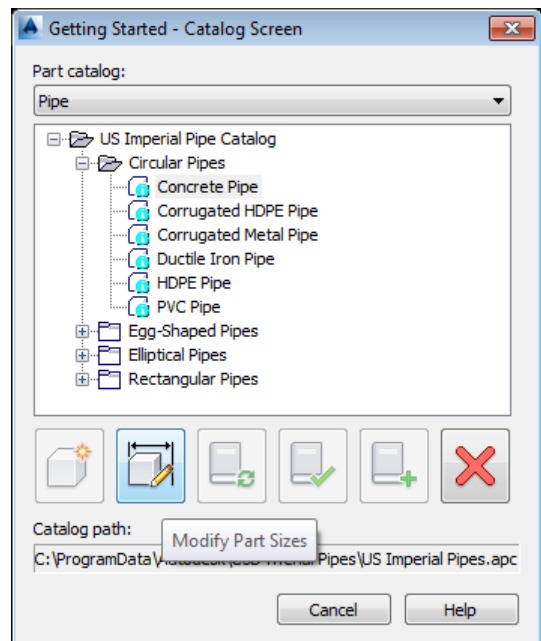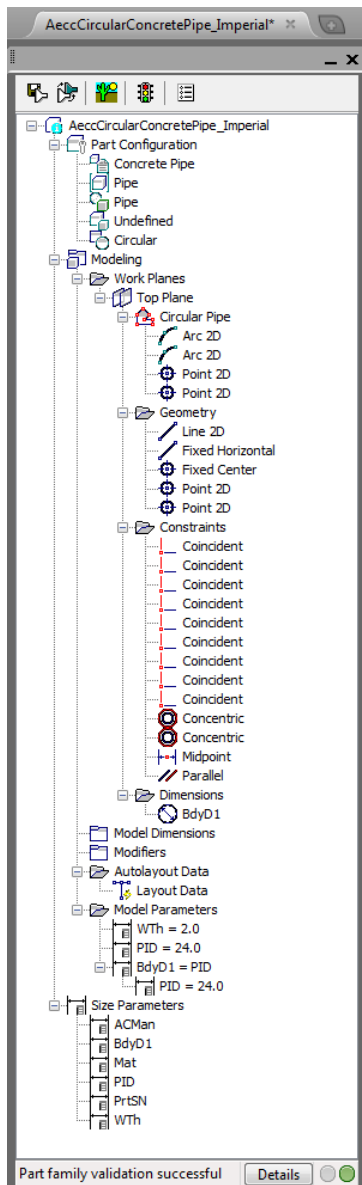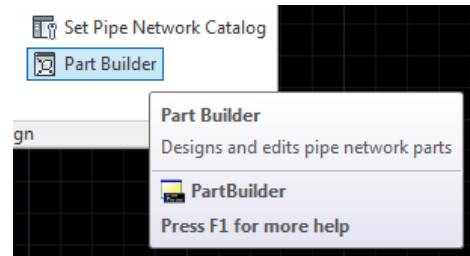
We will be focusing mostly on the Size Parameters portion to do the customization within Part Builder. Right click on Size Parameters and select Edit Configuration. This will bring up the Edit Part Sizes dialog box. This is laid out in a familiar spreadsheet format that shows us the configurations of the applicable values for this part. Parameters are sorted by Attribute which is a simple abbreviation of the description. The underlying code of the part catalogs will use the Attributes, but the long descriptions are there for us to make sense of them all. Especially notice the values listed in the Data Storage row. These are the different options for how we can assign values to our parameters. Shown are Table, List, Constant, and Calculation. The one not shown is Range which we will use when we get to structures. Also listed are the units assigned to each parameter, and whether the parameter is visible to us in Civil 3D or not.

| Attribute	PID	WTh	ACMan	Mat	PrtSN	BdyD1
Description	Inner Pipe Diameter	Wall Thickness	Manning Coefficient	Material	Part Size Name	Body Diameter 1
Data Storage	Table	Table	List	Constant	Calculation	Calculation
Data Type	Decimal	Decimal	Decimal	String	String	Decimal
Units	inch	inch				inch
Visible	True	True	True	True	True	False
Context	Inner Pipe Diameter	Wall Thickness	Manning roughne...	Material	Partsize Name	Body Diameter
Index	0	0	0	0	0	1

For pipes, the Inner Pipe Diameter and Wall Thickness values will always be done using a table. We can edit these values inside of Part Builder if we wish by switching over to either the Calculations or Values view of the Edit Part Sizes dialog box. From here we can add more sizes, delete sizes, or change the listed values. For this specific part, the Manning Coefficient is using a list of values and Material is using a constant. Both lists, constants, and our un-used ranges can be modified from either the Calculations or Values view as well. Lastly, our Part Size Name and Body Diameter parameters are using a Calculation to determine its value. To edit that calculation you have to use the Calculations view, and then use the Values view to preview the actual value.

	PID	WTh	ACMan	Mat	PrtSN	BdyD1
1	12.0000	2.0000	0.0130	Reinforced Concrete Pipe	FormatNumber($PID,0) + " inch Concrete Pipe"	$PID
2	15.0000	2.2500	0.0130	Reinforced Concrete Pipe	FormatNumber($PID,0) + " inch Concrete Pipe"	$PID
3	18.0000	2.5000	0.0130	Reinforced Concrete Pipe	FormatNumber($PID,0) + " inch Concrete Pipe"	$PID
4	21.0000	2.7500	0.0130	Reinforced Concrete Pipe	FormatNumber($PID,0) + " inch Concrete Pipe"	$PID
5	24.0000	3.0000	0.0130	Reinforced Concrete Pipe	FormatNumber($PID,0) + " inch Concrete Pipe"	$PID
6	27.0000	3.2500	0.0130	Reinforced Concrete Pipe	FormatNumber($PID,0) + " inch Concrete Pipe"	$PID
7	30.0000	3.5000	0.0130	Reinforced Concrete Pipe	FormatNumber($PID,0) + " inch Concrete Pipe"	$PID

While we are still in Civil 3D, we will look at one other important location we will be using for this class.

▲   Toolspace – Settings Tab – Pipe Network category – Parts Lists folder

Shown here are the parts lists contained in the _AutoCAD Civil 3D (Imperial) NCS.dwt drawing template. Once you get your own custom part catalogs set up, you will also want to create your own custom parts lists that includes the pipes and structures that you most commonly use. Depending on how you prefer to organize your parts, you may want to have different parts lists for different municipalities or states that you work in, different clients that you work with, or different manufacturers of parts that you specify. You can mix and match any way that works for your company. When you are creating pipe networks, you can include parts from multiple parts lists, so there is no limit on how you can organize these. We will get back to building parts lists more after we discuss customizing the actual parts themselves.
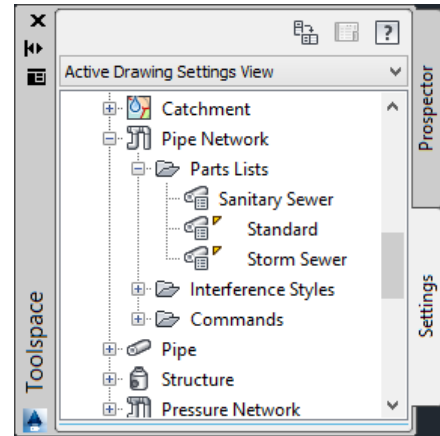
Pipe Network Catalog outside of Civil 3D

We found where Civil 3D is looking for the part catalog files within the program; now we will take a look at exactly what those files are and what they consist of.

Using Windows Explorer, navigate to the default path and let's take a look at everything.

Local Disk (C:) ▶ ProgramData ▶ Autodesk ▶ C3D 2014 ▶ enu ▶ Pipes Catalog ▶
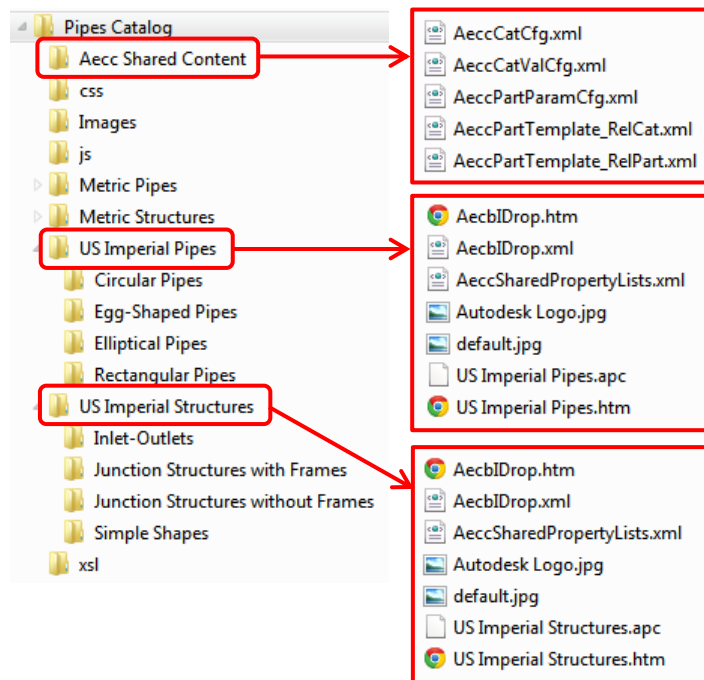
It is important to note that you need the entire directory structure shown here for the part catalog to work correctly. If you only copy certain parts of it for your custom catalog, it may not function as you expect.

Files in the Aecc Shared Content directory will be used throughout the entire catalog. The most important file here is *AeccPartParamCfg.xml*, which will include all of the required and optional parameters that can be included in your parts. A lot of it will be gibberish but there will be a few items that we will modify later.

The bulk of the catalog that we will be working with is located in the US Imperial Pipes and US Imperial Structures directories. Each directory has a file named *AeccSharedPropertyLists.xml*, which contains lists that are used for all pipes (like material), or all structures (like frame, cover, grate, and material). The other important files are *US Imperial Pipes.apc* and *US Imperial Structures.apc*, which are the catalogs themselves. The catalog files contain all of the parts available for us to use.

US Imperial Pipes Catalog

Besides the files within the US Imperial Pipes folder, there are also a variety of sub folders. These sub folders are organized based on the pipes cross sectional shape. The default installation includes six circular, one egg shaped, three elliptical, and one rectangular pipe. Each different type of pipe is defined by three different files: a ".bmp" bitmap image that serves as an icon for when you're adding parts from the catalog into a parts list, a ".dwg" drawing file that is used in the Part Builder environment, and a ".xml" extensible markup language file that contains the values for the different pipe sizes. We will be spending the most time in the .xml files.
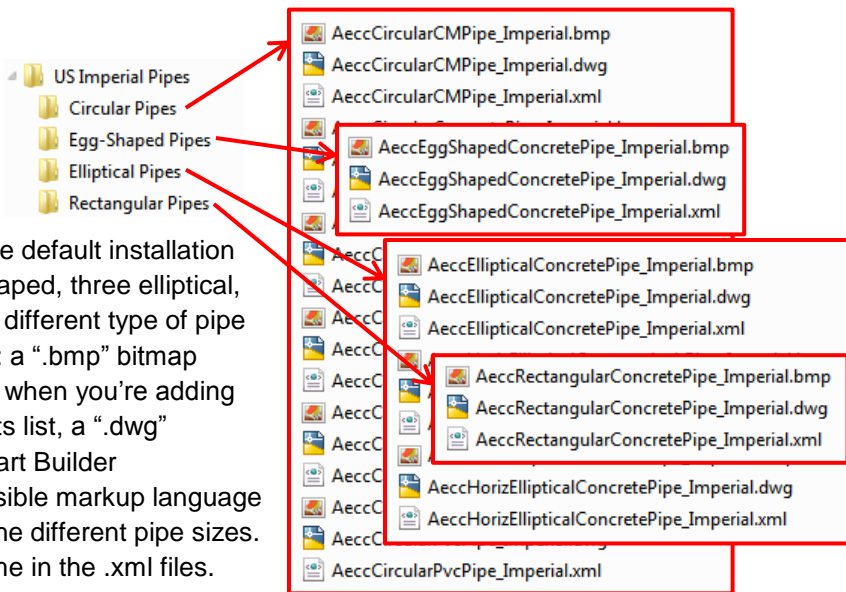
Typically the reason for the multiple types of pipe in each sub folder is to allow for the varying materials that the pipes are made of. This is where I have found myself doing the most customization work with pipes. I want to add in every different material pipe that I use so that when I build my pipe networks, I am able to label them correctly, and very accurately see interferences between other pipes and structures.

US Imperial Structures Catalog

Most of the same organization applies to structures as it does to pipes – with a few key differences. The sub folders are organized based on the function of the structure, such as inlet-outlet or junction. Inlet-Outlets are structures like flared end sections or headwalls, and junctions are the typical catch basin or manhole. Junctions come in two flavors: either with or without frames on top.

With structures, the reason for the multiple types in each subfolder is for the multitude of ways you can build a different structure. Inlet-Outlets has six different types of structure; two are end sections and the other four are headwalls that either vary depending on the type of pipe attached to them, or having a wing wall or not. Junction Structures with Frames has the most options at twelve, and it all depends on whether the structure is round or rectangular, if it is one tier or two tiers tall, if the cone section is eccentric or concentric, or if it is a flat top or a cone top. Junction Structures without frames simplifies it a little bit and only gives you three types based on the shape. The Simple Shapes sub folder contains two types of structure based on shape, and even though these two structure types are in the catalog, they are not available by default within Civil 3D.
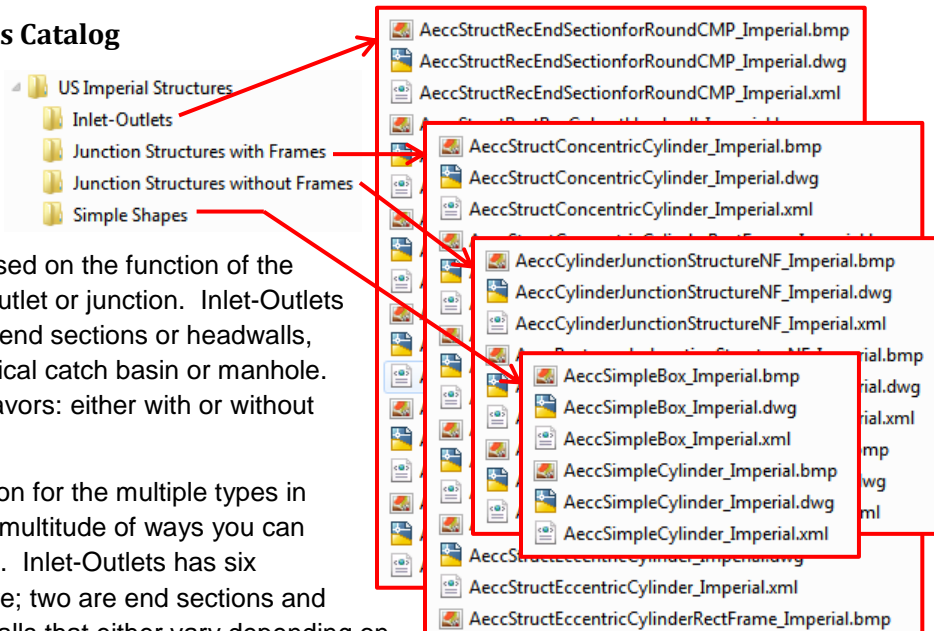
Part Catalog XML Files

Now that we have taken a look at all of the files involved, let's take a look inside them and see what is going on. Fair warning right here – there is a lot of information in the files. We are only going to be looking at and editing key parts of each file. The other parts of the file are important as well, and can break all of the functionality if accidently changed. Make sure you have backup copies of the original files and that you are very deliberate on the items you are editing.

Find your way to the default installation path once again – *C:\ProgramData\Autodesk\C3D 2014\enu\Pipes Catalog* – and open the file *AeccPartParamCfg.xml* in the *Aecc Shared Content* folder. XML files can be opened with a number of different programs, so it is important that you find one that you are comfortable with. For this class, we will be using good old Notepad that everyone has.

The *AeccPartParamCfg* file is broken into two separate sections: Parameter Declarations and Parameter Usages. Parameter Declarations are used to call out and define the part properties and geometry contexts that are used within Part Builder to model the shape and behavior of the parts.

Parameter Usages are used to define which types of parts get which parameter declarations. For example, you would not want a pipe to be assigned declarations that specify the length and width of a structure or which cone height to use. A structure also does not need to be assigned the minimum curve

radius of a pipe. If you get far enough into the customization process, you will eventually end up here to add custom parameters and usages to your parts. The best advice I can give you is to copy the closest match to what you want your new parameter to be letter for letter.

Next, let's look at the *AeccSharedPropertyLists.xml* files in both the *US Imperial Pipes* and *US Imperial Structures* folders. The organization of the files will be nearly identical with the difference being what is included in the lists themselves. Notice that the only item in the Pipes file is a list of different materials to assign to the pipes. In the Structures file, we have a few more lists, but they only have one item each. When we start customizing, just remember that these files are here and available for you to work with. These will assign values to a list that you have defined

for EVERY pipe or structure in your catalog. If you only want a list to be used for some of your pipes or structures, you will define those in that pipe or structure. These files are for defining on a global basis. The Material definition is the best example and the only one used in both files. Another good example

would be to create a list of the available Frames, Grates, and Covers that you will use on top of your structures, and these are already started for you in the Structures file.

Pipe Specific XML Files

The next type of XML file that we will be looking at is the one that defines the individual part. We will start by looking at *AeccCircularCMPipe_Imperial.xml* and *AeccEllipticalConcretePipe_Imperial.xml* as examples. These are in the *Circular Pipes* and *Elliptical Pipes* folders respectively. Pipes are defined by rows, with each row corresponding to a different size of that type of pipe. Our CircularCMPipe file has 25 different rows for 25 different diameter pipes, while our EllipticalConcretePipe only has 21 rows or sizes.

The first thing you will notice is a section called ColumnUnique with a description of

Primary Key. This column uses a system of hexadecimal numbers to assign a unique identifier (called a Universally Unique Identifier, or more commonly a Globally Unique Identifier) to each pipe size. These UUID's (or GUID's) have to be completely different from any other UUID in the system. If you choose to add a row manually, it is best to use a GUID generator such as <u>guid.us</u>. If you do not want to deal with these manually, you can also add more pipe sizes from within Part Builder.

The next two columns define the Inner Pipe Diameter and Wall Thickness for each size of pipe from 12 inches up to 144 inches. I chose this file as an example to draw attention to the rows of Wall Thickness. You will notice that the Wall Thicknesses for pipes from 12 inches to 42 inches are the same as well as the pipes from 78 inches up to 144 inches. This makes me feel like this file is not completely accurate. Also, these thicknesses are described in inches. That may well be the thickness of the metal itself but it does not take into account the extra thickness that the pipe will actually have because of its corrugated shape. This would be one good place to start in your customizing adventure by changing the values of the Wall Thickness column to more real world numbers. Why is this important? Civil 3D uses both the Inner Pipe Diameter and the Wall Thickness when it is determining Interference Checks and when you are displaying the outer diameter in any of your pipe styles.

The final part of our file is the additional columns that assign a single value to every pipe for this part, called a ColumnConst, or Constant. Usually, the only things down here that change are the Part Name, Part Description, Part ID, Cross Sectional Shape, and Part Size Name. In most cases, you will not be editing this information directly in the XML file. Instead, you would change it in the Part Builder environment.

In our second example file, *AeccEllipticalConcretePipe_Imperial.xml*, there are a few differences. The first and most obvious is that we do not have an Inner Pipe Diameter column, but instead have Inner

Pipe Width and Inner Pipe Height. We still have our Wall Thickness column that looks like it could use some updating. We also have something new call a ColumnConstList with a description of Manning Coefficient. We mentioned lists when we were talking about the *AeccSharedPropertyLists.xml* file. When you add a list to the *Shared* file, it is available for every pipe or structure in the catalog, but when a list is used in this case, the list will only apply to this specific part. Our Elliptical part also has our ColumnConst entries at the bottom finishing out our file.

```
<Column desc="Inner Pipe Width" dataType="f
        <Row id="r0">14.0000</Row>
        <Row id="r1">19.0000</Row>
        <Row id="r2">22.0000</Row>

        <Row id="r19">106.0000</Row>
        <Row id="r20">116.0000</Row>
</Column>
<Column desc="Inner Pipe Height" dataType="
        <Row id="r0">23.0000</Row>
        <Row id="r1">30.0000</Row>
        <Row id="r2">34.0000</Row>

        <Row id="r19">166.0000</Row>
        <Row id="r20">180.0000</Row>
</Column>
<Column desc="Wall Thickness" dataType="flo
        <Row id="r0">4.0000</Row>
        <Row id="r1">4.0000</Row>
        <Row id="r2">6.0000</Row>

        <Row id="r19">12.0000</Row>
        <Row id="r20">12.0000</Row>
</Column>
<ColumnConstList desc="Manning Coefficient"
        <Item id="i0">0.0130</Item>
        <Item id="i1">0.0080</Item>
        <Item id="i2">0.0090</Item>
        <Item id="i3">0.0100</Item>
        <Item id="i4">0.0110</Item>
        <Item id="i5">0.0120</Item>
        <Item id="i6">0.0140</Item>
        <Item id="i7">0.0150</Item>
</ColumnConstList>
```

You can see from just these two files that the ways the parts are built are somewhat inconsistent. Some parts have Material as a list, some as a constant, and some leave it out altogether. I only found four out of the eleven different pipes that included a Manning Coefficient list. For the Material parameter only one pipe has it as a list, three others have it as a constant, and the other seven leave it out completely. When you start using a mix of these within Civil 3D and try to label properties such as Material on all of them, unexpected things can occur due to these inconsistencies. If you plan on make the most out of the Pipe Network functionality, it would be very worthwhile to spend a little time customizing these files to make them more consistent and to suit your needs.

Structure Specific XML Files

We have looked at a few examples with pipes, so let's go ahead and also look at a few structures. The first think you will notice no matter which structure XML file that you open is that we do not have rows within our columns, and therefore we do not need any of those crazy GUID numbers. Unlike pipes which use a very strict matching system with rows, structures are much more like a Vegas buffet where you can pick and choose the pieces and geometry that make up your structures.

Let's first look at *AeccStructConcentricCylinderNF_Imperial.xml* in the *Junction Structures without Frames* folder. Notice we have two ColumnConstList named Cone Height and Inner Structure Diameter and one ColumnRangeList named Rim to Sump Height. These columns provide similar, but slightly different purposes.

```
<ColumnConstList desc="Cone Height" dataType="float" uni
        <Item id="i0">24.0000</Item>
        <Item id="i1">36.0000</Item>
        <Item id="i2">48.0000</Item>
</ColumnConstList>
<ColumnConstList desc="Inner Structure Diameter" dataTyp
        <Item id="i0">48.0000</Item>
        <Item id="i1">60.0000</Item>
        <Item id="i2">72.0000</Item>
        <Item id="i3">96.0000</Item>
</ColumnConstList>
<ColumnRangeList desc="Rim to Sump Height" dataType="flo
        <Item id="i0" rangeVal="Min">12.0000</Item>
        <Item id="i1" rangeVal="Max">6000.0000</Item>
        <Item id="i2" rangeVal="Default">60.0000</Item>
</ColumnRangeList>
```

First, the ColumnConstList has the available item sizes for each piece of the structure. In this structure we only have two pieces to work with. What cone height do we want on top of what structure diameter? Now unlike pipes where row id "r1" for one column had to use row id "r1" in another column, structures can mix and match between items. I can put a 24 inch cone on top of any of my available structure diameters. With pipes if I only had 10 rows, that means I only had 10 available part sizes. With structures, if I have two constants, one with three

items and one with four items, I have 12 available part sizes. Once I start adding more constants, the amount of part sizes available grows exponentially.

Second, the ColumnRangeList allows me to have a range of values instead of pulling from a pre-set list. Ranges like this will always have three items for Minimum, Maximum, and Default. When customizing, you can set these values to what works for you, such as a more real world maximum rather than a 6000 inch tall structure.

Let's look at a much more complicated structure with many more constants like *AeccStructConcentricCylinderRectFrame_Imperial.XML* in the *Junction Structures with Frames* folder. I count seven different ColumnConstList plus one ColumnConstRange and even though the most items listed in one column is five, the number of combinations available is 14,400! Most of those obviously will not be used, or are even real world appropriate (I would not want an 8 foot diameter structure with only 5 inch walls). Four of the columns help you build the structure itself using Inner

```
<ColumnConstList desc="Inner Structure Diameter" dataTyp
        <Item id="i0">48.0000</Item>
        <Item id="i1">60.0000</Item>
        <Item id="i2">72.0000</Item>
        <Item id="i3">96.0000</Item>
</ColumnConstList>
<ColumnConstList desc="Cone Height" dataType="float" uni
        <Item id="i0">24.0000</Item>
        <Item id="i1">36.0000</Item>
        <Item id="i2">48.0000</Item>
</ColumnConstList>
<ColumnConstList desc="Wall Thickness" dataType="float"
        <Item id="i0">5.0000</Item>
        <Item id="i1">6.0000</Item>
        <Item id="i2">7.0000</Item>
        <Item id="i3">8.0000</Item>
</ColumnConstList>
<ColumnConstList desc="Floor Thickness" dataType="float"
        <Item id="i0">6.0000</Item>
        <Item id="i1">7.0000</Item>
        <Item id="i2">8.0000</Item>
        <Item id="i3">10.0000</Item>
</ColumnConstList>
<ColumnConstList desc="Frame Height" dataType="float" un
        <Item id="i0">4.0000</Item>
        <Item id="i1">6.0000</Item>
        <Item id="i2">8.0000</Item>
</ColumnConstList>
<ColumnConstList desc="Frame Length" dataType="float" un
        <Item id="i0">18.0000</Item>
        <Item id="i1">24.0000</Item>
        <Item id="i2">30.0000</Item>
        <Item id="i3">36.0000</Item>
        <Item id="i4">48.0000</Item>
</ColumnConstList>
<ColumnConstList desc="Frame Width" dataType="float" uni
        <Item id="i0">18.0000</Item>
        <Item id="i1">24.0000</Item>
        <Item id="i2">30.0000</Item>
        <Item id="i3">36.0000</Item>
        <Item id="i4">48.0000</Item>
</ColumnConstList>
<ColumnRangeList desc="Rim to Sump Height" dataType="flo
        <Item id="i0" rangeVal="Min">12.0000</Item>
        <Item id="i1" rangeVal="Max">6000.0000</Item>
        <Item id="i2" rangeVal="Default">60.0000</Item>
</ColumnRangeList>
```

Structure Diameter, Cone Height, Wall Thickness, and Floor Thickness while the other three columns are used for the frame component with Frame Height, Frame Length, and Frame Width.

## Pipe and Structure Catalog APC Files

The last files we will take a look at are some special XML files that actually are the catalog. These files are so special that they do not get the standard .xml extension, rater they get an .apc extension, which I can only imagine stands for Autodesk Pipe Catalog. These are pretty simple files that you should never have to customize manually. They include chapters to sort out different part types and the information on where to find each part.

```
<Chapter name="Circular Pipes">Circular Pipes
        <Desc>Circular Pipes</Desc>
        <Part name="AeccCircularCMPipe_Imperial" id="481DD6EF-B926-428E-99B7-A5BE30A17E59">
                <Desc>Corrugated Metal Pipe</Desc>
                <Images>
                        <Image>
                                <URL xlink:title="Corrugated Metal Pipe" xlink:href="Circular Pipes\Aecc
                        </Image>
                </Images>
                <TableRef>
                        <URL xlink:href="Circular Pipes\AeccCircularCMPipe_Imperial.xml"/>
                </TableRef>
                <Extrinsics>
                        <Extrinsic name="AeccPartSearchAttribList">
                                <AeccPartSearchAttribList domain="Pipe_Domain" part_type="Pipe" part_sub
                        </Extrinsic>
                </Extrinsics>
        </Part>
```

Customizing the Part Catalog

Let's look at a few different ways to make customizations both inside of Civil 3d using Part Builder and outside by making manual edits to XML files. For most of these edits, you could use either method to get the end result. I'll be sure to mention a few of the things that can only be done in one or the other, or which method I think is the easiest.

For this class we are going to make a copy of the default Part Catalog that ships with Civil 3D. It's always a good idea to practice making these changes in a 'dummy' copy before trying to implement them into your company's standard. In Windows Explorer we are simply going to copy the entire Pipes Catalog folder into a new folder right on the C: drive called AU Test Pipes. Do not forget to set your catalog path within Civil 3D to this path.
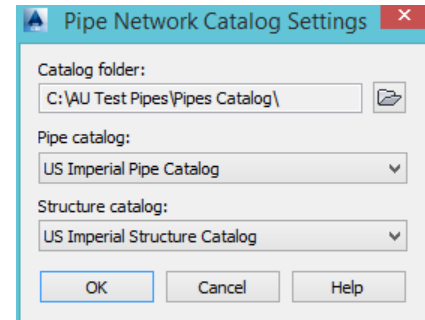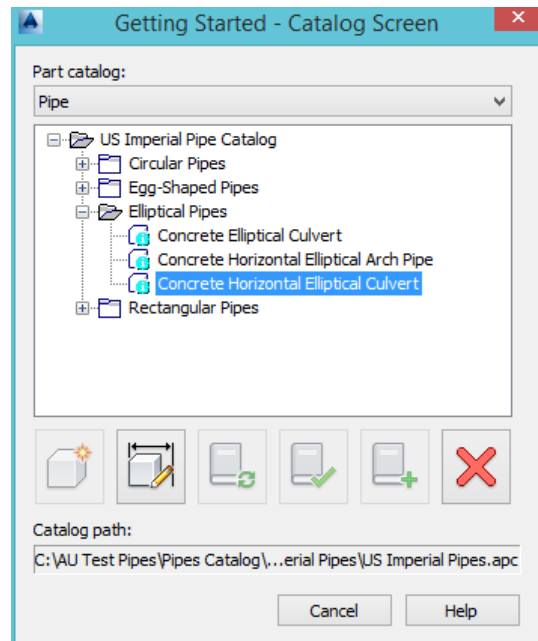
Edit Pipe Wall Thicknesses

Let's fix a few of the shortcomings in the catalog first. First we will fix one of my favorite pipes in the catalog to have real world wall thicknesses. We will do this in Part Builder and by editing the XML files directly. We'll start with Part Builder so go ahead and launch Part Builder from within Civil 3D.

▲ Home Tab – Create Design Panel drop down arrow – Part Builder

Remember while in this dialog box to check the path for your part catalog listed on the bottom of the window. Select Pipe for your Part catalog and then expand Elliptical Pipes and highlight Concrete Horizontal Elliptical Culvert. Click on Modify Part Sizes to work on this pipe in Part Builder.

Once in Part Builder, we are only going to change a few numbers in the Part Sizes so that the part matches up with what is actually available to build with. Scroll to the very bottom of the Part Browser on the left of the screen and right click on Size Parameters and select Edit Values. This will bring up the spreadsheet like dialog box where the rows match up with the data in the XML file.

The local supplier in Michigan only makes pipe as small as 14" x 23" so the first thing to do is to delete the 12" x 18" row. Just highlight row 1 by clicking on the 1 on the left, and then select Delete on the top.

Next is to set the wall thicknesses to the correct values for the next eight sizes of pipe. There will be a few more rows to delete as well since the supplier doesn't make them. Make the first eight rows look like the picture on the right by either deleting rows or changing the value of the wall thickness. When finished, click OK to exit the dialog box.

	PIW	PIH	WTh	
1	23.0000	14.0000	3.6250	
2	30.0000	19.0000	3.6250	
3	38.0000	24.0000	3.7500	
4	45.0000	29.0000	4.5000	
5	53.0000	34.0000	5.0000	
6	60.0000	38.0000	5.5000	
7	68.0000	43.0000	6.0000	
8	76.0000	48.0000	6.5000	
9	83.0000	53.0000	3.7500	

We're going to finish updating the sizes by editing them in the XML file so you can see how it is done with both methods. To save the changes and exit out of Part Builder is a two-step process. The first step is not always mandatory, but is a good habit to start. At the top of the part browser click on Validate, which is the stop light icon. Validate is checking over everything in the part to make sure nothing is wrong and that it will work in Civil 3D. Lastly click on Save Part family, which is the far left icon. Then go ahead and exit Part Builder and the part to return to Civil 3D.
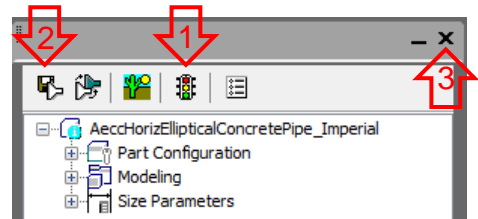
Using Windows Explorer, browse to the Part Catalog location and find the elliptical pipe. That location is *C:\AU Test Pipes\Pipes Catalog\US Imperial Pipes\Elliptical Pipes\AeccHorizEllipticalConcretePipe_Imperial.xml*. Open the file with notepad to begin the editing.

So far we've edited the first eight rows of pipe which will be Row id's r0 through r7. The pipe supplier only has six more sizes of pipe so we will delete all of the rows after that. The largest size we have is 77" x 121" which is in row r13, so delete rows r14 though r19 for the four sections named Primary Key, Inner Pipe Width, Inner Pipe Height, and Wall Thickness.

Now that we are down to the 14 rows available from the supplier (rows r0 though r13) we just need to edit the wall thickness to be accurate. Go ahead and change rows r8 through r13 under Wall Thickness to match the picture on the right. Save and close the file.

```
<Row id="r7">6.5000</Row>
<Row id="r8">7.0000</Row>
<Row id="r9">7.5000</Row>
<Row id="r10">8.0000</Row>
<Row id="r11">8.5000</Row>
<Row id="r12">9.0000</Row>
<Row id="r13">9.5000</Row>
</Column>
```
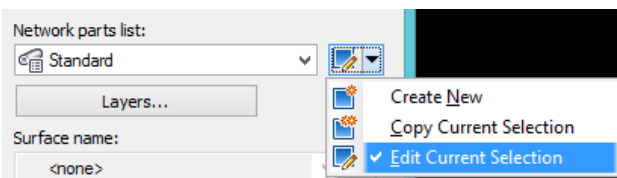
Lastly let's check that everything worked by creating some of these new pipe sizes in Civil 3D. Create a new drawing using the *AutoCAD Civil 3D (Imperial) NCS.dwt* template.

On the Create Design panel, click Pipe Network drop down and select Pipe Network Creation Tools.
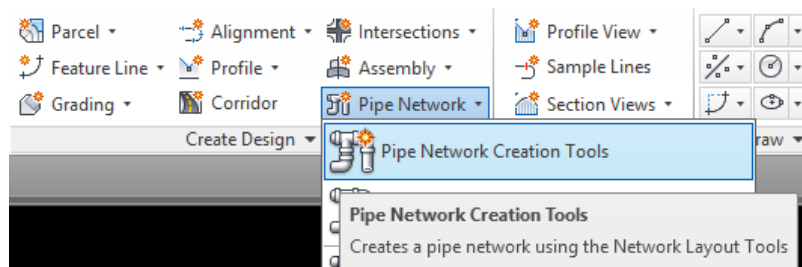
> ▲ Home Tab – Create Design Panel – Pipe Network drop down arrow – Pipe Network Creation Tools

In the Create Pipe Network dialog box, make sure the Network parts list is set to Standard and Edit the Current Selection.

In the Network Parts List dialog box on the Pipes tab, right click on the Standard pipe library and select Add part family. Put a checkmark by the Concrete Horizontal Elliptical Culvert and click OK.
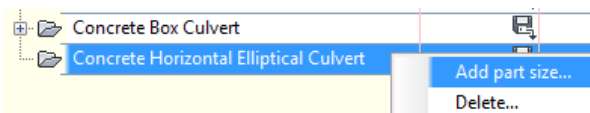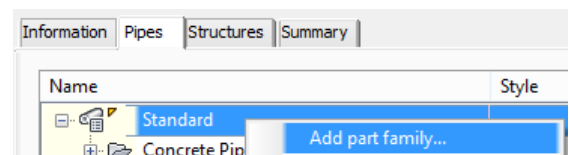
Right click on the Concrete Horizontal Elliptical Culvert and select Add part size.

In the Inner Pipe Width row, checkmark the Add all sizes box and click OK. You should now see all of the sizes listed in the Network Parts List dialog box. Click OK to exit, and then click OK again to create the Pipe Network.
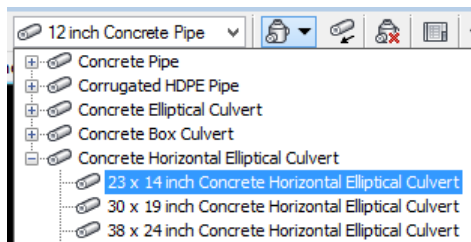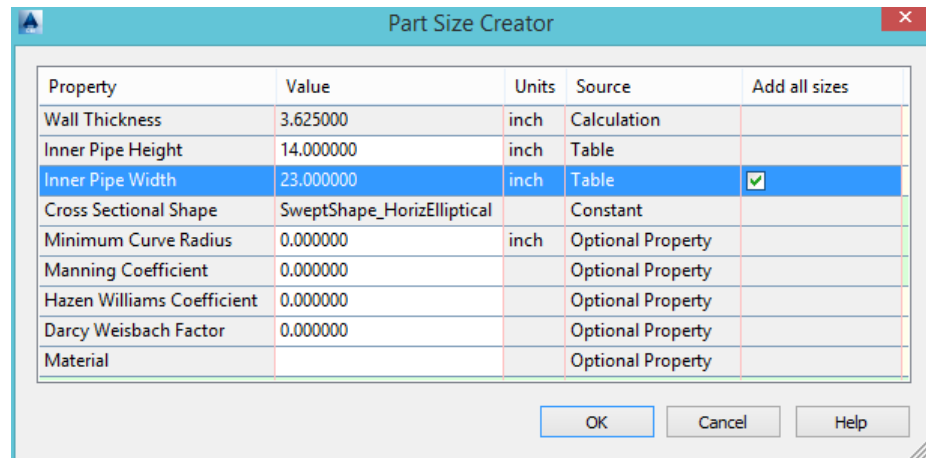

In the Network Layout Tools, change the pipe drop down to a small size of the elliptical pipe and draw a pipe. Do the same with a medium size pipe and a large size pipe.

Select one of those pipe, right click and select Pipe Properties. Scroll to the bottom of the Pipe Properties dialog box under Part Data and observe what the Wall Thickness is. It should match the value that we programmed in earlier. Do the same with the other two pipes.

We can also visualize the pipe wall thickness by displaying the inner and outer pipe walls in our pipe style. Select one of the pipes again, right click and select Edit Pipe Style. In the Pipe Style dialog box on the Display tab, turn on the visibility for Outside Pipe Walls and click OK. You should be able to actually see the larger wall thicknesses on the pipes now.

You have just successfully edited one of the pipes in the default part catalog to make it more accurate for you to use within Civil 3D. We used two different approaches to get the same result so that you now have the choice of which one you are more comfortable with. For this type of customization I personally do not think that either method is easier than the other or has more benefit than the other. This one is all up to you.

Copy an Existing Pipe to Create a New Pipe

The default catalog does not include all of the materials that you will use in any given project. Instead of creating another pipe material that you need from scratch, we are going to make a copy of one and just make the necessary adjustments to it to make it work for you. As an example, we are going to add Clay pipe into our part catalog.

To start, launch Part Builder and select the pipe that is the closest to the new one you want to create. We will use PVC Pipe as a starting point. Click on Modify Part Sizes to open it up in Part Builder.

🔺 Home Tab – Create Design Panel drop down arrow – Part Builder

We are not going to be doing any editing inside of Part Builder just yet. First we need to make our copy. The easiest way to do this is by doing a Save Part Family As at the top of the Part Browser. Click on that second button from the left and that will bring up the Save Part Family As dialog box.

Highlight the US Imperial Pipe Catalog folder and then select the New chapter button. You could save your part in any of the existing chapters, but we are going to save our newly created parts into a separate chapter for easy organization. For this class we will name our new chapter AU Pipes. Type this in as the name in the New Chapter dialog box and click OK. The AU Pipes chapter should show up in line with the other chapters under the US Imperial Pipe Catalog. If you happened to have highlighted the wrong item before clicking on New chapter, you may have created a subfolder under one of the existing chapters.
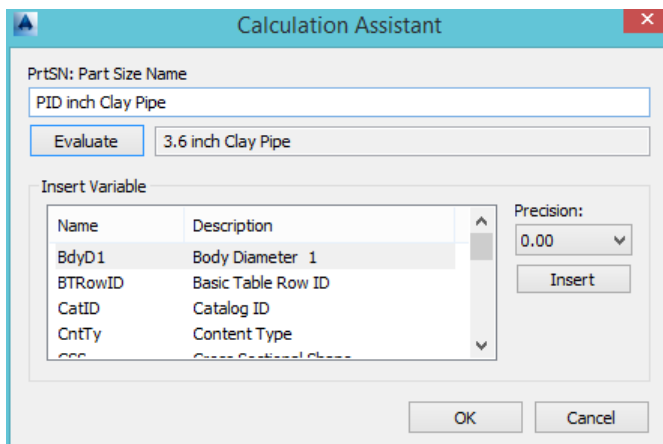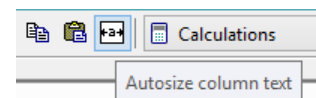
Make sure that the AU Pipes chapter is highlighted and then fill in a new Part name and Part description. Use AUPipesClayPipe_Imperial and Vitrified Clay Pipe as the name and description and click OK. You can obviously use whatever names for any of these that you want once you are doing your own customization work.

For now, we are going to Validate, Save, and exit Part Builder so we can look at the files that have been created.
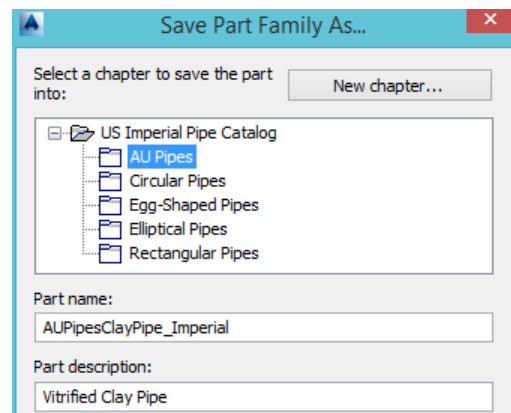
Using Windows Explorer, browse to the part catalog and open up the newly created AU Pipes folder inside of US Imperial Pipes. Part Builder has created all of the necessary files for us to start the editing process. If you were to attempt to do this from scratch by selecting New Parametric Part in the Getting Started screen of Part Builder, you would have to go through the whole process of drawing the pipe objects, constraining the geometry, adding the model parameters, assigning the size parameters, and then create a bitmap icon to go with it. Copying just saves a ton of time and work.

Now it is time to go back into Part Builder and start the editing process. Launch Part Builder and make your way back into our new Clay Pipe. Once in, right click on Size Parameters in the Part Browser and this time we are going to select Edit Calculations. I like to always click on the Autosize column text button first whenever I open these dialog boxes so I can see everything going on.

Under the Part Size Name column (PrtSN), double click in any of the rows to bring up the Calculation Assistant dialog box. Change PVC to Clay and click on the Evaluate button. It should update the text for you to Clay, and then click OK. All of the rows in the Edit Part Sizes dialog box should update accordingly.

To start editing the pipe sizes and wall thicknesses, you need to switch over to the Values view by using the drop down at the top of the dialog box. Only from the Values view can you add and delete rows. This next part might seem strange, but it alleviates possible problems later on down the road. You need to delete every row and add new rows for the new sizes of clay pipe. The only problem with this is that it will not let you delete every row. I personally will delete all but one row and then add a few new rows in. Type in the new information into those new rows, delete the row you missed the first time, then go ahead and add the rest of the rows in that you need and insert that information.

The reason I do this has to do with the Column named Primary Key in the XML file that has all of our RowUnique id's and their corresponding UUID or GUID values. When you copied the part and used Save Part Family As, it kept the same GUID numbers as the original pipe. It is a recommendation of mine that you make sure that these numbers do not ever get reused in the part catalog. You could also do this part manually by editing the XML files directly, but you would still need to make sure that you created new GUID values either manually or by using a GUID generator such as `guid.us`. I find that letting Part Builder automate this process is much easier.

Now that we have discussed this to length, go ahead and continue to add enough rows and add the appropriate information for the clay pipe until you match the picture on the right. Click OK, then Validate, Save, and exit part Builder. You can check your parts just the same as we did for our Elliptical Concrete Pipe if you wish.

	PID	WTh	PrtSN	BdyD1
1	4.0000	0.6250	4.0 inch Clay Pipe	4.0000
2	6.0000	0.8125	6.0 inch Clay Pipe	6.0000
3	8.0000	1.1250	8.0 inch Clay Pipe	8.0000
4	10.0000	1.2500	10.0 inch Clay Pipe	10.0000
5	12.0000	1.5000	12.0 inch Clay Pipe	12.0000
6	15.0000	1.8125	15.0 inch Clay Pipe	15.0000
7	18.0000	2.1250	18.0 inch Clay Pipe	18.0000
8	21.0000	2.6250	21.0 inch Clay Pipe	21.0000
9	24.0000	2.9375	24.0 inch Clay Pipe	24.0000
10	27.0000	3.2500	27.0 inch Clay Pipe	27.0000
11	30.0000	3.3125	30.0 inch Clay Pipe	30.0000
12	33.0000	3.2500	33.0 inch Clay Pipe	33.0000
13	36.0000	3.5000	36.0 inch Clay Pipe	36.0000
14	42.0000	4.2500	42.0 inch Clay Pipe	42.0000

Adding a Material parameter to every Pipe

As we discussed earlier in this handout, the way that the default catalog handles pipe materials varies from pipe to pipe. We can quickly take care of this by either using Part Builder or by editing the XML files so that the Material parameter is used consistently. You will get the greatest benefit from this when you get to using pipe labels and tables. I think you can do this faster and easier by editing the XML files, but we will go through the process with both methods to see the difference.

We will start with the one pipe that got it right by making the Material parameter a list within the part, and that is the Corrugated HDPE pipe. Launch Part Builder and open up the Corrugated HDPE pipe. Once open, right click on Size Parameters in the Part Browser and select Edit Configuration. Notice that the attribute Mat with the Description of Material is showing a list as its form of Data Storage. This is the best option for it to be the most use for us.

| Attribute	Mat
Description	Material
Data Storage	List
Data Type	String

To actually edit the items in the list, switch over to either the Calculations or the Values view. Currently listed under Mat is the only item in the list, Corrugated HDPE Pipe. If you double click on this, it would let you change between different items in the list. Since there is currently only the one, this doesn't get you very far. In order to edit the items in the list, highlight one of the entries in the Mat column, and then click on Edit in the toolbar. This will bring up the Edit Values dialog box.

From here you can edit the contents of the list as well as add additional items to the list. Note you cannot delete items from the list here. That can only be done by editing the XML files. Go ahead and add some values that you would use to label this type of pipe for your specific work and click OK.

		Calculations	
Edit			
	PID	WTh	Mat	
1	4.0000	0.4000	Corrugated HDPE Pipe	0
2	6.0000	0.4500	Corrugated HDPE Pipe	0

Back in the Edit Part Sizes dialog box you could now double click on an entry in the Mat column and change the default material to one of the ones you added to the list. Notice that if you change the material for one row, it will change it for all of the rows. It doesn't remember that you changed it the next time you come into the part in Part Builder, since it will always reset to the first item in the list as the default. Keep that in mind if you will always use one material description more than any other in the list.

Go ahead and click OK in the Edit Part Sizes dialog box, and then Validate, Save, and exit Part Builder. Let's look at a before and after of the XML file to see what exactly you just changed.
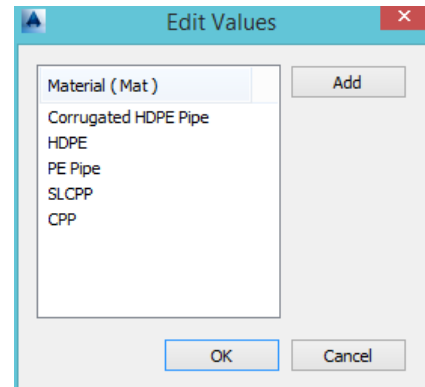
Shown below on the left is the Corrugated HDPE pipe as it is in the OOTB catalog and on the right is the pipe as we just edited it. In this case since this part already had the material parameter set up as a list, it only added additional items to that list.

```
<ColumnConstList desc="Material" dataType="string"
        <Item id="i0">Corrugated HDPE Pipe</Item>
</ColumnConstList>
```

```
<ColumnConstList desc="Material" dataType="string"
        <Item id="i0">Corrugated HDPE Pipe</Item>
        <Item id="i1">HDPE</Item>
        <Item id="i2">PE Pipe</Item>
        <Item id="i3">SLCPP</Item>
        <Item id="i4">CPP</Item>
</ColumnConstList>
```

Next we'll move on to a pipe that has the material parameter already defined as a constant, and we will change it to a list so we can add items to that list. There are three pipes in the catalog that have the material parameter set up as a constant and they are the Concrete Pipe, Concrete Elliptical Culvert, and Concrete Box Culvert. Go ahead and launch Part Builder and open up the Concrete Pipe.

Start by right clicking on Size Parameters in the Part Browser and select either Edit Calculations or Edit Values. From here you could double click on one of the Material items and it would change the constant for all of the parts, but we do not want to do that. Switch over to the Parameter Configuration view and note that the Material parameter is currently set as a constant. To change it from a constant to a list is as easy as selecting constant, and then changing it to list in the drop down that appears. Now that you have it set as a list here, switch back to either the Calculations or the Values view, and add more items to the list like you did above with the Corrugated HDPE pipe.
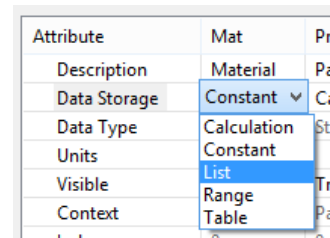
Once you are done with the list, click OK to get out of the Edit Part Sizes dialog box, Validate, Save, and exit Part Builder. We will look again at the changes that were made to the XML files. Below on the left is Concrete Pipe from the OOTB catalog that shows the material as a constant and on the right shows how it changed to a list and added our items to that list.

```
<ColumnConst desc="Material" dataType="string" unit=""
name="Mat" id="CC10" visible="1" context="Material_Type"
index="0">Reinforced Concrete Pipe</ColumnConst>
```

```
<ColumnConstList desc="Material" dataType="stri
        <Item id="i0">Reinforced Concrete Pipe<
        <Item id="i1">CONC</Item>
        <Item id="i2">RCP</Item>
        <Item id="i3">RCP, CL III</Item>
        <Item id="i4">RCP, CL IV</Item>
</ColumnConstList>
```

There is one last group of pipes that we need to add our material parameter to and those are the pipes that do not have a material defined in them at all. This is the majority of our OOTB catalog. Go ahead and launch Part Builder one more time and we will work with the Concrete Horizontal Elliptical Culvert once again. Right click on Size Parameters in the Part Browser and select Edit Configuration. Notice this time that Material is not one of the attributes in use.
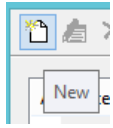
To add it as one of the attributes, just click on New in the upper left hand corner. This will bring up the New Parameter dialog box. Listed here are all of the possible parameters that you can add to this type of part. Remember from earlier in this class that all of the possible parameters for every pipe and structure are defined in the *AeccPartParamCfg.xml* file. Also in that file is the list of which parameters can be used for each individual part type. The list shown here is directly from that part of the configuration file.

Go ahead and select Material and click OK. It defaults to adding Material as a constant, but you can just change it to a list and add items to that list just like we did with the Concrete Pipe above. The before and after would be near identical to either example above, except the before would not list Material anywhere in the file.
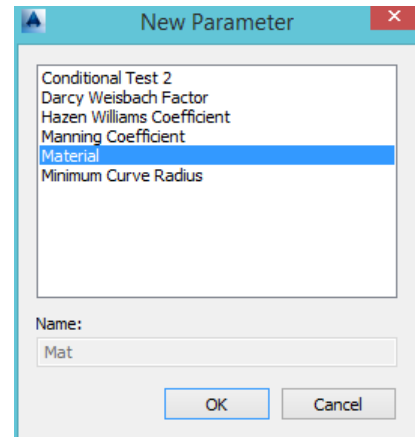
I personally think that doing all of these edits is much easier in the XML files. It is simply a matter of copy and paste, and then add and edit the items, being sure to increase the Item id by one for each new item. The important thing is to start with the one part that got it right – the Corrugated HDPE pipe. Copy the original text from this file and paste it into the correct location in all of the other pipe files. The one key thing to watch for is the 'id' attribute. As shown below in the Corrugated HDPE pipe file, the id is "CCL1" meaning it is the first ColumnConstList in the file. Shown right below that is the Manning Coefficient with an id of "CCL2". You just need to make sure to not have duplicate values for the id attribute. In most cases it will not matter since the majority of pipes do not have any lists in them. For the few that already have the Manning Coefficient defined, you just need to bump that id up to CCL2 like below.

```
</Column>
<ColumnConstList desc="Material" dataType="string" unit="" name="Mat" id="CCL1" visible="1" context="Mat
        <Item id="i0">Corrugated HDPE Pipe</Item>
</ColumnConstList>
<ColumnConstList desc="Manning Coefficient" dataType="float" unit="" name="ACMan" id="CCL2" visible="1"
        <Item id="i0">0.0120</Item>
        <Item id="i1">0.0130</Item>
```

Adding additional structure sizes

Let's switch over to working with structures and see what kind of customization we can do. We will start in Part Builder by opening up the Cylinder Junction Structure NF in the Junction Structures without Frames folder. Expand all of the items in the Part Browser to get an idea of how different and how similar structures are to pipes. This is a very simple structure with a minimal amount of parameters and should be easy to work with. Right click on Size Parameters and we will look at Edit Configuration first. For now just take notice of which attributes are being used for this part and what type of Data Storage they are using.

In this simple part, the only attribute that is currently being used as a list is the Inner Structure Diameter. If you switch over to the Values or Calculations view, you can edit that list to see the sizes currently

available. We are going to add all of the available sizes from the local supplier. Add values until you match the picture on the right (all the way up to 144 inches).

If we only wanted to do the bare minimum with this part, we could be done with it right now. There are some other quick things we can do to make this part much more functional than it currently is.

Switch back to the Parameter Configuration view and look at the Wall Thickness and Floor Thickness attributes. These are both currently set as constants, which we know every size structure does not have the same wall and floor thickness. Change both of the Data Storage types for these attributes to List and then switch back to either the Values or Calculations view.

Edit both the Wall Thickness and the Floor Thickness values list as shown (plus add 11 and 12 to Wall Thickness).

On occasion when I was practicing this while writing the material, I would get some strange errors. I was able to get around all of the errors by doing the above steps in small parts, clicking OK to exit the Edit Part Sizes dialog box, then validating and saving the part and going back into the Size Parameters. If you are unable to get it to look just like this by using Part Builder, there may be some XML file editing in your future.

Once we are done with all of those changes, validate, save, and exit Part Builder and play with these structures in a blank drawing to make sure they are acting as you would expect them too. The before and after images of the XML files are below.


```
<ColumnConstList desc="Inner Structure Diameter"
dataType="float" unit="inch" name="SID" id="CCL1"
visible="1" context="StructInnerDiameter" index="0">
        <Item id="i0">48.0000</Item>
        <Item id="i1">60.0000</Item>
        <Item id="i2">72.0000</Item>
        <Item id="i3">96.0000</Item>
</ColumnConstList>
<ColumnConst desc="Wall Thickness" dataType="float"
unit="inch" name="WTh" id="CC10" visible="1"
context="WallThickness" index="0">4.0000</ColumnConst>
<ColumnConst desc="Floor Thickness" dataType="float"
unit="inch" name="FTh" id="CC11" visible="1"
context="FloorThickness" index="0">6.0000</ColumnConst>
```

```
<ColumnConstList desc="Inner Structure Diame
        <Item id="i0">24.0000</Item>
        <Item id="i1">36.0000</Item>
        <Item id="i2">48.0000</Item>
        <Item id="i3">60.0000</Item>
        <Item id="i4">72.0000</Item>
        <Item id="i5">84.0000</Item>
        <Item id="i6">96.0000</Item>
        <Item id="i7">108.0000</Item>
        <Item id="i8">120.0000</Item>
        <Item id="i9">132.0000</Item>
        <Item id="i10">144.0000</Item>
</ColumnConstList>
<ColumnConstList desc="Wall Thickness" dataT
        <Item id="i0">3.0000</Item>
        <Item id="i1">4.0000</Item>
        <Item id="i2">5.0000</Item>
        <Item id="i3">6.0000</Item>
        <Item id="i4">7.0000</Item>
        <Item id="i5">8.7500</Item>
        <Item id="i6">9.0000</Item>
        <Item id="i7">10.0000</Item>
        <Item id="i8">11.0000</Item>
        <Item id="i9">12.0000</Item>
</ColumnConstList>
<ColumnConstList desc="Floor Thickness" data
        <Item id="i0">6.0000</Item>
        <Item id="i1">8.0000</Item>
        <Item id="i2">12.0000</Item>
</ColumnConstList>
```

Adding a custom pipe parameter

So far we have only looked at what we can do with the parameters that are given to us by default. We can also add some of our own parameters to increase the functionality. I will demonstrate an easy text field for a pipe, but you can really add almost anything that you can imagine. I personally always combine my existing and proposed storm pipes into one network so that they will interact with one another, such as adding a proposed pipe into an existing structure. This custom parameter will enable me to label existing vs. proposed pipes (or any other type of status).

You cannot add custom parameters with only the Part Builder interface, it will be necessary to edit some XML files in order to do this. To add our parameters is a two-step process. The Parameter has to be declared, and then it has to be assigned a usage. Both of these steps are done by editing the *AeccPartParamCfg.xml* file in the *Aecc Shared Content* directory. Open up the file for editing and try not to get overwhelmed by what is in there.

First, we will declare our new parameter in the Part Properties Sort Group. Look for the line <AeccDfSortGroup name="Part Properties". Like I mentioned earlier, it is always a good idea to copy a line item that is the closest to the new one that you want to create. Since we are just doing a text field, we will copy a parameter that is already a text field, such as Cover. Copy that entire line and paste it wherever you like. It does not matter the order of the parameters, so you may want to create a section specifically for all of your new custom parameters. Once you have a copy, all you need to change is the name, description, and context. Change those three items to match the picture on the right.

```
            <AeccDfParameter name="ACDW" desc="Darcy Weisbach Factor"
context="FlowAnalysis_DarcyWeisbach" index="0" datatype="Float"
usage="Double_General" unit="" visible="True" internal="True"/>
            <AeccDfParameter name="PiSt" desc="Pipe Status"
context="Pipe_Status" index="0" datatype="String" usage="String_General"
managelist="True" unit="" visible="True" internal="True"/>
            <!--AeccDfParameter name="PIB" desc="Inner Pipe Bottom to
Base Point" context="PipeInnerBottomToBasePt" index="0" datatype="Float"
usage="Double_Distance" unit="in" visible="True" internal="True"/-->
```

Next, we need to assign the new parameter a usage. As we talked about earlier, parameter usages are for telling the catalog which parameters are used for which specific part. Scroll down and find the line <AeccPartTypeCfg type="Pipe" desc="Pipe">. The parameters called out under this line are the parameters available for all the pipes in the catalog. We need to add a line for the new Pipe Status parameter, so copy an existing line and make this section match the picture on the right. Those are the two steps necessary in this file. From here we can go back into Part Builder to add this parameter to a part, or do it right in an XML file. We will look at both.

```
<AeccParamUsage>
    <AeccPartDomainCfg domain="Pipe_Domain">
        <AeccReqParam context="SweptShape"/>
        <AeccPartTypeCfg type="Pipe" desc="Pipe">
            <AeccReqParam context="WallThickness"/>
            <AeccShpParam context="PipeInnerDiameter"/>
            <AeccShpParam context="PipeInnerHeight"/>
            <AeccShpParam context="PipeInnerWidth"/>
            <AeccOptParam context="Material_Type"/>
            <AeccOptParam context="MinCurveRadius"/>
            <AeccOptParam context="FlowAnalysis_Manning"/>
            <AeccOptParam context="FlowAnalysis_HazenWilliams"/>
            <AeccOptParam context="FlowAnalysis_DarcyWeisbach"/>
            <AeccOptParam context="Pipe_Status"/>
        </AeccPartTypeCfg>
    </AeccPartDomainCfg>
```

At this point, make sure you have Civil 3D closed and are starting it up from scratch. No matter what you do, Civil 3D and Part Builder will not see the new parameter until it starts up fresh. Start Civil 3D from scratch, launch Part Builder, and before picking a pipe, I like to make sure that I regenerate and validate the catalog. Then pick a pipe to add our new parameter to, such as the PVC pipe, and open Part Builder.
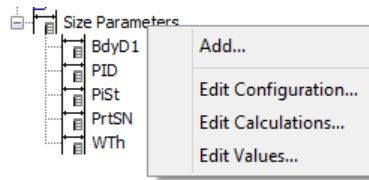
First in Part Builder, right click on Size Parameters and select Add. This will bring up the New Parameter dialog box where you will pick the parameter to add to the part. Notice all of the other parameters that are not being used by this part. Select the new Pipe Status parameter and click OK.
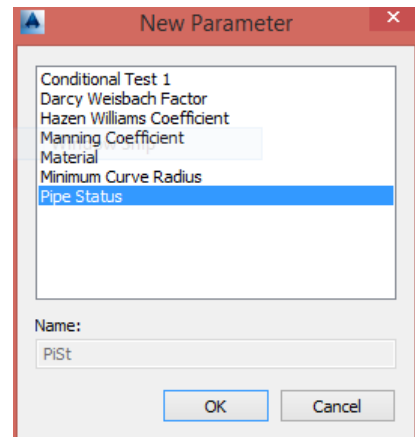
This will bring you to the Parameter Configuration view and instead of using the default of constant for data storage, we want to be able to use a list. Switch the data storage option for our new Pipe Status parameter from constant to list.
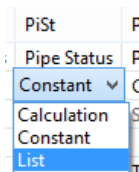
Switch over to either the Calculations or Values view and edit the values for the new Pipe Status parameter. I went ahead and added the five options as shown on the right, but you could add anything else that you wanted to use.

That should be it. Validate, save, and exit Part Builder and we will look at how to take advantage of this new parameter.
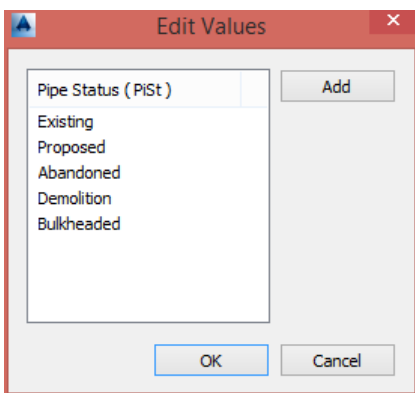
Building Parts Lists

The foundation for any good pipe network in Civil 3D starts with the parts list. The default templates give you some good starting points, but this class is all about customization, so we are going to make some great parts lists. We are going to focus mostly on pipes since that has been the majority of the parts that we have customized so far. A lot of what we do for pipes we can also do for structures.

To start, we will make four parts lists for what I feel we will use the most. There will be one each for existing and proposed Storm Sewer and Sanitary Sewer. You may also want to even expand beyond that depending on how you would like to do Quantity Takeoff for items such as demolition or future, etc.

Let's begin by creating the four parts lists; Existing Storm Sewer, Proposed Storm Sewer, Existing Sanitary Sewer, and Proposed Sanitary Sewer. For each parts list, add the appropriate parts that you would use for each category, being sure that you are taking full advantage of our new customizations. Make sure that for an Existing parts list you are assigning the new Pipe Status parameter as Existing.

Also be sure to set the correct default pipe style, as well as rules, render material, and pay items as your company uses them. It is always best to have these set up at the parts list level so they are automatically defined with each and every pipe.
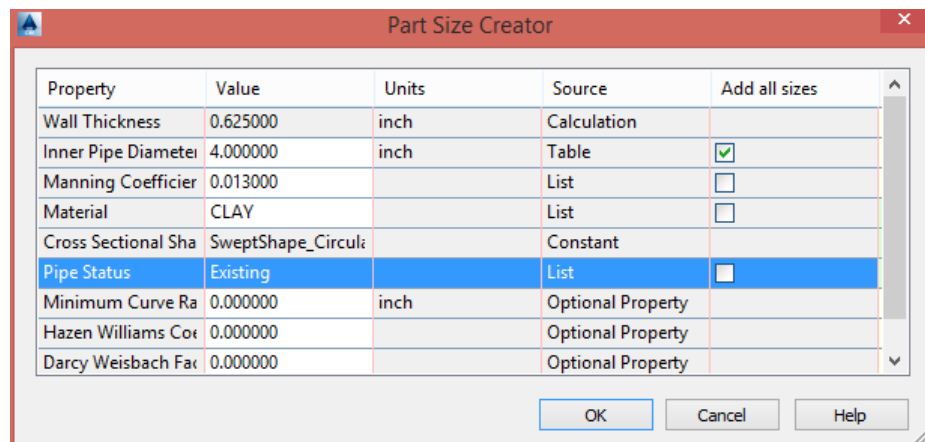
Pipe Label Styles

Now that we have our great parts lists created, it is time to take advantage of them in our label styles. We have customized the Material and Pipe Status for every pipe, so let's take a look at how we can use these in styles.

Using the same drawing with the new parts lists, create a pipe network with a good mix of existing and proposed pipes, as well as using different materials, so you can see how the customized labels will work.

▲   Annotate Tab – Labels & Tables Panel – Add Labels

Go ahead and label all of your pipes using the Length Description and Slope label style. I personally always like to use the Add Labels dialog box available on the Annotate ribbon. Once done with that, select one of the labels, right click and we will edit the label style. Now in the Label Style Composer, switch to the Layout tab. We are going to add an additional property to the Text Component already in place for the label. Under Text and Contents, click on the ellipsis to bring you into the Text Component Editor.
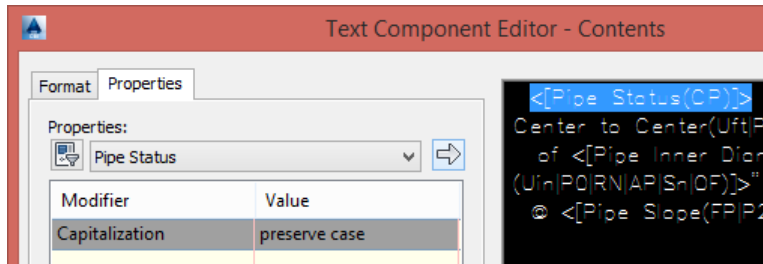
Find the new Pipe Status in the properties drop down, change the value of any modifiers that you would like, and then always remember to click on the right arrow to add the property into the text field.

Click OK three times to bring you back to the drawing, and you should see the label style update with the new Pipe Status property. Also notice the different materials of pipes being labeled. If you need to change either of these properties after you have created the pipe, you can find them both in the pipe properties. Select the pipe you want to change, right click, and select pipe properties. Both Material and Pipe Status should be drop down lists here with the new part catalog. If you need a different Material pipe, you will have to use swap part.

Pipe Table Styles

Just as you customized the individual pipe labels, you can also customize pipe and structure tables. We will quick look at a pipe table to use as an example. The process is exactly the same as adding the property to a pipe label style. Simply edit the table style you want to change or create a new table style. Once in the Table Style dialog box, you can either add a column to add the custom property to, or add it to an existing column.

Structure Label and Table Styles

Structure labels and tables can also use custom properties that are designed for structures. The only limitation that I have found with labeling any of these custom properties is that you cannot use the custom pipe parameters in any structure labels or tables when using the connected pipe properties.

Conclusion

The possibilities are near endless as to what you can customize with your pipes and structures. Do your research and see what other people are doing. Just remember that there are a few things that you cannot do. Be patient when testing new ideas. Save often. Always keep backups.

As of this class it is still an issue that these methods do not work with Civil 3D 2015. Hopefully in the future this issue will be resolved. Follow the conversation on the Autodesk forums to stay up to date.

If you are having problems with getting any of these to work, post a question on the forums, or feel free to email me. It is my hope that I have provided enough information for you that you are able to make your projects much more informative and have an easier time completing them. Happy piping!

Reference Material:

Autodesk Help and Forums

http://help.autodesk.com/view/CIV3D/2015/ENU/?guid=GUID-74BA8832-34F1-4734-9884-4D5D9F43D767 - Best Practices Guide. Definitely check out 'How the Part Catalog Works' and 'Digging It: Display Flow Capacity with Manning Equation'.

http://help.autodesk.com/view/CIV3D/2015/ENU/?guid=GUID-B5E8D10E-2958-431B-BF3C-516C526048B3 - Part Builder. Read ALL of this!

http://help.autodesk.com/view/CIV3D/2015/ENU/?guid=GUID-99EDD05E-0A51-45BA-B7F8-6F531A2AD791 - Part Builder Tutorials.

http://forums.autodesk.com/t5/autocad-civil-3d-general/i-know-i-shouldn-t-have-but-i-ve-got-a-partbuilder-problem/m-p/5174293

http://forums.autodesk.com/t5/autocad-civil-3d-general/changing-pipe-material/td-p/5127904

Autodesk University Classes

http://au.autodesk.com/au-online/classes-on-demand/class-catalog/2011/autocad-civil-3d/creating-custom-storm-inlets-using-part-builder

http://au.autodesk.com/au-online/classes-on-demand/class-catalog/2013/infrastructure-design-suite/ci2170

Expert Blogs

http://beingcivil.typepad.com/my_weblog/2009/12/part-builder-how-to-add-custom-part-sizes.html

https://civil2inventor.wordpress.com/2008/11/20/civil-3d-part-builder-intro/ - https://civil2inventor.wordpress.com/2009/09/16/civil-3d-part-builder-solutions/ - 8 part series followed by a 2 part series

http://www.civil4d.com/2009/08/setting-frame-grate-cover-in-your-parts-list/

http://beingcivil.typepad.com/my_weblog/2010/07/assigning-optional-properties-to-a-part-size.html

Civil 3D Country and State Kits

http://knowledge.autodesk.com/support/autocad-civil-3d/downloads/caas/downloads/content/civil-3d-country-kits.html?v=2014 - Autodesk Country Kits

http://knowledge.autodesk.com/support/autocad-civil-3d/downloads/caas/downloads/content/civil-3d-country-kits-for-the-united-states.html - ODOT State kit

http://www.dot.wisconsin.gov/business/engrserv/roadway-design-civil3d.htm - WisDOT