



CES502192

Civil 3D Templates: Restructuring for Collaboration and Maximum Efficiency

Presenters:

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Learning Objectives

By following us through our journey in the development and restructuring of our Civil 3D templates attendees will be able to:

1. Define template requirements, and leverage best practice workflows
2. Restructure your templates to utilize new Civil 3D functionality with property sets and reference templates
3. Implement procedures to manage, and develop template content
4. Use Dynamo to automate the application of meta data, and generate IFC files

Description

With our post-pandemic industry immersing into a new normal, our designers and engineers are now looking to technology to enhance collaboration and improve efficiency around the globe. With Civil 3D we now have greater ability to provide users with more template functionality and content. During this case study, we will review our workflows to restructure Civil 3D templates, that allowed us to provide our teams around the globe, the necessary standardization and functionality for any project. From small site works to the largest BIM multi-disciplinary mega-projects, we will show you how to rethink how and what content to distribute to better leverage your standards. Discover which primary and reference templates to create, and when to use them. Learn how to restructure your templates, to achieve greater efficiency, realize more cost savings, and flexibility with your current templates.

We will cover the best practice uses for your primary templates, and your reference template setup. With the importance of styles and settings in your template we will share our tricks to maximize the benefits they can offer you. Custom client requirements? No problem, we will cover that workflow too!

To add additional flexibility, we have utilized Dynamo and we will discuss how we leveraged new reference templates with property sets to automate the way client meta data enriches our BIM models based on a required level of detail (LOD), and how it can be used to provide your clients with project IFC data from Civil 3D.

During this discussion, we will cover the initial challenges we faced, and the process we developed to overcome, and how we delivered our new templates companywide! Lastly, efficiency and cost savings realized will be discussed.

During the next hour we will be discussing the new Civil 3D functionality and how it allowed our teams to update our approach to providing templates. With the strain that the last 2 years has placed on the consulting industry (Covid and working from home), we will share the criteria that we used to help guide us in the correct direction for GHD.

Do you find the development of standards challenging?

We'll help you change the approach you take to incorporate the functionality every one of your teams require.



Think of templates as being rather dry? With no excitement?

Well not anymore!

Showing you how we leveraged our new standards by using Dynamo to automate your workflows. How property sets automated our labels and styles.



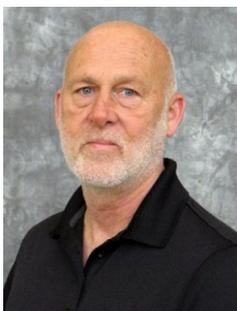
Speaker(s)

Michael Pavlovec Graduating back in 1993, I was fortunate enough to secure a position in the Engineering Office at the Ontario Ministry of Transportation as a Highway Designer. As part of the new Design Teams using CAD within the Ministry and transportation industry for the first time, the development of standards was a hot topic. Always volunteering for various committee's and working groups to help drive consistency throughout my career, my experience includes use of Softdesk, Land Development, and now Civil 3D among other associated applications. Specializing in the Transportation business sector, I am a registered Engineering Surveyor and certified Highway Designer. My career has progressed into the Project Management space now supporting Design-Build and Design-Bid-Build delivery models. I leverage technology and automation on each and every project! I am presently working at GHD in the Kingston ON, CA. office.



Randy Brook I finished full time schooling in 1984 and began a career in Civil Engineering as a consultant. I have worked as a surveyor (legal, topo and construction layout). I then graduated to inspector and had the opportunity to work on all forms of projects including large subdivisions (300 lots), road reconstructions and widenings, an underground 1,000,000-gal storage tank and pumping station and a 50ft deep wet well and pumping station. After a brief time with a contractor, I came back to consulting and started my career as a designer. My design career has included design in AutoCAD, Land Development Desk Top and more recently (since 2007) Civil 3D. Within the Civil 3D era of my career, I have created many different templates and utilized them on many different types of projects, including, subdivisions, road reconstruction, stream restoration design and site plan designs. I am presently working at GHD in the Waterloo ON, CA. office.

I have been known as intense or the 'Grumpy Old Man'

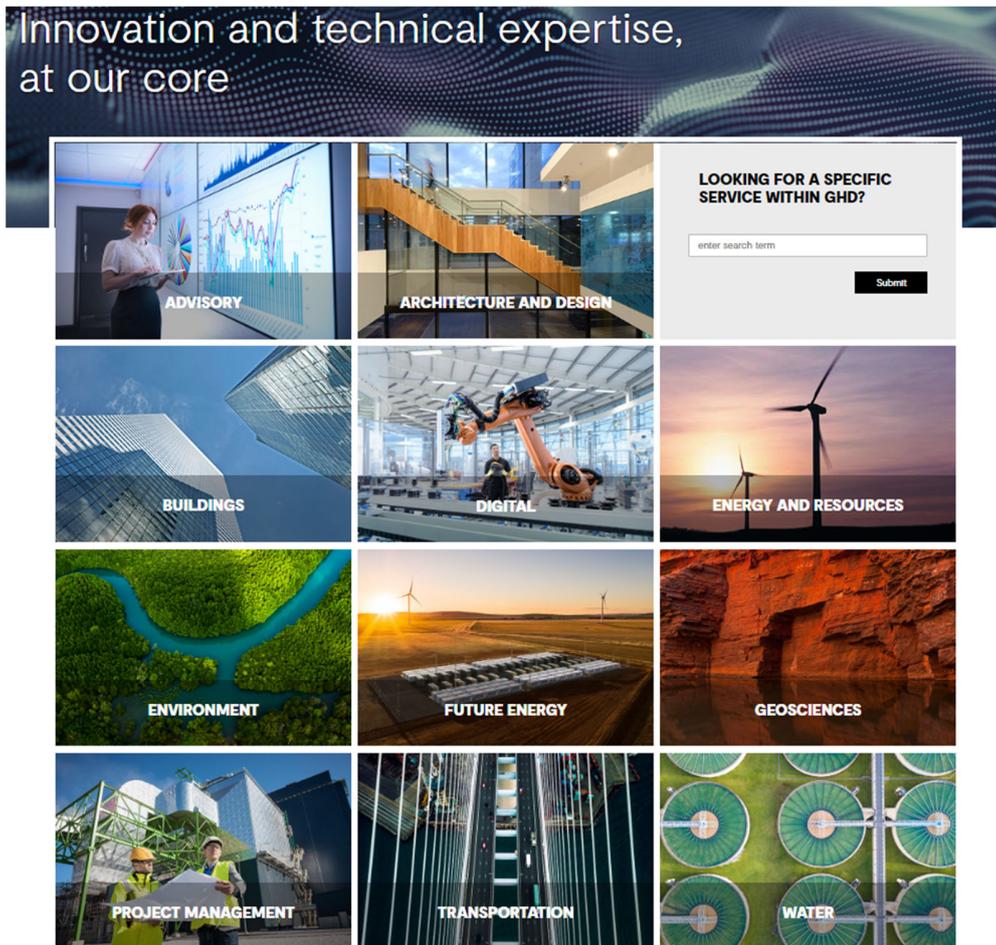




GHD Journey

With innovation and technical expertise at our core, GHD has always been dedicated to helping our clients embrace the future. With over 10,000 employees in over 200 offices worldwide our diverse and talented team has helped clients solve complex challenges with advanced technology. With Civil 3D being one of our most widely used applications for modeling, we found our design groups pushing the envelope and needing more and more from our templates.

We were starting to outgrow our templates! While very well developed over the years, we had business groups reach out needing more functionality and content as we transitioned into the pandemic. As our workforce moved out of the offices, and being a full-service engineering firm, global collaboration required our teams to rethink our standard template approach to cover all business lines and delivery models.



A global workgroup was formed from our Civil 3D Champions to assess our templates and develop a workplan to take them into the future.



Starting Point

Our current templates were originally created in partnership with Autodesk, around the time Civil 3D was implemented. In use for the last 10+ years, and based on the National Cad Standards (NCS), we had a fully developed set of templates for our global Civil 3D users. Our assessment found that while functional, with more development we could offer greater functionality to support our teams. Through new functionality released in Civil 3D 2023, we could restructure how we provided the standards and styles to our teams around the globe to drive greater efficiency.

We had templates for imperial and metric workflows, and templates for each of our regions. Templates were separated based on project types, but we found more could be offered.

Name	Date modified	Type	Size
2D Design	11/4/2021 9:04 AM	File folder	
Corridor Design	11/4/2021 9:04 AM	File folder	
Existing Condition	11/4/2021 9:04 AM	File folder	
Grading Design	11/4/2021 9:04 AM	File folder	
Pipe Network Design	11/4/2021 9:04 AM	File folder	
Reference	2/10/2022 12:03 PM	File folder	
GHD C3D 2022 - All Design - US Imperial.dws	11/5/2015 2:43 PM	AutoCAD Drawing...	4,937 KB
GHD C3D 2022 - All Design - US Imperial.dwt	5/22/2019 5:53 PM	AutoCAD Template	4,865 KB
Local Templates	9/30/2021 7:48 AM	Shortcut	3 KB

Existing Tempalte Structure

In order to take a look deep inside our current template offerings, we needed an outside set of eyes - enter Autodesk and the team at CADPRO Systems, an Autodesk reseller. Sessions were setup to look at new functionality within Civil 3D for reference templates, corridor templates, and even property sets.

The verdict? While the templates looked to functional for most projects, restructuring to provide a new approach to provide easy to consume consistency, they could be taken to another level. We needed more controls using Point Groups and Description Keys; Property Sets and Styles for Pipe Networks and Sites. More Dynamo! A challenge from a Cad Management perspective... Terminology around the globe also differed, units changed, languages too. Where to start?

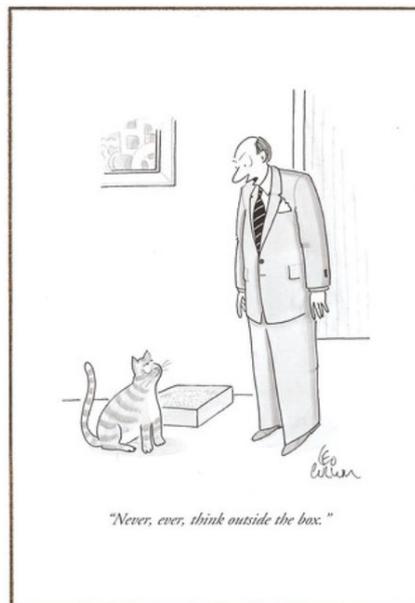
We stuck to our roots with our NCS based approach - and started to think of it as less of a standard and more of a methodology. It had to be flexible! We took liberties when it came to NCS layering, and used an approach to ensure all objects of a specific type ended up on the same layer based on the Object Layer Settings. The layers for Civil 3D objects were then further developed.

Object	Layer	Color
Feature Line	C-FEAT	None
Fitting	CU-PLST_WATR	None
Fitting-Labeling	C-ANNO_STRC	None
General Note Label	C-ANNO	None
General Segment Label	C-ANNO	None
Grading	C-GRAD	None
Grading-Labeling	C-ANNO_SURF	None
Grid Surface	C-SURF	None
Grid Surface-Labeling	C-ANNO_SURF	None
Interference	CU-CLSH_INTT	None
Intersection	C-ISEC	None
Intersection-Labeling	C-ANNO	None
Mass Haul Line	C-HAUL_LINE	None
Mass Haul View	C-HAUL	None
Match Line	C-FRAM_VIEW	None

Object Layer Settings

We leveraged more Expressions, created User Defined Classifications, and Description Keys. We ensured that all commands had been reviewed in our new templates. Initially thought of as a complete template overhaul, it turned into a straight forward restructuring – with some additions.

Our content was there, we just wanted more! With Civil 3D now supporting the use of reference templates and corridor templates, we began the restructuring of our global templates.



And for that, we thought outside the box!



Defining Template Requirements, and Leveraging Best Practice Workflows

Our GHD Champions represented our business lines, from Roads and Rail to Land Development, Environmental to Water Resources, and each was tasked with the development of a new set of reference templates to serve their groups needs.

We workshopped with Autodesk, and the team at CADPRO Systems, to prioritize our goals in order to find a structure that worked globally and on every project. From small sites to the largest BIM mega projects. We discussed different ways we could control consistency and leverage functionality, all while empowering our BIM Managers to assemble templates for each projects needs as defined by our BIM Execution Plans. It was also determined that the templates needed to be living documents with a minimum of 2 gate keepers (metric and imperial). Along with the team of our Civil 3D Champions from around the globe to guide us in the development and maintenance of these new templates.

As we all know there are many ways to achieve things in Civil 3D, so we kept an open mind – and thought outside the box! Remember, Flexibility!

So, what were our our outcomes and needs from these workshops?

- Living templates and documents – The ability to update and distribute
- Defined and consistent workflows – consistency equals efficiency!
- Concise templates - Working from home through Covid, VPN connections, and varying internet speeds
- Common Data Environment (CDE) - easy access to data for our stakeholders
- Keep to your standard – but be flexible! We used the National Cad Standards (NCS)
- ISO 19650 Compliance – you need control, checks, and records
- Cloud based - central CDE storage to maintain your 3D models
- Flexible Cad Management – Serving a diverse global company
- Collaboration - Model coordination’s between Civil 3D groups
- Automate – Leverage property sets for consistency
- Reference templates! – layers of standardization and functionality at your fingertips
- Autodesk Best Practices – why recreate the wheel?
- Descriptions, descriptions, and more descriptions!

Name	Description	Created by
_C-PROF-EGRD-ASRD-E	Existing No Geometry Points	rbrook
_C-PROF-EGRD-E	Existing No Geometry Points	rbrook
_C-PROF-FGRD-DTCH-N	New Finished Ditch Profile	rbrook
_C-PROF-FGRD-N	New Finished Geometry Points Displayed	rbrook
_C-PROF-FGRD-NOPI-N	New Finished No Geometry Points	rbrook
_C-PROF-INTR-FGRD-NOPI-N	New No Markers, Interpolated Finished Ground Surface	rbrook
_C-PROF-INTR-FGRD-NOPI-NPLT-N	New No Markers, Interpolated Finished Ground Surface, No Plot	rbrook
_C-PROF-WATR-N	New Finished No Geometry Points	rbrook

Point Groups



Some of our considerations?

- Point groups names = point label style = point insertion layer
- Point groups assign the point style and the label style, description key code is at the front of the Description
- Some Point Groups create the surface and some read the surface

Name	Description	Style	Label Style	Num...	Classification
[C] _All Points		_C-SITE-E	_C-TOPO-CTRL-N	0	All
[C] C-NODE-CON	con, Coniferous Tree	_C-SITE-CON-N	_C-SITE-DESC-VIEW-N	0	None
[C] C-NODE-DEC	dec, Deciduous Tree	_C-SITE-DEC-N	_C-SITE-DESC-VIEW-N	0	None
[C] C-NODE-PALM	pm, Palm Tree	_C-SITE-PALM-N	_C-SITE-DESC-VIEW-N	0	None
[C] C-SITE-NDSP	No display point style,	_C-NODE-NDSP	_C-SITE-NDSP	0	None
[C] C-SITE-TEXT	p, Surface Point, L100	_C-SITE-N	_C-SITE-TEXT-N	0	None
[C] C-SITE-TEXT-CBSN	cb, Surface point, with CB point style, L100	_C-SITE-CBSN-N	_C-SITE-TEXT-CBSN-N	0	None
[C] C-SITE-TEXT-F	f, Furture interpolated point, L100	_C-SITE-F	_C-SITE-TEXT-F	0	None
[C] C-SITE-TEXT-FLOOR	ff, Finished Floor Elevation from High Buildi	_C-SITE-NDSP	_C-SITE-TEXT-INTR-FLOOR-N	0	None
[C] C-SITE-TEXT-HGWE	gw, High Groundwater Elevation and Minim	_C-SITE-NDSP	_C-SITE-TEXT-INTR-HGWE-N	0	HGWE Seperation
[C] C-SITE-TEXT-HIGH	hp, High point of road, has (HP) as discripti	_C-SITE-N	_C-SITE-TEXT-HIGH-N	0	None
[C] C-SITE-TEXT-INTR	i, Interpolated surface pointed, L100	_C-SITE-N	_C-SITE-TEXT-INTR-N	0	None
[C] C-SITE-TEXT-INTR-CNTR	cl, Centre line of road, L80, rotated 90	_C-SITE-N	_C-SITE-TEXT-INTR-CNTR-N	0	None
[C] C-SITE-TEXT-INTR-CURB-TOPP	tc, Edge of Pavement with top of curb Calcu	_C-SITE-N	_C-SITE-TEXT-INTR-CURB-TOPP-N	0	None
[C] C-SITE-TEXT-INTR-DTCH	sw, Elevation of swale, L100 with (SW)	_C-SITE-N	_C-SITE-TEXT-INTR-DTCH-N	0	None
[C] C-SITE-TEXT-INTR-L80	i80, Interpolated surface pointed, L80	_C-SITE-N	_C-SITE-TEXT-INTR-L80-N	0	None
[C] C-SITE-TEXT-INTR-RTWL-BOTM	bw, Bottom of Retaining wall, L80 with BW=	_C-SITE-N	_C-SITE-TEXT-INTR-RTWL-BOTW-N	0	None
[C] C-SITE-TEXT-INTR-RTWL-TOPP	tw, Top of retaining wall, L80 with TW=	_C-SITE-N	_C-SITE-TEXT-INTR-RTWL-TOPP-N	0	None
[C] C-SITE-TEXT-INTR-X	x, Interpolated surface pointed, L100	C-SITE-X-N	_C-SITE-TEXT-N	0	None
[C] C-SITE-TEXT-LOW~	lp, Low point of road, has (LP) as description	_C-SITE-N	_C-SITE-TEXT-LOW~-N	0	None
[C] C-SITE-TEXT-MTCH	m, Match existing ground - Slanted L80 with	_C-SITE-N	_C-SITE-TEXT-INTR-MTCH-N	0	None
[C] C-SITE-TEXT-TOPG	tg, Surface point, with T/G=CB point style, L	_C-SITE-CBSN-N	_C-SITE-TEXT-TOPG-N	0	None

Our Setup

- Point Description Keys are in both upper and lower case for design template, only layers and scaling come from the Description Keys
- Set the layer in a label style to '0', just like you would with a block. This will minimize the number of layers that you need to worry about

Label Style Composer - _C-SITE-TEXT-INTR-CNTR-N

Property	Value
Label	
Text Style	GHD Arial Narrow
Label Visibility	True
Layer	0
Behavior	
Orientation Reference	Object
Forced Insertion	None
Plan Readability	
Plan Readable	True
Readability Bias	91.0000 (d)
Flip Anchors with Text	True

Label Styles



Code	Style	Point Label Style	Format	Layer	Scale Parameter	Fixed Scale Fac
CB	<input type="checkbox"/> < default >	<input type="checkbox"/> < default >		<input checked="" type="checkbox"/> C-SITE-TEXT-CB-N	<input type="checkbox"/> Parameter 1	<input type="checkbox"/> 1.000
cl	<input type="checkbox"/> < default >	<input type="checkbox"/> < default >		<input checked="" type="checkbox"/> C-ROAD-CNTR-TEXT-N	<input type="checkbox"/> Parameter 1	<input type="checkbox"/> 1.000
CL	<input type="checkbox"/> < default >	<input type="checkbox"/> < default >		<input checked="" type="checkbox"/> C-ROAD-CNTR-TEXT-N	<input type="checkbox"/> Parameter 1	<input type="checkbox"/> 1.000
con	<input type="checkbox"/> < default >	<input type="checkbox"/> < default >	\$1cm	<input checked="" type="checkbox"/> C-SITE-TREE-TEXT-N	<input checked="" type="checkbox"/> Parameter 1	<input checked="" type="checkbox"/> 0.050
CON	<input type="checkbox"/> < default >	<input type="checkbox"/> < default >	\$1cm	<input checked="" type="checkbox"/> C-SITE-TREE-TEXT-N	<input checked="" type="checkbox"/> Parameter 1	<input checked="" type="checkbox"/> 0.050
dec	<input type="checkbox"/> < default >	<input type="checkbox"/> < default >	\$1cm	<input checked="" type="checkbox"/> C-SITE-TREE-TEXT-N	<input checked="" type="checkbox"/> Parameter 1	<input checked="" type="checkbox"/> 0.090
DEC	<input type="checkbox"/> < default >	<input type="checkbox"/> < default >	\$1cm	<input checked="" type="checkbox"/> C-SITE-TREE-TEXT-N	<input checked="" type="checkbox"/> Parameter 1	<input checked="" type="checkbox"/> 0.090
f	<input type="checkbox"/> < default >	<input type="checkbox"/> < default >		<input checked="" type="checkbox"/> C-SITE-TEXT-F	<input type="checkbox"/> Parameter 1	<input type="checkbox"/> 1.000
F	<input type="checkbox"/> < default >	<input type="checkbox"/> < default >		<input checked="" type="checkbox"/> C-SITE-TEXT-F	<input type="checkbox"/> Parameter 1	<input type="checkbox"/> 1.000
ff	<input type="checkbox"/> < default >	<input type="checkbox"/> < default >		<input checked="" type="checkbox"/> C-SITE-TEXT-INTR-BLDG	<input type="checkbox"/> Parameter 1	<input type="checkbox"/> 1.000
FF	<input type="checkbox"/> < default >	<input type="checkbox"/> < default >		<input checked="" type="checkbox"/> C-SITE-TEXT-INTR-BLDG	<input type="checkbox"/> Parameter 1	<input type="checkbox"/> 1.000
gw	<input type="checkbox"/> < default >	<input type="checkbox"/> < default >		<input checked="" type="checkbox"/> C-SITE-TEXT-INTR-HGWE	<input type="checkbox"/> Parameter 1	<input type="checkbox"/> 1.000
GW	<input type="checkbox"/> < default >	<input type="checkbox"/> < default >		<input checked="" type="checkbox"/> C-SITE-TEXT-INTR-HGWE	<input type="checkbox"/> Parameter 1	<input type="checkbox"/> 1.000
hp	<input type="checkbox"/> < default >	<input type="checkbox"/> < default >		<input checked="" type="checkbox"/> C-SITE-TEXT-INTR-N	<input type="checkbox"/> Parameter 1	<input type="checkbox"/> 1.000
HP	<input type="checkbox"/> < default >	<input type="checkbox"/> < default >		<input checked="" type="checkbox"/> C-SITE-TEXT-INTR-N	<input type="checkbox"/> Parameter 1	<input type="checkbox"/> 1.000
i	<input type="checkbox"/> < default >	<input type="checkbox"/> < default >		<input checked="" type="checkbox"/> C-SITE-TEXT-INTR-N	<input type="checkbox"/> Parameter 1	<input type="checkbox"/> 1.000
I	<input type="checkbox"/> < default >	<input type="checkbox"/> < default >		<input checked="" type="checkbox"/> C-SITE-TEXT-INTR-N	<input type="checkbox"/> Parameter 1	<input type="checkbox"/> 1.000
i80	<input type="checkbox"/> < default >	<input type="checkbox"/> < default >		<input checked="" type="checkbox"/> C-SITE-TEXT-INTR-N	<input type="checkbox"/> Parameter 1	<input type="checkbox"/> 1.000
I80	<input type="checkbox"/> < default >	<input type="checkbox"/> < default >		<input checked="" type="checkbox"/> C-SITE-TEXT-INTR-N	<input type="checkbox"/> Parameter 1	<input type="checkbox"/> 1.000
Ia	<input type="checkbox"/> < default >	<input type="checkbox"/> < default >		<input checked="" type="checkbox"/> C-SITE-TEXT-INTR-HOUS	<input type="checkbox"/> Parameter 1	<input type="checkbox"/> 1.000
LA	<input type="checkbox"/> < default >	<input type="checkbox"/> < default >		<input checked="" type="checkbox"/> C-SITE-TEXT-INTR-HOUS	<input type="checkbox"/> Parameter 1	<input type="checkbox"/> 1.000
Ib	<input type="checkbox"/> < default >	<input type="checkbox"/> < default >		<input checked="" type="checkbox"/> C-SITE-TEXT-INTR-HOUS	<input type="checkbox"/> Parameter 1	<input type="checkbox"/> 1.000

Description Key Settings

- Preset object names to help with NCS layers

Name	Description	Network Parts List	Source drawing
C-SSWR	Design Sanitary Sewer	_C-SSWR-N	
C-STRM	Design Storm Sewer	_C-STRM-N	
C-STRM-FDCS	Design Foundation Drain Collection System	_C-STRM-FDCS-N	
C-WATR	Design Watermain	_C-WATR-E	

Part List Connectivity

- Use Object layers to start setting the layers, use modifiers and values

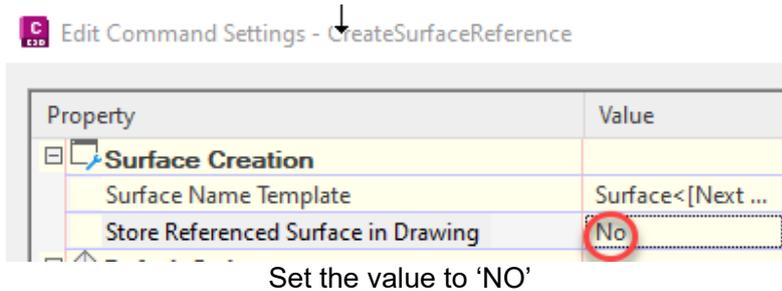
Object	Layer	Modifier	Value	Locked
Pipe	-PIPE-N	Prefix	*	
Pipe-Labeling	-TEXT-N	Prefix	*	
Pipe and Structure ...	-TEXT-N	Prefix	*	
Pipe Network Section	-PROF-N	Prefix	*	
Pipe or Structure Pr...	-PROF-N	Prefix	*	
Point Table	C-SITE-TEXT-N	None		
Pressure Network S...	-SECT-N	Prefix	*	
Pressure Part Profile	-PROF-N	Prefix	*	
Pressure Part Table	-TEXT-N	Prefix	*	
Pressure Pipe	-PIPE-N	Prefix	*	
Pressure Pipe-Label...	-TEXT-N	Prefix	*	

Object Layer Settings

Look through the Commands and have them preset. With Autodesk adding new Commands, check annually during your template migration into new versions.

Our favorite shared tip!!

Don't store Reference Surfaces (preset is to Yes) in drawing. This will reduce the size of drawings and greatly reduce load times. Look for many more of these types of Commands to help you be more productive and efficient



We also used expressions for ensuring the slope is always in the correct direction,
 $IF(\{Surface Slope\} < 0, 0, \pi)$
and to be placed in the rotation angle of the arrows.

All of these standards were then applied to the imperial and metric templates - which contain approximately 1500 style, 900 layers, and the following pre-defined objects in total – surfaces, sites (4), gravity networks (4), pressure networks (2), point groups (22) and discretion keys.

With this much context and functionality being offered, we used reference templates to spread our offerings! Remember – easy to consume. Remember these areas when developing templates - Mass Haul, Rail, Superelevation, Cant, Bridges, Building Sites. Some of these may be client specific and are not part of our general Civil Engineering Template – we created a reference template. And with this just the design templates, our survey templates are another discussion entirely, but was approached with the same methodology and principles.

Restructuring - Reference Templates and Property Sets

There were Xref's, Dref's and we now have Reference Templates (Tref's) to think about. Tref's will allow you to add all sorts of required content to a model file, then remove items that were not used - without purging them. Just by unloading the Tref!

We were then able to restructure our templates in a manner that would provide the maximum amount of flexibility and still maintain the intent and purpose each service line required in their templates.

When thinking of Reference Templates, and with the help of the Autodesk Best Practice guides, we started this journey by asking a few questions...

- What reference templates would we need?
- How would we migrate our current template functionality into these reference templates?
- How does this new workflow look?



As it turns out, these questions were easy to answer!

We started with our primary template. Keep it simple was the motto! We wanted our users to have all the necessary functionality for their day-to-day modelling - but just the basics. We started to create our reference templates to house all the items that were pulled out of our template. We moved content into the following:

- Corridor – into the Corridor Reference Template
- Surveying - into the Survey reference template
- Meta Data – into the BIM Reference Template
- Regional Requirements – create reference templates

You get the idea – think of it as adding layers of functionality based on each projects requirements or complexity!

So how do we get all of this functionality and data to the locations that require it, and maintain the data in consist templates? We ended up with 3 primary templates with a host of reference templates per unit (imperial/metric).

Name	Contains
2D2022_Prime_2DBlank_CA_M 2D2022_Prime_2DBlank_US_I	Blank templates, they have references to the C3D2022_Ref_CAD_CA_M (Metric) or Imperial as a reference template.
C3D2022_Prime_Base_CA_M C3D2022_Prime_Base_US_I	These templates contain the base information to start a C3D drawing, there is predefined point groups, Design Surface, Sites and Description Keys. These items are not transferred with a reference template. They reference C3D2022_Ref_CAD_CA_M and I, C3D2022_Ref_CAD_CA_M and I, and C3D2022_Ref_Property_Set_CA_M and I
C3D2022_Prime_Survey_CA_M C3D2022_Prime_Survey_US_I	These are standalone templates, there are predefined point groups, surfaces and sites, for surveying
C3D2022_Ref_CAD_CA_M C3D2022_Ref_CAD_US_I	When referenced into other drawings, these templates bring all the basic AutoCAD goodies such as Civil Layers, Blocks, Line Types, Dimension Styles, and Text Styles.
C3D2022_Ref_Design_CA_M C3D2022_Ref_Design_US_I	When reference into other drawings, these templates will add all the C3D settings and styles for objects.
C3D2022_Ref_Property_Set_CA_M C3D2022_Ref_Property_Set_US_I	When referenced, these templates will add the Property Set Data and Style functionality to your models

Example Setup

Now onto the new workflow!

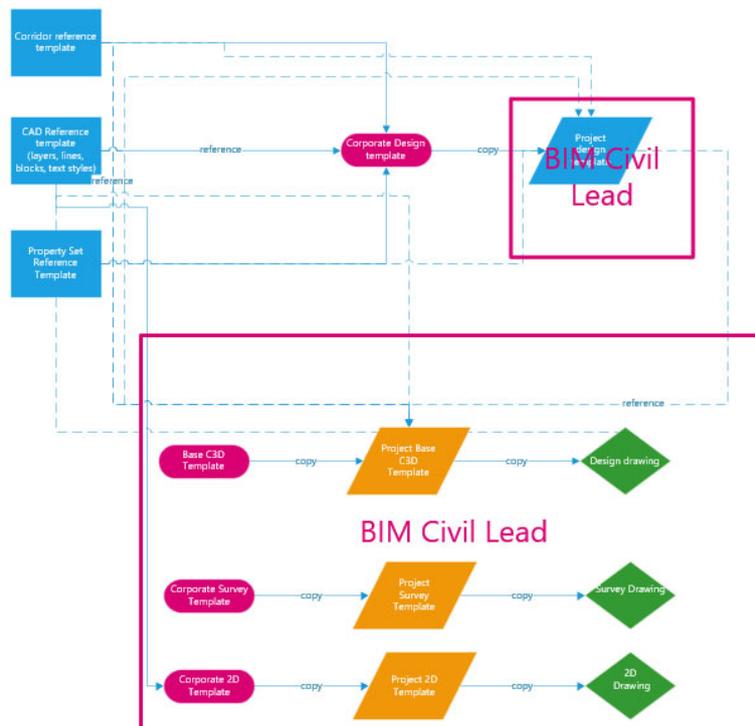
When developing our new workflow to allow our global users to consume these templates – we looked to Civil 3D 2023 and came up with the following....

Once again, we workshopped with the experts at Autodesk and CADPRO Systems to provide support on the best practices. The recommendation? Use a heavy dose of reference templates! This meant for each projects we could have project specific styles that could be transferred to all project drawings just by reference template management. We had several template workflows but only one maintained the criteria that we had collected.

We utilized a Base C3D template that contains predefined items that are not transferred thru Reference Templates, like Pipe Networks, Sites, Point Groups, Surface Name and Description Keys. So why not use it and designers can add the styles that they need for specific design types (grading or servicing) this will minimize the number of styles in each design, if they need to add more styles, they have the option.

The following illustration represented our restructured template workflow, and provides the maximum flexibility while using DWT's - so we can have only the items that we want coming out of each template. But still add more, if and when required. We now have standards that we can control at a project level.

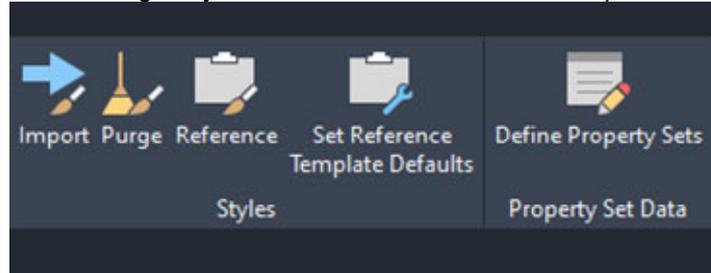
Restructured Template Flow



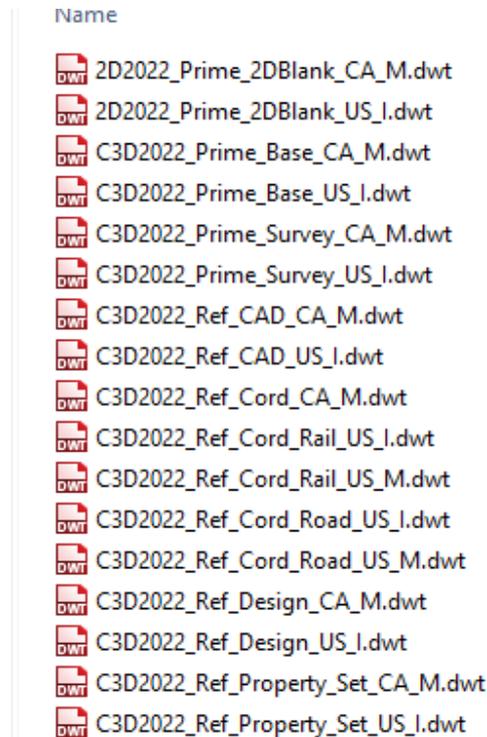


Once the templates are copied to the project, the reference templates should be re-pathed to the project location. This should be completed using the standard C3D setup with no customization.

On the Manage Tab, look to the right - you will see the Reference Templates & Property Sets

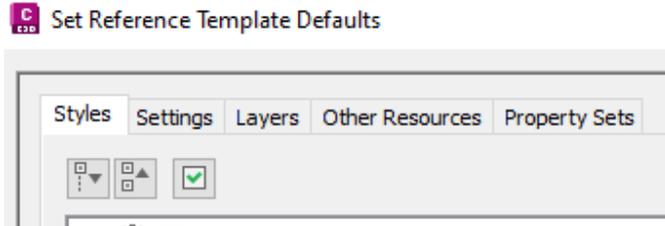


Manage Tab



Example Template Setup

The 'Set Reference Template Defaults' is where we control or turn on or off the items that we want leaving the template.

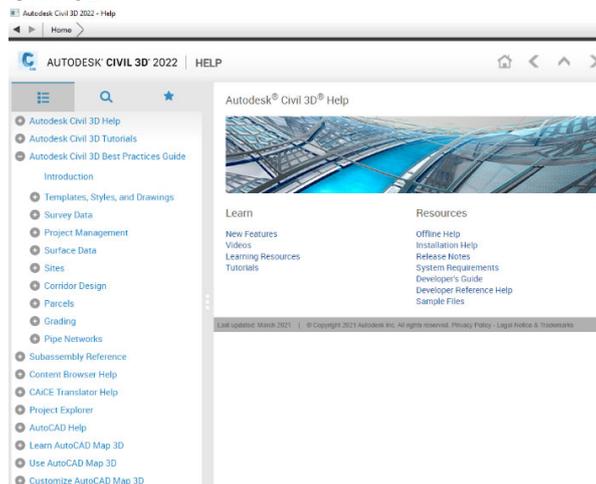


Set Reference Template Default Menu

Benefits....

- When using a DWT Reference Template, we control what leaves the template
- Styles, Setting, Layers, and other Resources (Blocks, Text Styles and Line Types), and Property Sets
- Project templates - update the reference templates and all drawings are updated
- Settings and styles - not included – preset objects point groups, pipe networks
- Edit the dwt file for maximum functionality
- How and why to put them together and connect them – for each project
- 'AECREFTEMPLATEAUTOUPDATE' set to 0 OR 1 ? – at this time we have chosen '0' – so we can manually update each drawing as required.

We included Best Practice training to highlight the importance of this new workflow - located under the help button in Civil 3D



And another favorite Tip!

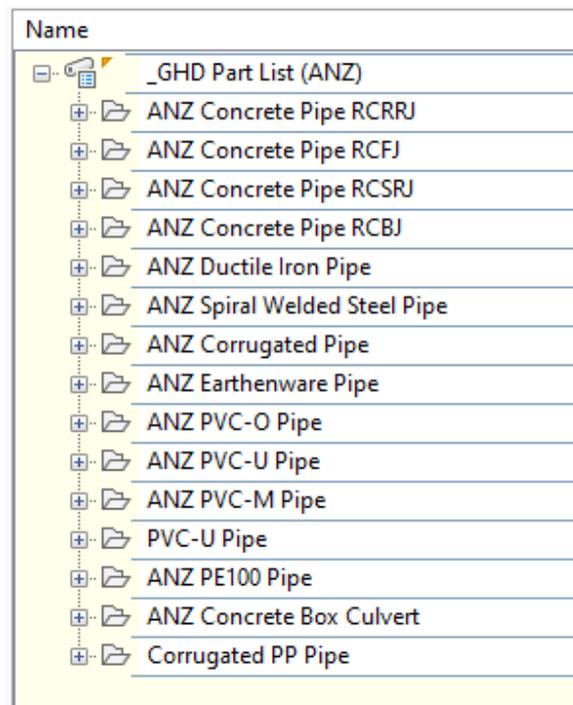
Use References to Reduce Drawing Size

Create a surface directly from the point file rather than importing the points as COGO points. This practice avoids the use of system memory to keep the point data labels up to date. Rather than starting a design in the same drawing as the surface, create a data shortcut to the surface. This practice will dramatically reduce the active drawing size.

Property sets

There are so many exciting ways to utilize Property Sets in your modeling. We started with Meta Data! What do clients want as the meta data? What do we need? Pipes are a great place to start: Pipe material class, Strength, Connection types, Slopes, Wall thickness and much much more.

While we set up the pressure pipes, we starting thinking of our BIM models Level of Detail (LOD) requirements. Do we need every pipe type, every class, and strength? Can we reduce the browsed number of pipes in the pipes catalog and have one wall thickness? In gravity pipes there is a significant difference in wall thickness between concrete and PVC, but on most pressure pipes the wall thickness difference is not that much, for standard pipes. We settled on using meta data so we can have one pipe size and wall thickness – leveraging property sets to display with the labels



Example Regional Catalogs

Do start w looked to the basics to minimize and consolidate our catalogs - What kind of data, pipes, material, and strength?

Key considerations:

- Property set data does not transfer from plan to profile until C3D 2022.2
- Create lists with consistent terminology
- Set property sets to Objects, and not labels
 - This data will travel thru XREF or DataShort cuts
- Use 'non-breaking space character' ALT+255, this will make a blank or space for you
- Think about 'AECPSDAUTOATTACH' and 'PROPERTYDATAEDIT' settings



In the defaults, there is nothing after the style name for the lists, and do not have spaces in the Property Set information as some of this information goes into code.

Style	Description	Ignore During Standards Synchronization
GeneralLabels		No
GradingType		No
LineList		No
Origin		No
PipeClass		No
PipeMaterial		No
PondType		No
PressurePipeClass		No
PressurePipeMaterials		No
SlopeConstraintType		No
Standard		No
UtilityFamily		No

Default settings

We put a PS after the style type (same name as the list name) to identify it as a Property Set. The red dot means that it will be Ignored During Standards Synchronization.

Style	Description	Ignore During Standards Synchronization
AdditionalInformationPS	This PropertySet designates Additional information for objects.	Yes
CurveLabelPS	This PropertySet designates Curve information for labels.	Yes
GeneralLabelPS	This PropertySet designates General information for labels.	Yes
LineLabelPS	This PropertySet designates Line information for labels.	Yes
PipeClassPS	This PropertySet designates Pipe Class & Ratings information for o...	Yes
PipeMaterialPS	This PropertySet designates Pipe Material information for objects.	Yes
PressurePipeClassPS	This PropertySet designates Pressure Pipe Class & Ratings informa...	Yes
PressurePipeMaterialPS	This PropertySet designates Pressure Pipe Material information for ...	Yes
PressurePipeOriginPS	This PropertySet designates the Origin of a pressure part Pipe, Fitti...	Yes
PressurePipeUtilityFamilyPS	This PropertySet designates the Utility Family of a pressure part Pip...	Yes

Our settings

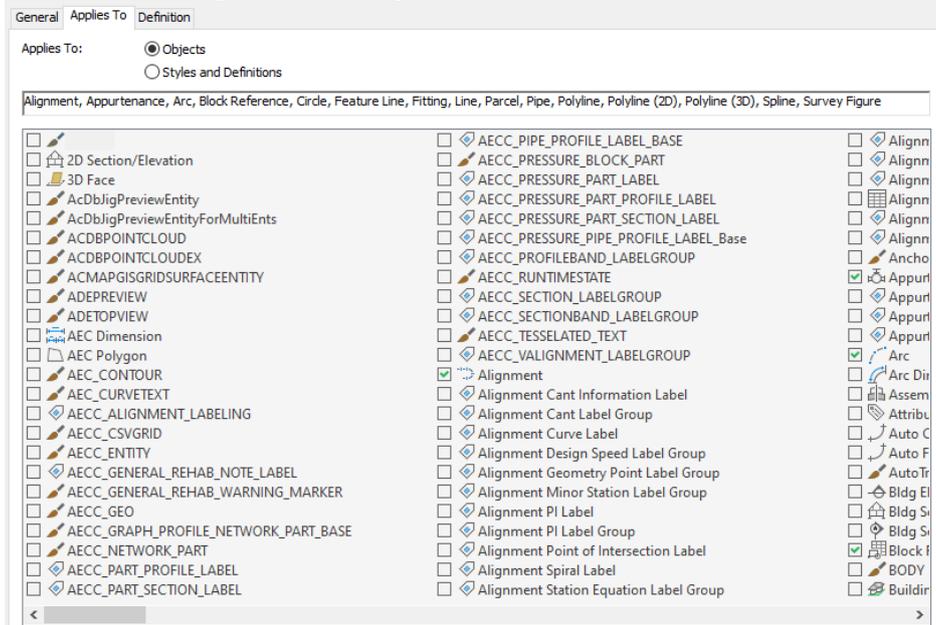
We then added a D after the Name (Same Name as the property set and list name) to identify it as a Definition.

General Applies To Definition									
Name	Description	Type	Source	Default	Units	Format	Exa...	Visible	Order
LengthD	Length	Automatic	Polyline (3D):Lengt...			Standard		<input checked="" type="checkbox"/>	
OriginD	OtherInformationD	List	Origin	Future		Standard	Future	<input checked="" type="checkbox"/>	
UtilityFamilyD	OtherInformation D2	List	UtilityFamily			Standard		<input checked="" type="checkbox"/>	

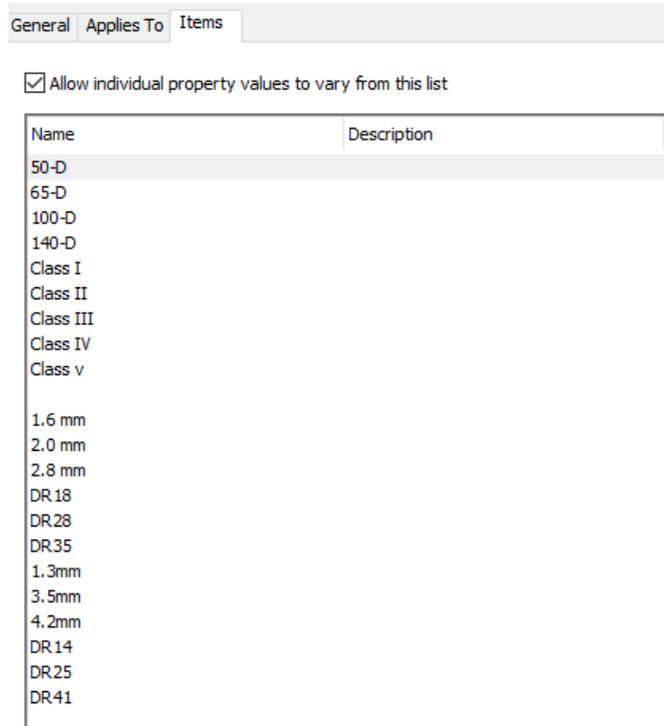
Our settings



All of the items that we assign the Property Set under the Applies to Tab



How we assign Property Sets



Example list of pipe classes



Don't forget about Project Explorer! it will also indicate how many property Sets are attached

Sample Line Group Name	Description	Start Station	End Station	Alignment Name	Sample Lines	Property Sets
[L] SL Collection - 2	<None>	0+028.01	0+028.01	SAN blg 95	1	0

Feature Line Name	Feature Line Style	Site	Points	2D Length	3D Length	Minimum Elevation	Maximum Elevation	Minimum Gradient	Maximum Gradient	Editable	Property Sets
Feature 4 (6) (1)	_C-SITE-FEAT	C-SITE	2	1.1735	1.1735	0.000	0.000	0.00 %	0.00 %	Yes	2
Feature 4 (6) (2)	_C-SITE-FEAT	C-SITE	2	1.1735	1.1735	0.000	0.000	0.00 %	0.00 %	Yes	2
Feature 4 (6) (3)	_C-SITE-FEAT	C-SITE	2	1.1735	1.1735	0.000	0.000	0.00 %	0.00 %	Yes	2
Feature 10	_C-SITE-FEAT	C-SITE	5	5.9940	6.1210	182.979	183.535	4.13 %	298.88 %	Yes	2

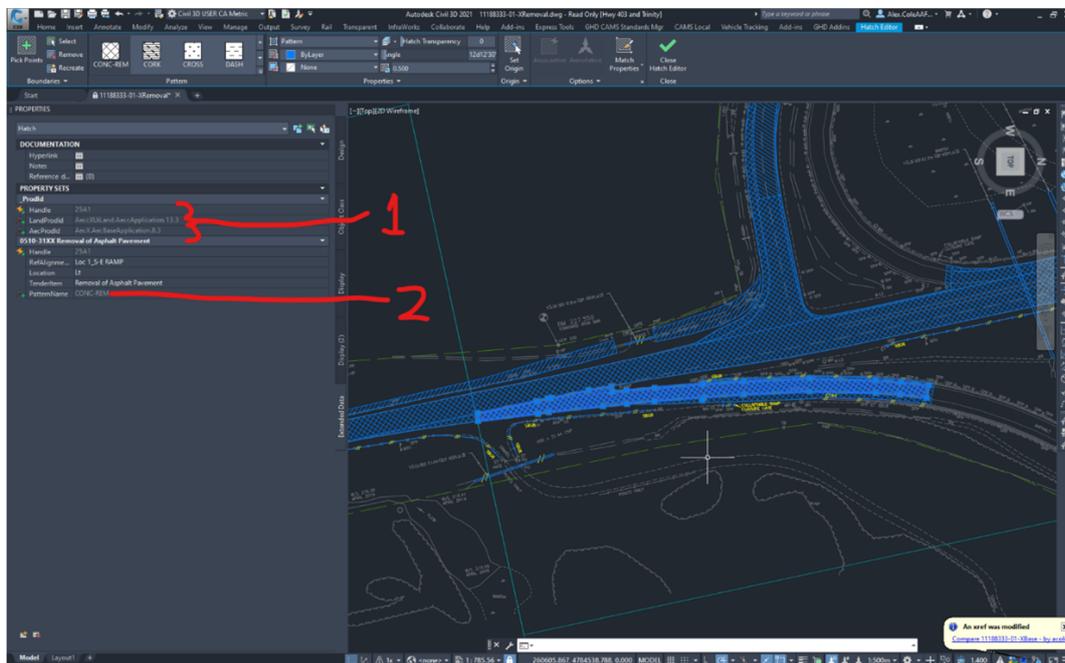
PE Funtionality

And remember (all) the commands!

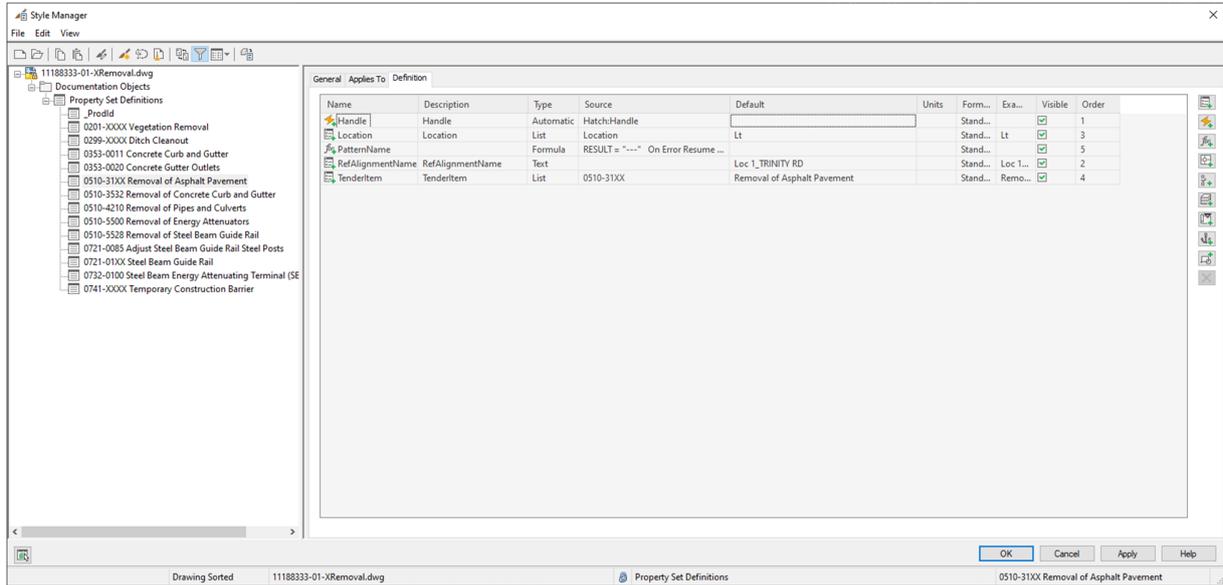
- 'AECPSDAUTOATTACH'
- 'PROPERTYDATAEDIT'

So, now that we have covered the the basics, let's look to a straightforward example of getting an objects property, in this case a Hatch Pattern Name.

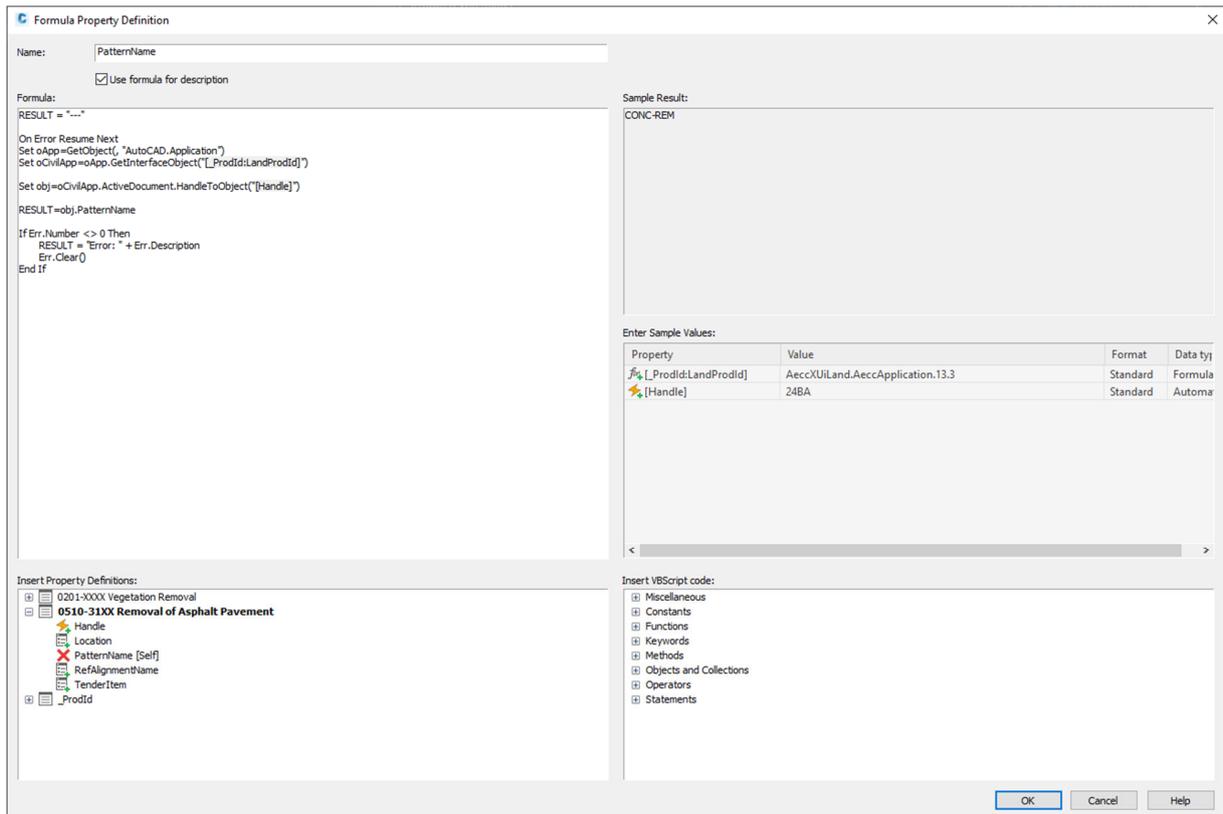
- 1 - Property set that extracts the various Product Id's used to interrogate the API
- 2 - Property extracted.



Handle and Pattern Name



Property Set Definitions



Formula

Best Practices

Managing your new Templates

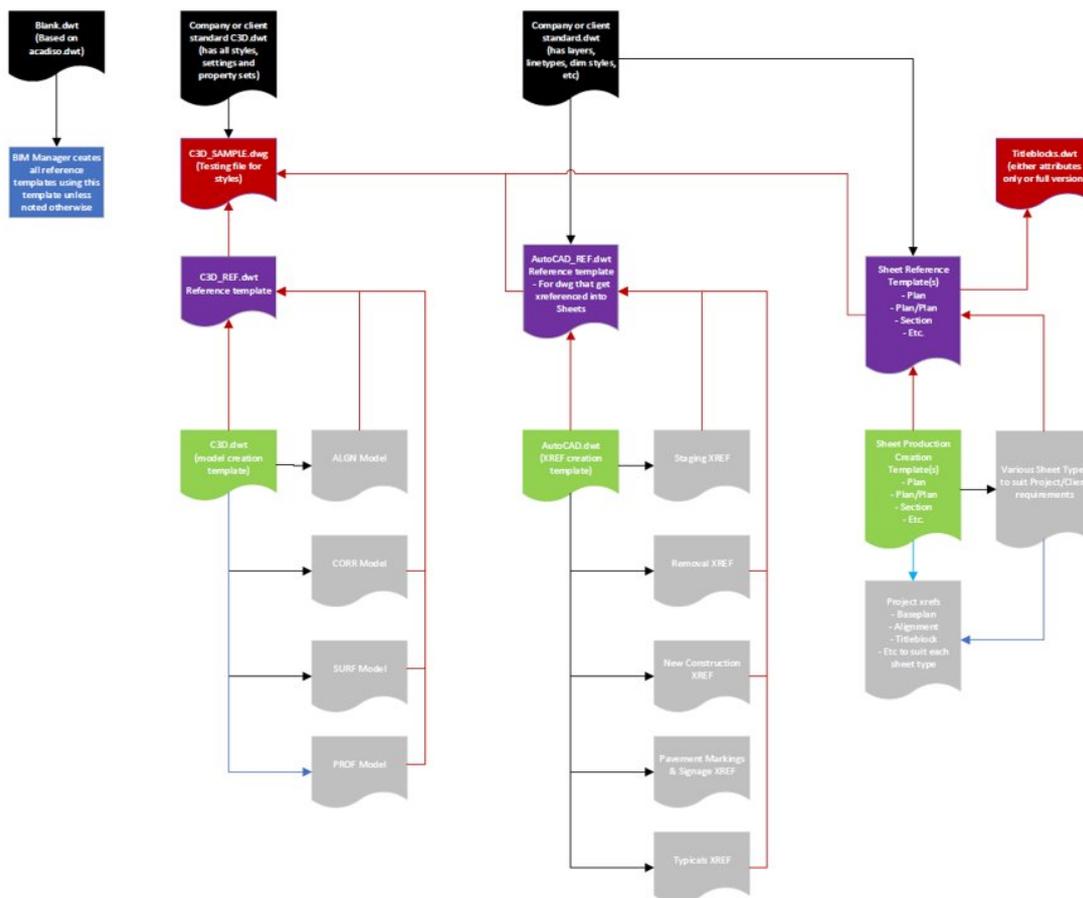
We kept things straight forward and placed ownership on those doing the modeling! Why create a complex structure to create and maintain templates.

Our CAD Managers manage the regions primary templates, and annual migration. The contribute new functionality when Autodesk adds new functionality – Think Corridor Templates in 2022.1!

Our BIM Managers look to ISO 19650 compliance and property set required for meta data needs. They manage our code set styles and ensure LOD flexibility is provided.

Lastly our Design Managers take the responsibility of our reference templates!

We have monthly meetings to ensure managers from around the globe can provide updates on new requirements, and shared all lessons learned. Think living documents! We provide cloud based sharing of templates to allow for easy consumption and real time updates when needed.



Sample Project Template Setup and Operation



Leverage Dynamo!

Now that we had our Reference Templates created for our property sets, and our models were jam packed with rich meta data - we leveraged the power of Dynamo for Civil 3D! What is this power you ask? It's visual programming for us non-programmers! You can use Dynamo to manage your property set data – by importing and updating your meta data, exporting your property set data.

Think of a simple example like curb and gutter. A feature line placed on placed on your curb & gutter layer, and property sets attached to add meta data for the following elements:

- Straight or circular, for circular enter radii
- Barrier, dropped, or mountable
- Concrete or asphalt
- Unit costing

You can now create a simple Dynamo graph to export the property data for your curb & gutter model elements to generate quantities for your estimate.

Want more?

Add a property set for your regions construction production rates for the various curb types. Metres per day, Concrete cure times, etc. You can use Dynamo to export your critical path schedule for constructing the curb & gutter elements.

For more advanced applications, like generating IFC files for your federated model in Navisworks, you can utilize Python to create some custom nodes to leverage the power of the Civil 3D API. Grab custom client meta data requirements from a spreadsheet, attach the information to your IFC – then import into Navisworks.

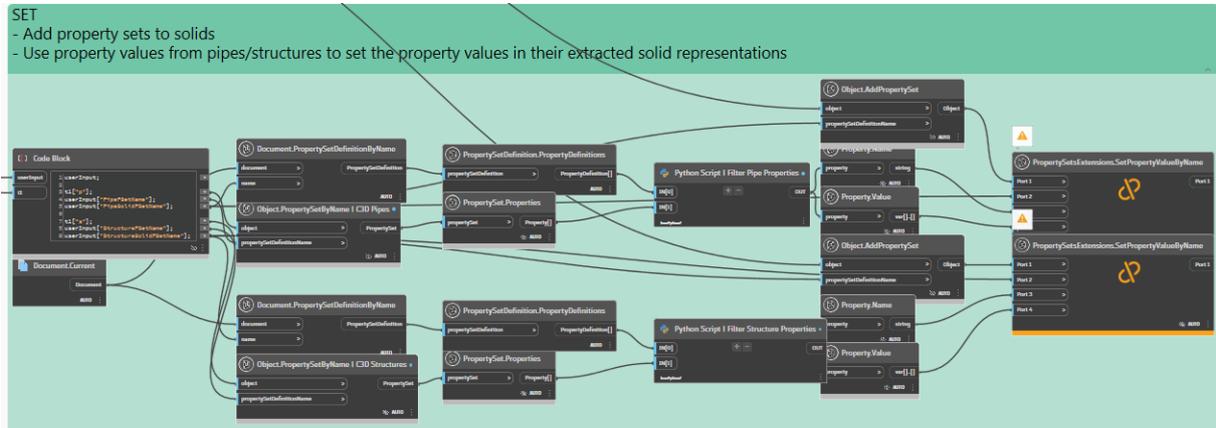
- Automation for meta data:
 - Convert your gravity pipes, and corridor pipes (pressure pipes) to solids;
 - Convert your solids to IFC's for Navisworks;
 - Export property set information to Excel;

#	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T
1	Handle	Asset_ID	Status	Use	Size_of_Ci	Floor_Mat	Wall_Mate	Wall_Cons	Cover_Mat	Cover_Diar	Floor_Cons	Lining	Drop_type	Name	Surfacelev	Invertlevel	Invert_dept	Number_of	Diameter	mm
2	20AEE1B	WWTR-ACHM-TBC_-10103	--	MAINTENANCE HOLE	--	--	--	--	--	--	--	--	--	MH1	288.419	282.043	6.526	3	2100	
3	20AEDAD	WWTR-ACHM-TBC_-10094	--	MAINTENANCE HOLE	--	--	--	--	--	--	--	--	--	MH10	295.452	291.545	4.057	2	1650	
4	20AEDA1	WWTR-ACHM-TBC_-10093	--	MAINTENANCE HOLE	--	--	--	--	--	--	--	--	--	MH11	297.284	293.21	4.224	2	1650	
5	20AED95	WWTR-ACHM-TBC_-10092	--	MAINTENANCE HOLE	--	--	--	--	--	--	--	--	--	MH12	298.361	294.575	3.936	2	1650	
6	20AED89	WWTR-ACHM-TBC_-10091	--	MAINTENANCE HOLE	--	--	--	--	--	--	--	--	--	MH13	299.61	295.93	3.83	2	1650	
7	20AED7D	WWTR-ACHM-TBC_-10090	--	MAINTENANCE HOLE	--	--	--	--	--	--	--	--	--	MH14	301.314	297.49	3.974	2	1650	
8	20AED6F	WWTR-ACHM-TBC_-10089	--	MAINTENANCE HOLE	--	--	--	--	--	--	--	--	--	MH15	303.042	298.873	4.52	4	1800	
9	20AED63	WWTR-ACHM-TBC_-10088	--	MAINTENANCE HOLE	--	--	--	--	--	--	--	--	--	MH15A	303.48	299.456	4.175	2	1200	
0	20AED57	WWTR-ACHM-TBC_-10087	--	MAINTENANCE HOLE	--	--	--	--	--	--	--	--	--	MH16	305.479	300.76	4.869	2	1650	
1	20AED4A	WWTR-ACHM-TBC_-10086	--	MAINTENANCE HOLE	--	--	--	--	--	--	--	--	--	MH17	307.199	302.74	4.61	3	1800	
2	20AED3E	WWTR-ACHM-TBC_-10085	--	MAINTENANCE HOLE	--	--	--	--	--	--	--	--	--	MH18	308.875	304.709	4.316	2	1200	
3	20AED32	WWTR-ACHM-TBC_-10084	--	MAINTENANCE HOLE	--	--	--	--	--	--	--	--	--	MH19	310.659	306.68	4.129	2	1200	
4	20AED0F	WWTR-ACHM-TBC_-10102	--	MAINTENANCE HOLE	--	--	--	--	--	--	--	--	--	MH2	289.552	285.348	4.353	2	1650	
5	20AED26	WWTR-ACHM-TBC_-10083	--	MAINTENANCE HOLE	--	--	--	--	--	--	--	--	--	MH20	313.114	308.656	4.608	2	1200	
6	20AED1A	WWTR-ACHM-TBC_-10082	--	MAINTENANCE HOLE	--	--	--	--	--	--	--	--	--	MH21	316.629	311.974	4.806	2	1200	
7	20AED0E	WWTR-ACHM-TBC_-10081	--	MAINTENANCE HOLE	--	--	--	--	--	--	--	--	--	MH22	320.402	316.47	4.082	2	1200	

- Make excel updates as required

#	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
1	Handle	Asset_ID	Status	Type	Use	Class	Lining	External_F	Embedme	Soil_Type	Rock_Exc	Name	Start_Stu	End_Struc	US_Invert	DS_Invert	US_Surface	DS_Surface	Diameter	US_Para	Length	m	Depth	m	Material	
2	20AEE3A	WWTR-GSPI-TBC_-10025	--	GRAVITY	SANITARY	--	--	--	--	--	--	Pipe - (34) MH6	MH6		290.47	289.45	294.194	293.311	450	1	0	107.38	3.408	DN450	GRP	SN10000
3	20AEE20	WWTR-GSPI-TBC_-10026	--	GRAVITY	SANITARY	--	--	--	--	--	--	Pipe - (20) --	MH1		282.043	282	288.419	288.367	600	1	0	8.76	5.759	DN600	GRP	SN20000
4	20AEE24	WWTR-GSPI-TBC_-10027	--	GRAVITY	SANITARY	--	--	--	--	--	--	Pipe - (21) MH1			282.309	282.19	288.28	288.419	450	1	0	23.792	5.768	DN450	GRP	SN20000
5	20AEE28	WWTR-GSPI-TBC_-10028	--	GRAVITY	SANITARY	--	--	--	--	--	--	Pipe - (28) MH1	MH2		285.348	282.115	289.553	289.419	525	1	0	170.169	5.764	DN525	GRP	SN10000
6	20AEE2B	WWTR-GSPI-TBC_-10029	--	GRAVITY	SANITARY	--	--	--	--	--	--	Pipe - (29) MH2	MH3		285.92	285.35	290.183	289.553	525	1	0	111.71	3.739	DN525	GRP	SN10000
7	20AEE2E	WWTR-GSPI-TBC_-10030	--	GRAVITY	SANITARY	--	--	--	--	--	--	Pipe - (30) MH4	MH5		287.401	286.54	291.704	290.889	525	1	0	168.768	4.128	DN525	GRP	SN10000
8	20AEE31	WWTR-GSPI-TBC_-10031	--	GRAVITY	SANITARY	--	--	--	--	--	--	Pipe - (31) MH5	MH6		287.726	287.4	291.969	291.704	525	1	0	63.982	3.786	DN525	GRP	SN10000
9	20AEE34	WWTR-GSPI-TBC_-10032	--	GRAVITY	SANITARY	--	--	--	--	--	--	Pipe - (32) MH6	MH7		289.134	287.73	292.192	291.969	525	1	0	67.681	3.749	DN525	GRP	SN10000
0	20AEE37	WWTR-GSPI-TBC_-10033	--	GRAVITY	SANITARY	--	--	--	--	--	--	Pipe - (33) MH7	MH8		289.45	288.21	293.311	292.169	450	1	0	176.95	5.535	DN450	GRP	SN10000
1	20AEE3D	WWTR-GSPI-TBC_-10034	--	GRAVITY	SANITARY	--	--	--	--	--	--	Pipe - (35) MH9	MH10		291.567	290.47	--	294.344	450	1	0	115.513	3.484	DN450	GRP	SN10000
2	20AEE40	WWTR-GSPI-TBC_-10035	--	GRAVITY	SANITARY	--	--	--	--	--	--	Pipe - (36) MH10	MH11		293.213	291.57	--	--	450	1	0	172.921	0	DN450	GRP	SN10000
3	20AEE43	WWTR-GSPI-TBC_-10036	--	GRAVITY	SANITARY	--	--	--	--	--	--	Pipe - (37) MH11	MH12		294.578	293.21	--	--	450	1	0	144	0	DN450	GRP	SN10000
4	20AEE46	WWTR-GSPI-TBC_-10037	--	GRAVITY	SANITARY	--	--	--	--	--	--	Pipe - (39) MH13	MH13		306.054	304.476	--	--	450	1	0	149.756	0	DN450	GRP	SN10000

- Import your revised property set meta data to your solids



Top not-so-secret tip of the day?

Template + Property Set Reference Template + Dynamo = Magic!

Our main Template controls the standard Civil 3D elements, like layers. By using our layers and our Layer Description, ensuring you implement standardized descriptions, we can leverage Dynamo to automate our drawing labels! With Property Sets adding additional meta data, we can generate Line labels to display text - based on the layer, Layer Description, and Property set data. With Civil 3D, each year has a different Application Variable, as shown below

```

File Edit Selection View Go Run Terminal Help
Get Started 'Declare variables Untitled-1
1 'Declare variables
2 RESULT = "---"
3 oAppVersion = ""
4
5
6 On Error Resume Next
7
8 'Get the AutoCAD application and its version
9 Set oApp = GetObject(,"AutoCAD.Application")
10 oAppVersion = oApp.Version
11
12 'Set variable values based on values of oAppVersion
13 If (Instr(oAppVersion, "23.0") > 0) Then '2019
14     oAeccAppVersion = "13.0"
15     oAecAppVersion = "8.1"
16 ElseIf (Instr(oAppVersion, "23.1") > 0) Then '2020
17     oAeccAppVersion = "13.2"
18     oAecAppVersion = "8.2"
19 ElseIf (Instr(oAppVersion, "24.0") > 0) Then '2021
20     oAeccAppVersion = "13.3"
21     oAecAppVersion = "8.3"
22 ElseIf (Instr(oAppVersion, "24.1") > 0) Then '2022
23     oAeccAppVersion = "13.4"
24     oAecAppVersion = "8.4"
25 Else
26     oAeccAppVersion = ""
27     oAecAppVersion = ""
28 End If
29
30 'Concatenate strings to create ProdID's which can be used to get COM interface objects
31 LandProdId = "AeccXllLand_AeccApplication." + oAeccAppVersion
    
```

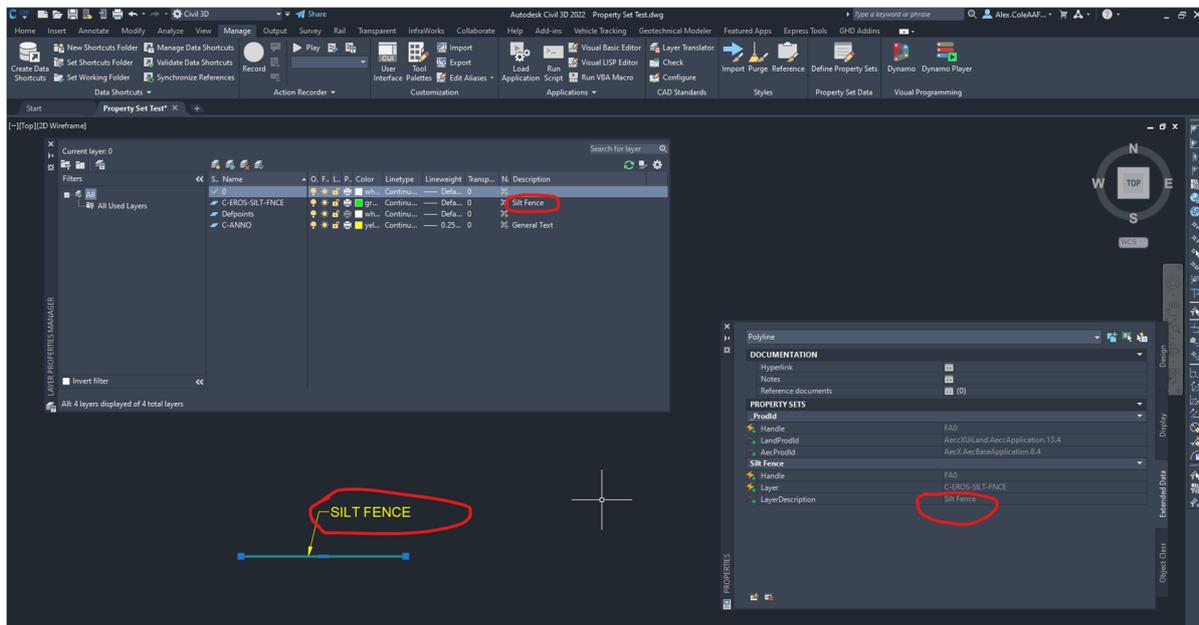
Handling Versions

```

1  RESULT = ""
2
3  On Error Resume Next
4  Set oApp = GetObject("AutoCAD.Application")
5  Set oCivilApp = oApp.GetInterfaceObject("[_ProdId:LandProdId]")
6
7  Set obj = oCivilApp.ActiveDocument.HandleToObject("[Handle]")
8
9  'Get the IAcadDocument
10 Set doc = obj.Document
11
12 'Get the Layers from the Document
13 Set layerCollection = doc.Layers
14
15 'Count the number of layers
16 count = layerCollection.Count
17
18 'Get the objects LayerName
19 objLayer = obj.Layer
20
21 'Iterate through the layerCollection
22 i = 0
23 Do While i < count
24     'Get the IAcadLayer at the specified index
25     Set ilayer = layerCollection.Item(i)
26     'Get the layer name
27     n = ilayer.Name
28     'Get the layer description
29     d = ilayer.Description
30     If n = objLayer Then Exit Do
31     i = i + 1
32 Loop
33
34 RESULT = d
35
36 If Err.Number <> 0 Then
37     RESULT = "Error: " + Err.Description
38     Err.Clear()
39 End If

```

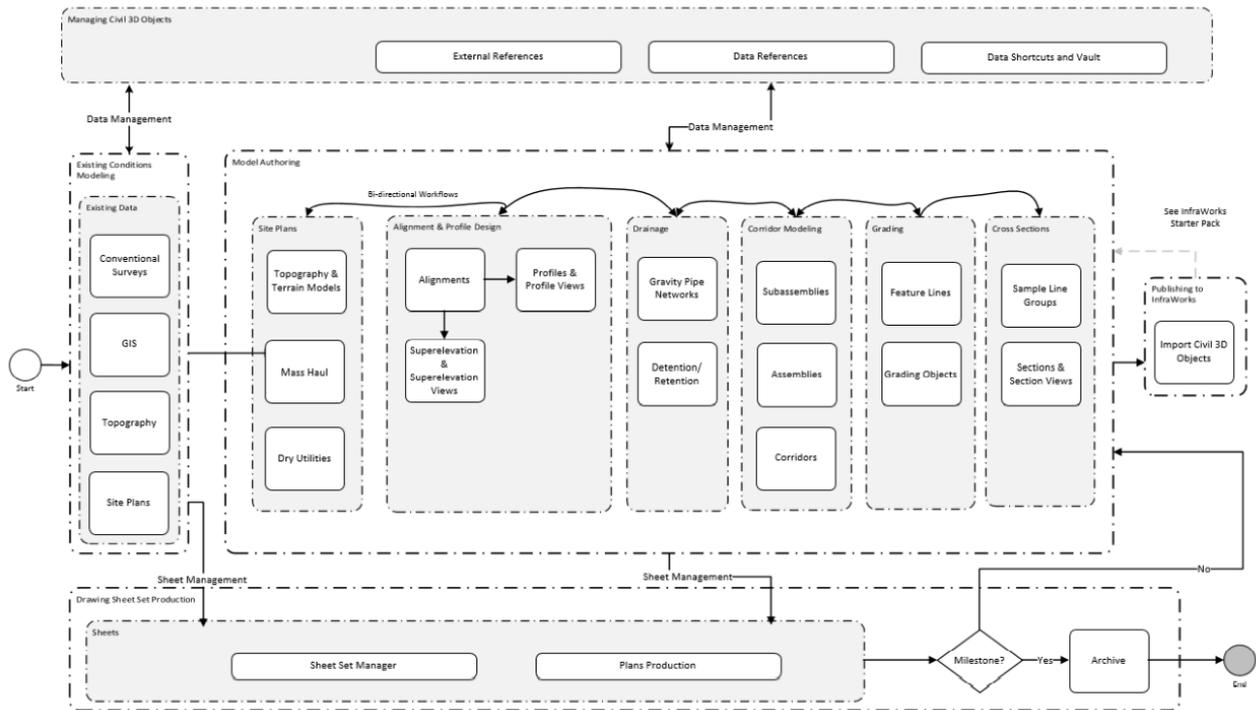
Extracting layer descriptions



Grabbing our Layer Description - through the Extend Properties of the object

Standard Work Flows

To accompany the new template structure, we needed to find a standard Workflow for Xrefs and Drefs together. We started with the Autodesk Best Practices Work Flow.



Best Practise Workflow

We utilized the concept of putting the background information in separate drawings, based on information type, and utilized the Autodesk folder structure to start – then modified to suit our needs – Thank Flexibility!

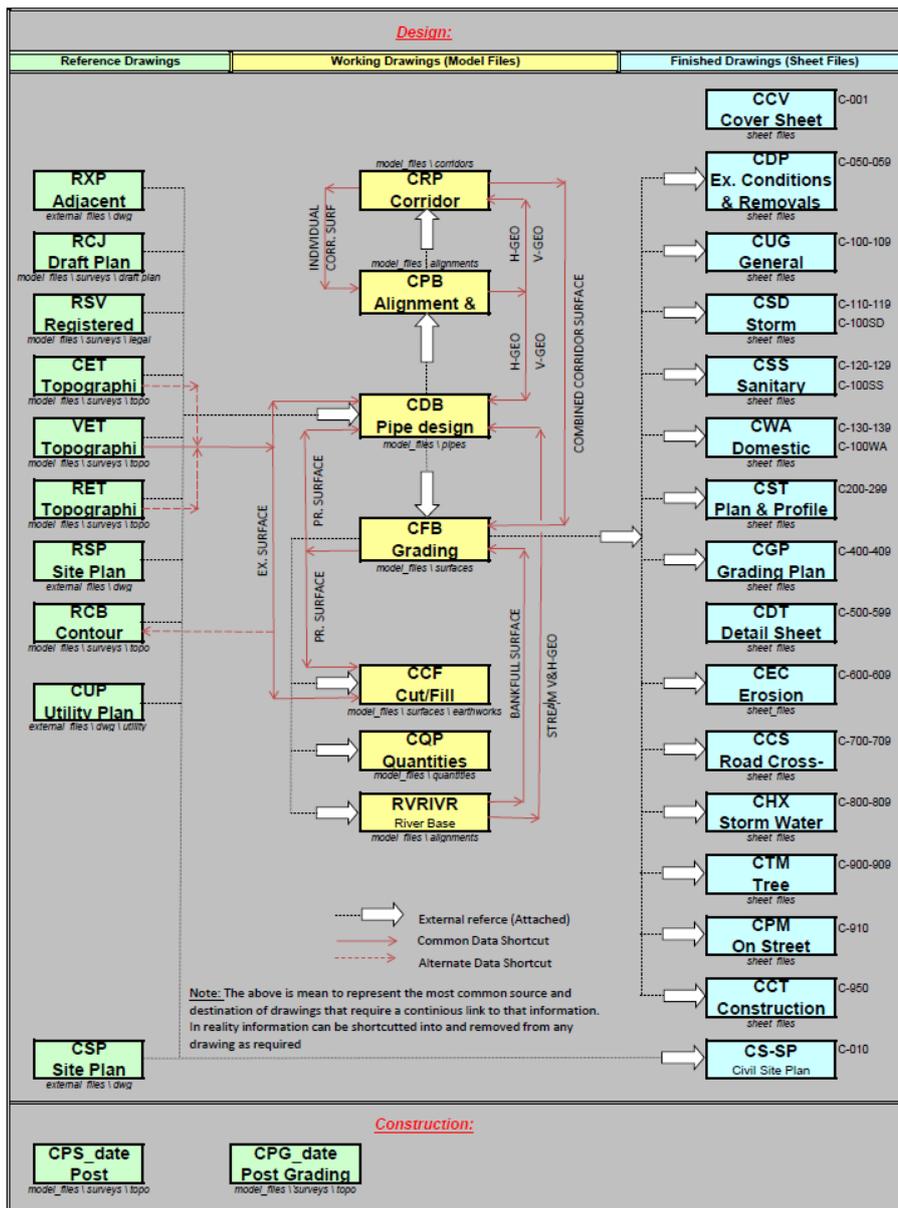
- ▼ Civil 3D Project Templates
- ▼ _Sample Project
 - Documents
- ▼ External References
 - DGN
 - DWF
 - DWG
 - Images
 - Production Drawings
 - Reports
- ▼ Source Drawings
 - Alignments
 - Pipe Networks
 - Pressure Networks
 - Surfaces
 - View Frame Groups

Standard Folder Structure



To simplify our folder structure, and better understand the connectivity, we colour code the connections. Black lines being our XRefs, Red Lines being our DRefs's.

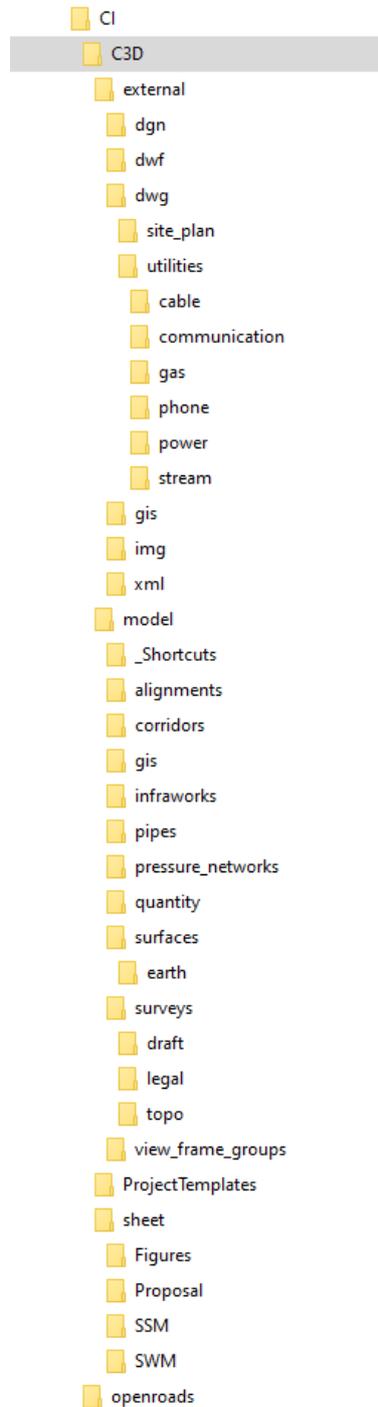
Civil 3D Xreferences



Our Structure



For complex projects, and the required flexibility, we utilized additional folder functionality. Some of the terminology was changed from the stock Autodesk publications to be in compliance with our NCS based templates, and we ended up with the following:

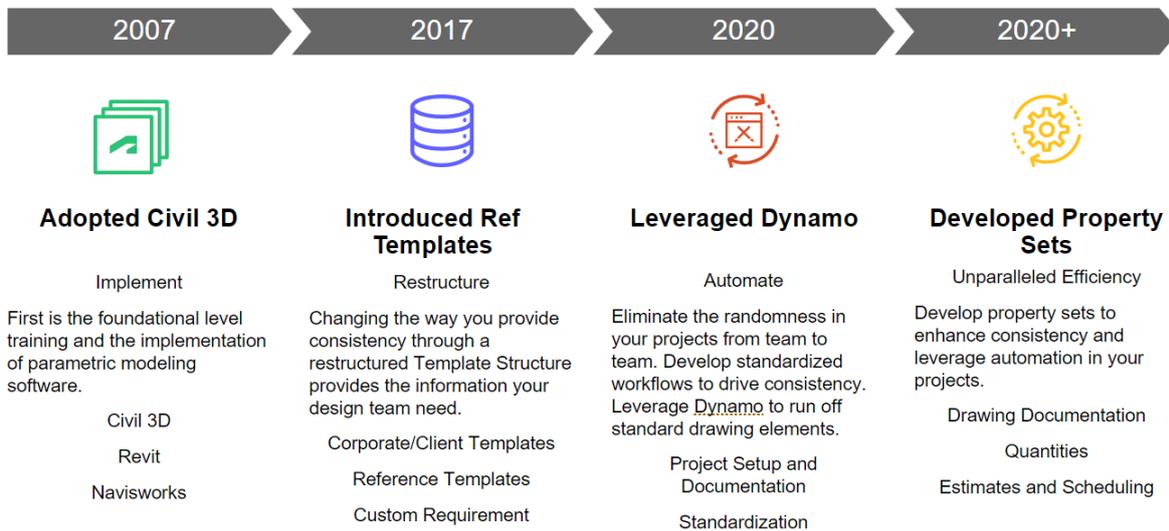


Our Structure



Efficiency

So where did we end up?



Our journey ended with unparalleled gains in workflow consistency. Which drove efficiency when the required content was provided in an easy to consume format. This allowed global collaboration opportunities when combined with cloud based operations. Resulting in tremendous cost savings and reduced delivery timing on our projects.....

Think LEGO!

Dump a box of LEGO on the floor and start to build - or - Provide the instructions, and just the pieces you need!



Good luck on your Journey!