City of Aurora
CAD Data Submittal Standards
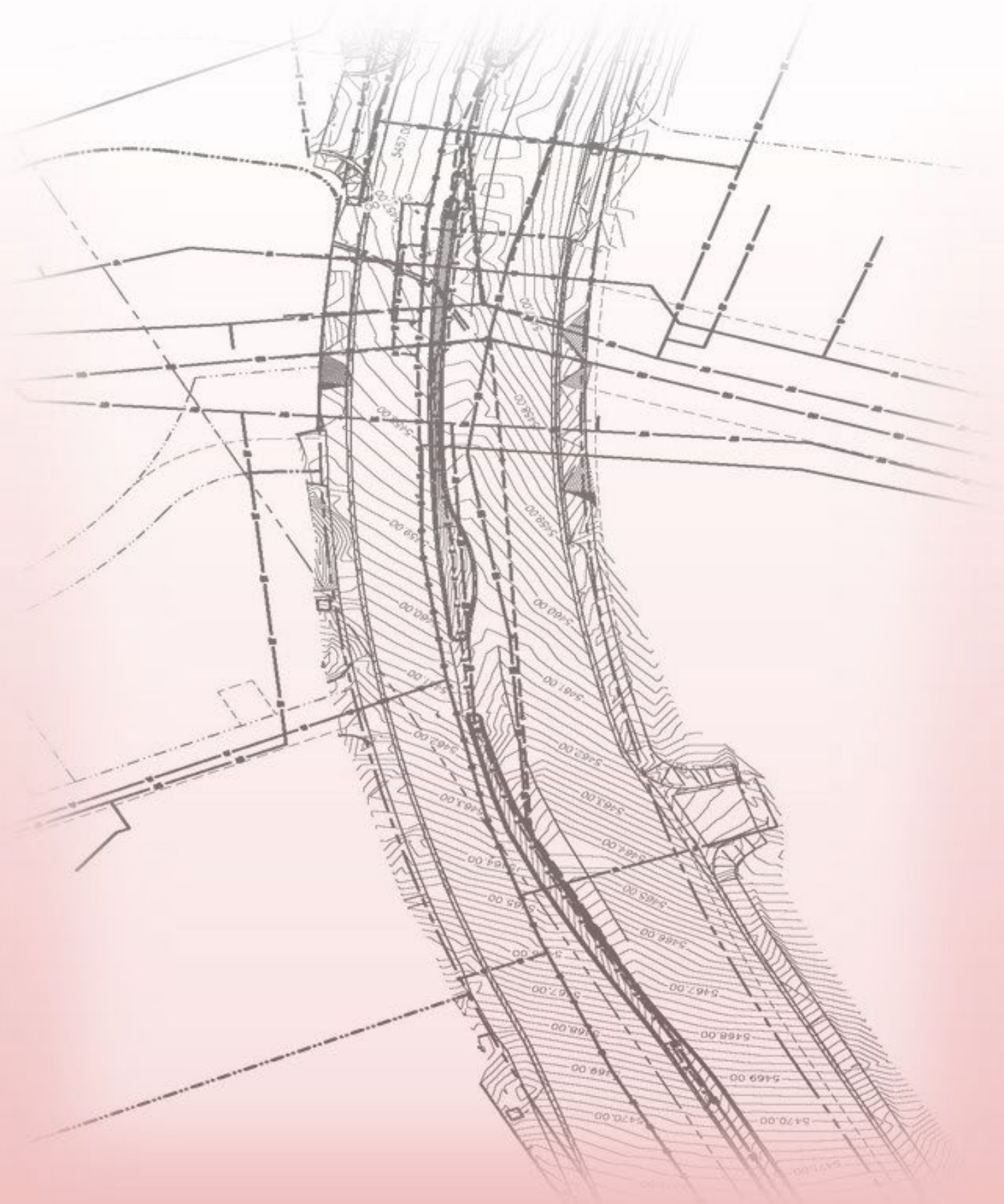
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List of Acronyms

A-E	Architect Engineer
A/E/C	Architecture, Engineering, and Construction
BIM	Building Information Modeling
CAD	Computer-Aided Design
CHX	AutoCAD Standards Check File
CIM	Civil Information Modeling
.CTB	AutoCAD Color-Based Plot Style File
.DGN	MicroStation Design File
.DWF	Design Web Format File
.DWG	AutoCAD Drawing Database File
.DWS	AutoCAD Drawing Standards File
ENG	Engineering
FAQ	Frequently Asked Questions
GIS	Geographic Information System
HTM/.HTML	Hypertext Markup Language (Webpage)
ISO	International Organization for Standardization
.LIN	AutoCAD Linetype File
NCS	National CAD Standards
NIBS	National Institute of Building Sciences
PDF	Portable Document Format File
SHX	AutoCAD Font and Shape File
TTF	True Type Font
XLS/XLSX	Microsoft Excel File Format
XREF	External Reference File
ZIP	Zipped File (Compressed File)

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Introduction

1.1 Summary

The City is requiring that all civil project submittals (signature sets) and oil & gas submittals (as-builts) be accompanied by an electronic (.dwg) drawing. The drawing shall conform to the formatting requirements in this AutoCAD Data Submittal Standard and should include the layers listed in Table 2 which are already required by the respective project design drawings. If specific layers are not included in the project design, those layers are not required in the submittal.

Drawing templates (which include approved layer names and the City boundary) can be found at this URL:

> https://auroragov.org/CADtoGISstandards

The electronic drawings will be transferred into the City's GIS system and ultimately, the updated GIS layers will feed additional, more accurate information into Aurora Open Data, which has nearly 160 current data sets for the public to access and download (such as survey control).

Explore Aurora Open Data at http://data.auroraco.opendata.arcgis.com/

1.2 Project Overview

The City of Aurora has developed AutoCAD (CAD) Data Submittal Standards to streamline the process of importing CAD information into the City's Enterprise GIS. The CAD Data Submittal Standards are required for consultants on development and capital projects when submitting drawings to the City for approval. The requirements ensure data received by the City can be rapidly incorporated into the City's GIS and made available internally and externally for future design projects. These requirements are limited to the data the City has defined as important information required for department function and operation, and data already required for project construction. The Standards have been developed based on Version 6.0 of the United States National CAD Standard® (NCS) and adapted for City use.

It is not the intent to provide the drawing information necessary to reproduce plan sets, but rather a select set of linework to migrate data from CAD to the City's GIS platform. Upon completion of civil and oil & gas projects, the designer should create a separate CAD drawing file that holds the required layers

described herein. **Only information detailed in *Table 2 – List of Required Features* should be included in the required digital drawing**. If the CAD feature in Table 2 is not a part of the submittal set, it is not required to generate the information to meet this submittal standard. Also, please note that prior to submitting the standardized CAD drawing to the city, **any layers not included as required features in Table 2 must be removed from the drawing**. The designer should continue to prepare their plans to be used in construction in the manner in which they choose. These standards do not dictate any aspect of plan production for construction.

All information regarding engineering and plan development in the City of Aurora Roadway Design & Construction Specifications is available and maintained by Aurora Public Works at following link:

Engineering Design Standards - City of Aurora (auroragov.org)

The Roadway Design & Construction Specifications documents will be the required reference for producing plans and supersedes any conflicting plan presentation or engineering information contained in this CAD Data Submittal Standards document.

The Aurora CAD Data Submittal Standards are broken into four sections: Introduction, General Requirements, Specific Data Requirements, and Appendices.

- **Section 1: Introduction:** This section includes the introduction and overview, including the software preference and requirements of the City of Aurora's CAD Data Submission Standards.

- **Section 2: General Requirements:** This section discusses the file formats, coordinate systems, and universal standards required by all City departments. Descriptions of the resource files and the associated links to those files used by the City for generating design information and document resources related to the Standards are also included.

- **Section 3: Specific Data Requirements:** This section includes details on the potential data submitted, the layer structure it should adhere to, and how this data maps to the City's Enterprise GIS environment. The data requirements are based on the operational needs of each City department.

- **Appendices:** This section includes supporting reference documents.

1.3   Software Requirements

The City conducted an online stakeholder survey as well as an in-person stakeholder session in fall 2015 to gather feedback on software and CAD standards used by the consultant community. The results found over 50% of consultants were using a 2010-2016 version of Autodesk's Civil 3D for design work; 40% use AutoCAD without Civil 3D; and 10% use other products such as MicroStation or IntelliCAD. Based on these findings, the City concluded to focus the majority of the Data Submittal Standards on AutoCAD. The City will also provide guidance and tools for consultants using other platforms.

1.3.1 AutoCAD and AutoCAD Civil 3D Submissions

The City is providing a comprehensive set of templates and tools for use with AutoCAD submissions. Not all drawing submissions will require all features within each template. These tools and templates include:

- A list of the features that may be required for submission (see Table 2)
- A list of attributes that are requested if available (see Table 3). These are NOT requirements for submission but appreciated inclusions if the attributed objects already exist in the drawing.
- An AutoCAD template-drawing file set up with the layers that may be required for each type of CAD submission.

The associated files can be downloaded at this URL: https://auroragov.org/CADtoGISstandards

Instructions on how to use the Batch Standards Checker are included in Appendix A. The recommended process for working with this standard when using AutoCAD is as follows:

1. Prior to beginning a submission, download the latest version of the CAD DATA Submittal Standards from the City of Aurora webpage, available here: https://auroragov.org/CADtoGISstandards.
   For organizations without a standardized layer naming convention, it may be helpful to use City of Aurora templates for your base file; these can be found in the same location.
2. After completing your project plans and before making the CAD submission for your project, create a file specifically for your CAD submittal. This file will include **only** the information requested in Table 2: List of Required Features on page 8 of the CAD Data Submittal Standards PDF. In most instances, **the fastest way to create this file is to isolate the requested information by layer and use the WBLOCK command to create a separate file that contains only that requested information**.
3. Once the new WBLOCK file is created, use the CHECKSTANDARDS command to verify the layers included in the new file match the requested layer standards for the CAD submittal type.
4. When the CHECKSTANDARDS reports zero errors, you are ready to submit.
   NOTE: Using the "ignore" option does not remove a problem and will still result in a FAIL.

Please contact CADGIS@auroragov.org for assistance if you are unfamiliar with any of these commands/processes or otherwise need assistance with your CAD submittal.

Optional Approach: For large scale, multi-stage projects or consultants who work extensively with the City of Aurora and have well established internal style parameters, using the AutoCAD Layer Translator prior to a submission may be more convenient. See Appendix B for instructions on using this tool or contact CADGIS@auroragov.org for assistance.

1.3.2　Other Submissions

For consultants making submissions using other environments such as MicroStation or IntelliCAD, please contact your Case Manager or EOR, or request assistance at CADGIS@auroragov.org .

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General Requirements

This section discusses the file formats, coordinate systems, and universal standards required by all City departments. Descriptions of the resource files (i.e., Civil 3D drawing template, Color Plot Style, Layer Translator, etc.,) used by the City for generating design information and document resources related to the CAD Data Submission Standard is also included.

2.1   File Format and Naming

All civil plan and oil & gas packages submitted to or prepared for the City will require a digital drawing submittal in the following file format:

- The primary drawing format shall be AutoCAD 2018 DWG file format, but any DWG file generated up to and including 2024 versions of AutoCAD Civil 3D, AutoCAD, or AutoCAD LT will be accepted.

If the submittal was created using a program other than AutoCAD Civil 3D, AutoCAD, or AutoCAD LT, the submitting organization must convert the file to an AutoCAD DWG file and ensure all required data has been converted.

2.1.1   General Drawing Templates

An AutoCAD template file, compliant with the City's Data Submission Standard, is available for use as a general drawing template. The file can be downloaded from the City's website at the following URL:

https://auroragov.org/CADtoGISstandards

2.2   Coordinate System Requirements

All data provided as part of the submission shall be created in real world coordinate systems based on the following projection:

- NAD83, State Plane, (Grid) Colorado Central Zone, US Foot (CO83-CF).
- **Do not use Ground, Modified, or Project coordinates.**

2.3   Model Space Requirements

All linework shall be submitted in model space in accordance with the City Engineering Design Standards. **All paperspace sheets, XREFs, attachments, images, text, borders, legends, margins, scale bars, etc. should be removed prior to submission**.

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Specific Data Requirements

This section includes details on the potential data submitted, the layer structure it should adhere to, and how this data maps to the City's Enterprise GIS environment. The data requirements are based on the operational needs of each City department.

The City of Aurora has identified a set of key required features that are needed to be extracted from plan submissions. The table on page 8 lists the key required features.

The City of Aurora based its standard layer naming on the National CAD Standards (NCS) Version 6.0. For more comprehensive details on the NCS see the following URL:

https://www.nationalcadstandard.org/ncs6/

Each layer name has a discipline designator which denotes the major category of the data contained on the specified layer and is a two-character element. Only Discipline Designators pertaining to the City's standard have been included. The following table is a list of the Discipline Designators used:

Table 1: List of Discipline Designators		
Discipline Designator	Definition	Notes
C	Civil	Used for proposed non-utility features
CU	Civil Utilities	Used for proposed utilities
CT	Civil Transportation	Used for proposed transportation features
L	Landscape	Used for proposed landscape features
OG	Oil & Gas	Used for proposed oil & gas features
V	Survey Mapping	Used for existing features

Note regarding requirements:
The City is aware that due to the nature of each individual project, not all design submissions will include all features. If an above listed feature is not required, then this standard does not make it a required part of a design submission. Similarly, if a required feature is not listed above, that feature is still required as part of the submitted plan set. All requirements for the drawing content must adhere to the City's standards and specifications for design and construction of public improvements.

Table 2: List of Required Features	
Descriptive Name (Feature Type)	**LAYER NAME**
Survey Control Benchmarks or Survey Corners [1]	**V-CTRL-SRVY**
Existing Property Lines, Parcels [1] (immediately adjacent to subject property only)	**V-PROP-LINE**
Existing Roadway- Right of Way [1] (immediately adjacent to subject property only)	**V-ROAD-RWAY**
Building Footprint	C-BLDG-AREA
Boundary Lines: Site Plan	C-BNDY-SITE
Boundary Lines: Subdivision	C-BNDY-SUBD
Easements, MUE's, CUA's	C-ESMT
Parking Edge	C-PRKG-EDGE
Property Lines, Parcels	C-PROP-LINE
Sidewalk-Edge	C-SWLK-EDGE
Roadway-Centerline	CT-ROAD-CNTR
Roadway-Edge of Asphalt	CT-ROAD-EOA
Roadway-Flowline	CT-ROAD-FL
Roadway-Right of Way	CT-ROAD-RWAY
Electric-Conduit (located in public right of way only)	CU-ELEC-COND
Electric-Pedestrian Light (located in public right of way only)	CU-ELEC-LGHT-PED
Electric-Street Light (located in public right of way only)	CU-ELEC-LGHT-STRT
Electric-Meter Location (located in public right of way only)	CU-ELEC-METR
Electric-Pull Box Location (located in public right of way only)	CU-ELEC-PBOX
Electric-Solar Panels	CU-ELEC-SOLR
Fire Hydrants/Connections	CU-FIRE-HYDT
Sanitary Sewer-Manhole	CU-SSWR-MHOL
Sanitary Sewer-Sand & Oil Interceptors	CU-SSWR-INTR
Sanitary Sewer-Pipe, service lines	CU-SSWR-PIPE
Storm Sewer-Channel-Centerline	CU-STRM-CHNL-CNTR
Storm Sewer-Inlet	CU-STRM-INLT
Storm Sewer-Manhole	CU-STRM-MHOL
Storm Sewer-Outlet	CU-STRM-OTLT
Storm Sewer-Piping	CU-STRM-PIPE
Storm Detention-Pond	CU-STRM-POND
Water Supply-Fitting	CU-WATR-FITI
Water Supply-Meter	CU-WATR-METR
Water Supply-Manhole	CU-WATR-MHOL
Water Supply-Piping, service lines	CU-WATR-PIPE
Water Supply-Valves	CU-WATR-VALV
Park-Boundary	L-PARK-AREA
Trail/Path-Centerline	L-TRAL-CNTR
Trail/Path-Path Edge	L-TRAL-EDGE
Oil & Gas-Crude Oil-Easement	OG-CO-ESMT
Oil & Gas-Crude Oil-Pipe [2]	OG-CO-PIPE
Oil & Gas-Natural Gas-Easement	OG-NGAS-ESMT
Oil & Gas-Natural Gas-Pipe [2]	OG-NGAS-PIPE
Oil & Gas-Produced Water-Easement	OG-WATR-ESMT
Oil & Gas-Produced Water-Pipe [2]	OG-WATR-PIPE

NOTES:
1. This layer must be included in ALL submittals to verify project locations. Files without this layer will be rejected.
2. All pipelines must be 3D polyline showing alignment, diameter, material, and depth of pipe throughout the project area. This information will be kept confidential.

3.1   Civil 3D and AutoCAD Block Attributes

The City has defined a set of Civil 3D or AutoCAD block attributes that are requested to be provided with submission if available. The following table lists the details of each of the attributes that are requested as part of the submittal. While appreciated by the CADGIS team this information is voluntary and non-inclusion will not in any way negatively impact the review of any project.

Table 3: List of Attributes					
Feature	**Feature Type**	**CAD Feature Type / Name**	**CAD Attribute Definition**	**Attribute**	**Data Type**
Potable Water Pipe	Line	Line/Polyline			
			Linetype	Diameter	Double
			Line Property	Length	Double
			Layer	Material	Text
Stormwater Pipe / Culverts	Line	Civil 3D Pipe Network			
			Civil 3D Object Data	Material	Text
			Civil 3D Object Data	Type	Text
			Civil 3D Object Data	Horizontal Diameter	Double
			Civil 3D Object Data	Vertical Diameter (optional)	Double
			Civil 3D Object Data	Upstream Invert Elevation	Double
			Civil 3D Object Data	Downstream Invert Elevation	Double
			Civil 3D Object Data	Slope	Double
			Civil 3D Object Data	Pipe Shape	Text
Wastewater Pipe	Line	Civil 3D Pipe Network			
			Civil 3D Object Data	Material	Text
			Civil 3D Object Data	Diameter	Double
			Civil 3D Object Data	Upstream Invert Elevation	Double
			Civil 3D Object Data	Downstream Invert Elevation	Double
			Civil 3D Object Data	Slope	Double
Manhole (Storm)	Point	Civil 3D Pipe Network			
			Civil 3D Object Data	Unit	Text
			Civil 3D Object Data	Depth	Double
			Civil 3D Object Data	Elevation (Rim)	Double
Manhole (Sewer)	Point	Civil 3D Pipe Network			
			Civil 3D Object Data	Diameter	Double
			Civil 3D Object Data	Unit	Text
			Civil 3D Object Data	Sump Depth	Double
			Civil 3D Object Data	Elevation (Rim)	Double
Inlet	Point	Civil 3D Pipe Network			
			Civil 3D Object Data	Width (Perpendicular to Street)	Double
			Civil 3D Object Data	Length (Parallel to Street)	Double
			Civil 3D Object Data	Type	Text

Outlet	Point	Civil 3D Pipe Network			
			Civil 3D Object Data	Type	Text
			Civil 3D Object Data	Elevation (Invert)	Double
			Civil 3D Object Data	Owner	Text
Valve	Point	Block with Attributes – COA Valve			
				Structure Diameter	Double
				Material	Text
				Valve Type	Text
Fittings	Point	Block with Attributes – COA Fitting			
			Structure Material	Material	Text
			Structure Type	Type	Text
Hydrant	Point	Block with Attributes – COA Hydrant			
			Diameter	Diameter	Double
Meter	Point	Block with Attributes – COA Meter			
				Diameter	Double
				Meter Function	Text
Subdivision	Line	Civil 3D Object			
			Civil 3D Object Style		Text
Building Footprint	Polygon	Line/Polyline			
			Layer		
Street Centerlines	Line	Civil 3D Object			
			Civil 3D Object Name	Street Name	Text
Curb (Face)	Line	Line/Polyline			
			Layer		
Sidewalk	Line	Line/Polyline			
			Layer		
Parking Edge	Polygon	Polyline			
			Layer		
Permanent Easement	Line	Civil 3D Object			
			Civil 3D Object Style	Easement Line Type	Text
Survey Benchmark	Point	Block with Attributes – COA Benchmark			
				Elevation	Double
				Name	Text
Ponds	Polygon	Line/Polyline			
				Ownership	Text
			Object Property	Capacity (CF)	Integer
Trails	Line	Line/Polyline With Object Table - Trail			
			Surface	Surface	Text
			Layer	Trail Type	Text
			Width of Trail	Width	Double
Park / Open Space	Polygon	Polyline			
			Object Property	Area	Double
				Site Class	Text

3.2   Policy on External References

The use of XREF files in the creation of plan sets is an acceptable practice, but for the purposes of the submission, **all required data should be merged into a single CAD file before submittal to the City**.

3.3   Relationship to Other Standards

The City of Aurora layer standard is based on the National CAD Standard, however it is not intended to be a design standard but rather a data migration translation standard for AutoCAD layer data into a GIS data structure.

3.3.1   Other City Standards

These CAD Standards are a supplemental guide to other documentation, requirements, and standards that exist at the City including but not limited to the following:

- Engineering Design Standards
  - o Roadway Design & Construction Specifications
  - o Water, Sanitary Sewer, and Storm Drainage Infrastructure Standards and Specifications
  - o Drainage Criteria Manual
  - o Material Prequalification
- Planning Design Standards
  - o Parks & Open Spaces Dedication & Development Criteria Manual
  - o Planning Department Design and Architectural Standards
- Site Plan Manual
- Subdivision Plat Manual
- Plan Review Checklist
- Pavement Design Submittal Checklist

All submittals still must adhere to all applicable City standards and checklists. It is recognized that there remains existing documentation found within the City of Aurora which may conflict with this CAD Standard. All efforts have been made to resolve these instances of conflict, but the City does not guarantee that all discrepancies have been found or resolved. **The City of Aurora Roadway Design & Construction Specifications should take precedence.**

3.3.2   National CAD Standard

The City of Aurora standard is fundamentally based on the NCS and an attempt has been made to comply with that standard wherever possible. However, there are many items within the NCS that are open to interpretation or items that may hinder the goals of City's standardization project. Where contradictions or interpretations exist, the City of Aurora CAD Data Submittal Standard will take precedence.

# 4

Appendices

This section includes supporting reference documents.

## 4.1   Appendix A: Batch Standards Checker

The provided templates/drawings have a corresponding .DWS file to help ensure the standards have been properly utilized. These files audit and analyze drawings for proper layer use and compare what they have found to the predefined standards.

STEP 1: Open the **Batch Standards Checker** by searching for it in your start menu or by typing BATCHSTANDARDSCHECKER at the command line when AutoCAD is open. On the **Drawings** tab, click the + (plus) symbol to add the drawing you want to check for compliance with the Aurora CAD Data Submittal Standards.
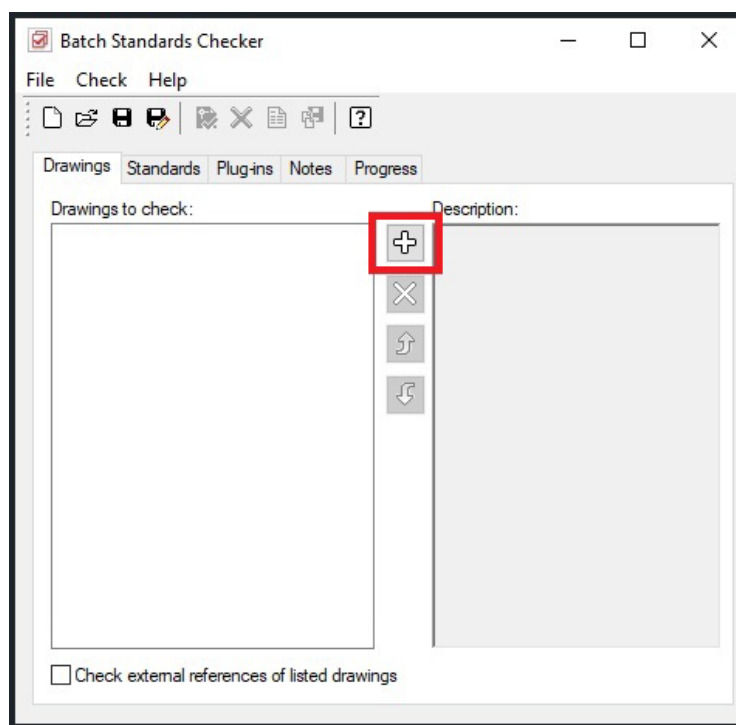
STEP 2: On the **Standards** tab, check the option *Check all drawings using the following standards files.* Then click the + (plus) symbol to add **COA-CADGIS_2024.dws** to use in performing the check. This file is available for download here:
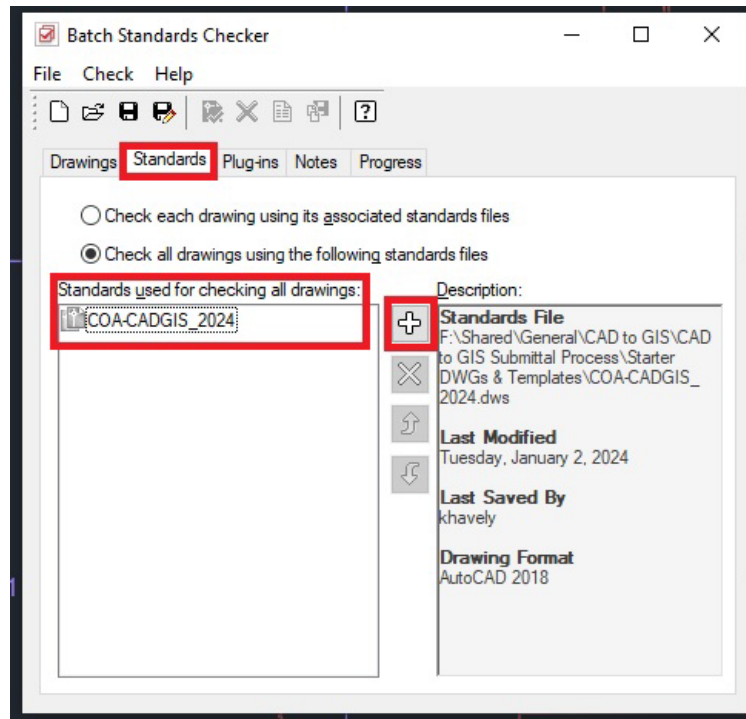
STEP 3: On the **Plug-Ins** tab, check only the **Layers** plug-ins.
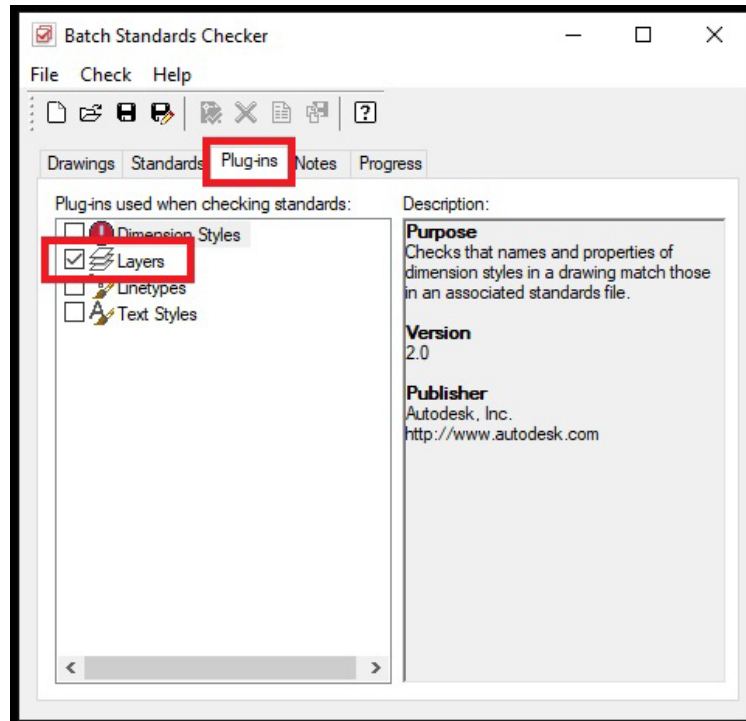
STEP 4: Once all of these settings are complete, start the check by selecting the "Start Check" button at the top.

STEP 5: Click "Ok" to save your settings. Upon completion, a report will open in your default browser. Use this to determine if any problems or inconsistencies exist between the .dws and your .dwg which will need to be addressed. To review the Standards Violations select the "Problems" option in the list on the left side of the report. Correct any problems in the drawing and run the check again until the document meets the compliance requirements of the City.

Please contact CADGIS@auroragov.org with any questions related to the standards check process.

## 4.2 Appendix B: Layer Translator Instructions*

Consultants who work extensively with the City of Aurora and have well established internal style parameters, may choose to use the AutoCAD Layer Translator prior to a submission as a quick way to bring their layers into compliant naming convention.

In order to take the layers from an existing file and bring them up to standard layer naming, you can use the Layer Translator tool in AutoCAD. Prior to running the tool, it would be best to PURGE the unused layers in your existing drawing to reduce the number of layers you are trying to translate.

To access the tool, click the Layer Translator button, located on the Manage tab of the ribbon on the CAD Standards panel (alternately type "LAYTRANS" at the command line):
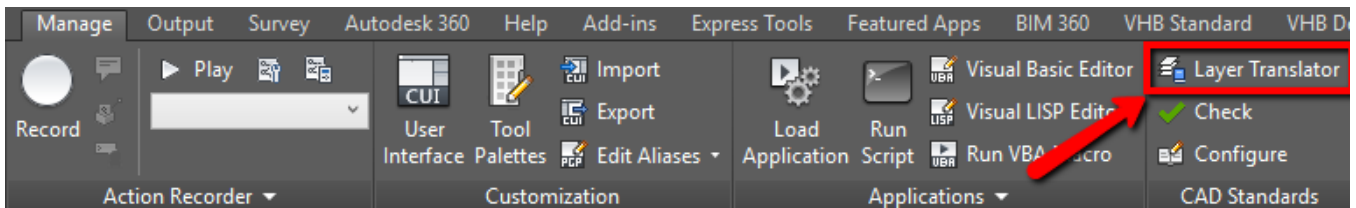

The Layer Translator pop-up window will appear with a list of the layers in the current drawing on the left panel labeled "Transfer From". On the right panel – "Transfer To" – you want to load the layers from the standards drawing. Click Load to browse for the drawing with the desired layers names:
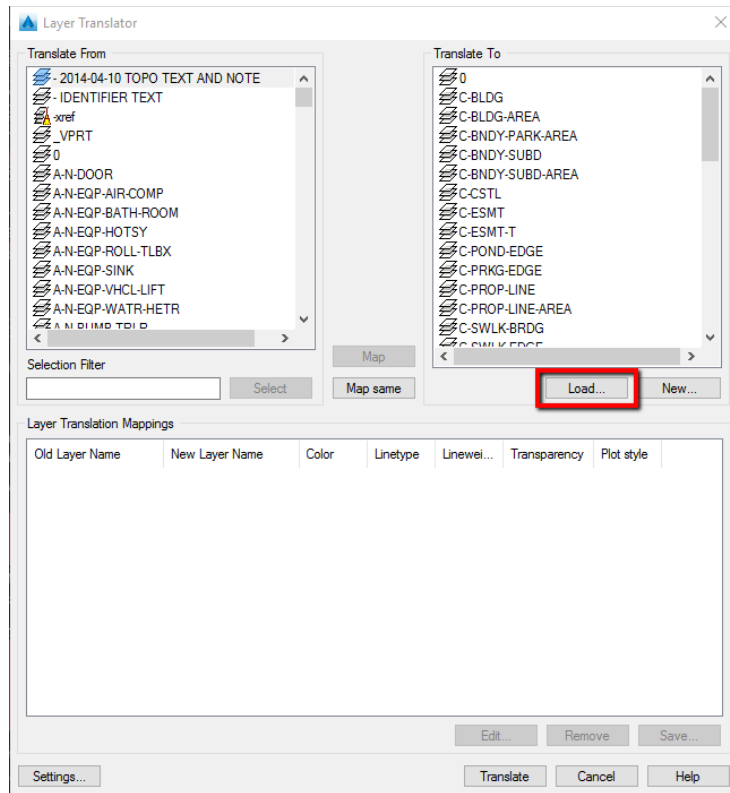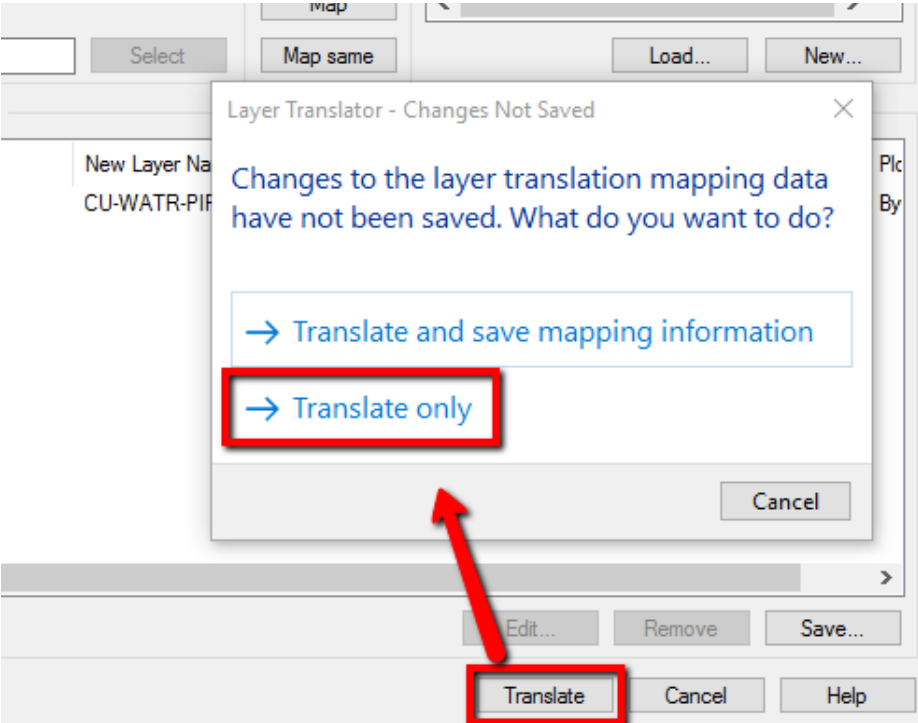
Choose the layer on the left, in the existing file, that matches the layer you want it to translate to on the right, the standard file. You can select 1 or multiple layers from the "Translate From" column to map to the desired layer in the "Translate To" column. Once you have chosen the layers from each column, click "Map" and a list of mappings will populate in the box on the lower half of the Layer Translator window.
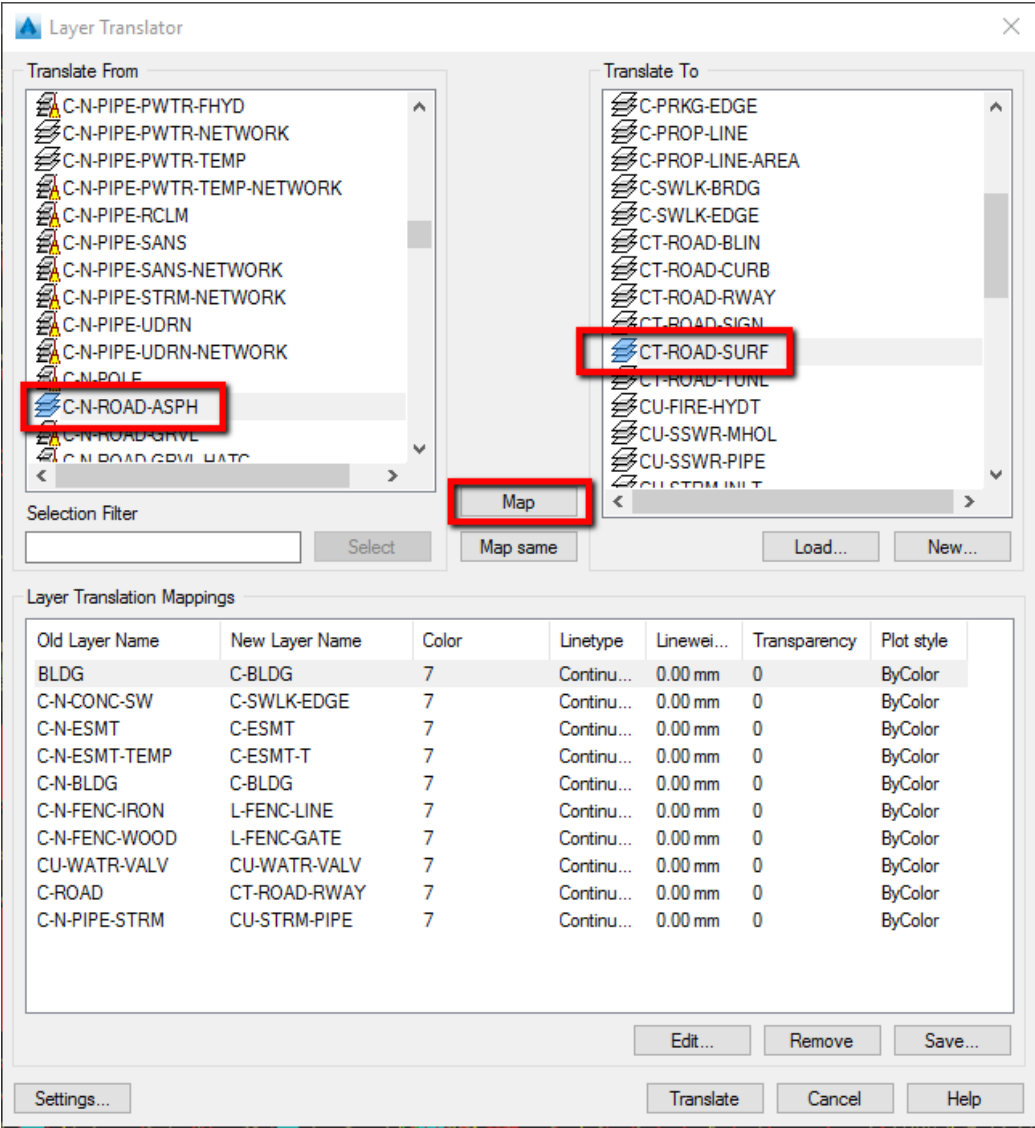
The default settings can be changed by selecting "Settings" in the lower left. You can refer to the Autodesk help topic *"Settings Dialog Box (Layer Translator)"* for information on how each option functions.
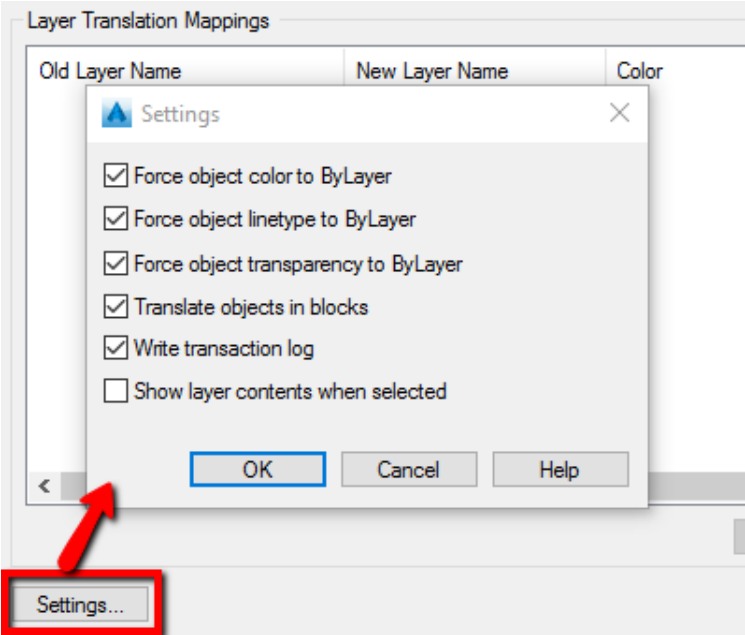
Once you have completed selecting the layers to translate from and to as described above, you may click "Translate" in the lower right corner. A popup box will ask if you want to save the mapping settings. Clicking "Translate Only" will translate the layers without prompting you to save the settings as a .dws file.

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