Overview: Use the following processes for exchanging georeferenced data between AutoCAD Civil 3D 2016 and ArcMap. The work must be based in any real world coordinate system. (This example uses NAD 83 UTM Zone 15, International Feet.) AutoCAD Civil 3D Objects cannot be directly exported to a shapefile. These objects (feature lines, gradings, points, surface contours, and alignments) need to be exploded and then exported. Methods A & B will transfer data from CAD to GIS. Methods C & D transfer data from GIS to CAD.

Software: AutoCAD Civil 3D 2020, NRCS C3D 2020 template, ESRI ArcGIS Pro

Notation: Button to Press *Displayed Text* **Icon** Action {Text to Enter} *Menu Item…*

Data management for CAD/GIS data exchange

GIS Filenames

Some versions of GIS allow no spaces in filenames. Using an underscore instead of a space is recommended. Shapefiles can only contain one type of object at a time – **A**rea (polygon), **L**ine, or **P**oint. Including the first letter of that object type in at the end of the shapefile name can be helpful. Examples: A **L**ine shapefile for the contours on a Smith pond project might be named Smith_Pond_Countours_**L**.shp. A **P**oints shapefile containing the survey shots on a Smith pond might be named Smith_Pond_Survey_**P**.shp.

When transferring shape files to another user, be sure to send all files associated with the .shp file, not just the .shp file. (.shp, .bdf, .prj, .sbn, .sbx, .shp.xml, .shx)

Coordinate Projection

ArcCatalog can be utilized to determine the coordinate projection of existing shapefiles. Descriptions such as "NAD_1983_UTM_Zone_15N" or "NAD83 UTM, Zone 15 North, Meter" both mean that the projection is in Meters. A description of "NAD83 UTM, Zone 15 North, Intnl Foot" would be a projection in international feet.

GIS directories

Options for saving CAD data being sent to GIS would include placing the zipped file into the directory called F:\geodata\project_data\nrcs\engineering.

CAD directories

Creating a *GIS from CAD* folder inside the CAD folder for an engineering project will provide a good place to output shapefiles from a CAD project. The files from this folder could be zipped up and then sent possibly via email to the ArcGIS/Toolkit user who is needing this data.

A *GIS to CAD* folder in the engineering project's CAD folder is recommended for managing files to be imported into CAD.

Method A

Output points as text data from AutoCAD Civil 3D for use in ArcMap.

- This process converts survey points as text data to be ready for use an ArcGIS Pro project.

Method A - Part I

- Using Civil 3D to Create and Export Points

Create objects and set Coordinate system of CAD project:

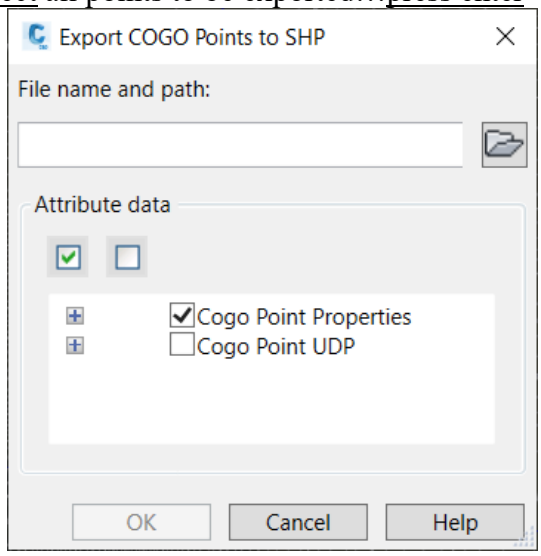
1) Create points in Civil 3D using normal CAD procedures.

Set the Coordinate System and Zone

2) Toolspace>Settings… Right click on the current Drawing name…
3) Click *Edit Drawing Settings… Units and Zone* tab
4) Click into the *Selected coordinate system code* and input {UTM83-15if}for IA.
5) Click OK

Use the SHP Import/Export tool in the Toolbox to export points:

6) Toolspace>Toolbox…expand *SHP Import/Export Utilities*…expand *SHP Import/Export*… right click *Export COGO Points to SHP*… click *Execute*
7) Select all points to be exported…press enter



8) Click the folder button to give the SHP a file name & path…click Save. Click OK

Method A - Part II

- Using ArcGIS Pro to Import Point Text file sent from AutoCAD

Check the GIS project's coordinate system:

9) Open your ArcGIS Pro Project
10) Right click *Map… Properties…*
11) Click *Coordinate System* on the left and make sure that a Current Coordinate System has been set. A typical setting would be NAD_1983_UTM_Zone_15N. Consult your GIS specialist for more info. You may need to browse to *Predefined… Projected Coordinated Systems… UTM… NAD83…* and select your UTM Zone.
12) Click Ok

Import the point shapefile data into GIS

13) Click *Map…* Add Data… *Data…*
14) Browse to the shapefile exported from CAD (e.g. *Williams_Survey_Points.shp*) and select it.
15) Click OK
16) Continue within GIS. Displaying the data by elevation or description can be helpful.

Note: These elevations are displayed to the nearest foot. To see the elevation to the nearest tenth or hundredth you will need to look at the Geometry section of attributes (select the point, right click *attributes*, click geometry tab and the third column shows Feet).

Method B

Output contours, alignments, etc as shape files from Civil 3D for use in ArcGIS Pro.

- This process converts these objects into shape files to be ready for use in an ArcGIS Pro project. ArcGIS Pro reads the coordinate projection from the CAD exported shape files to determine correct location.

Method B - Part I

- Using AutoCAD Civil 3D to Create and Export Objects as Shapefiles

Create objects and set Coordinate system of CAD project:

1) Create points, contour lines, and other objects using AutoCAD Civil 3D.

Set the Coordinate System and Zone.

2) Toolspace>Settings… Right click on the current Drawing name…
3) Click *Edit Drawing Settings… Units and Zone* tab
4) Click into the *Selected coordinate system code* and input {UTM83-15if}for IA.
5) Click OK

Export non-closed contours, 2d polylines, 3d polylines, and feature lines as line shape files:

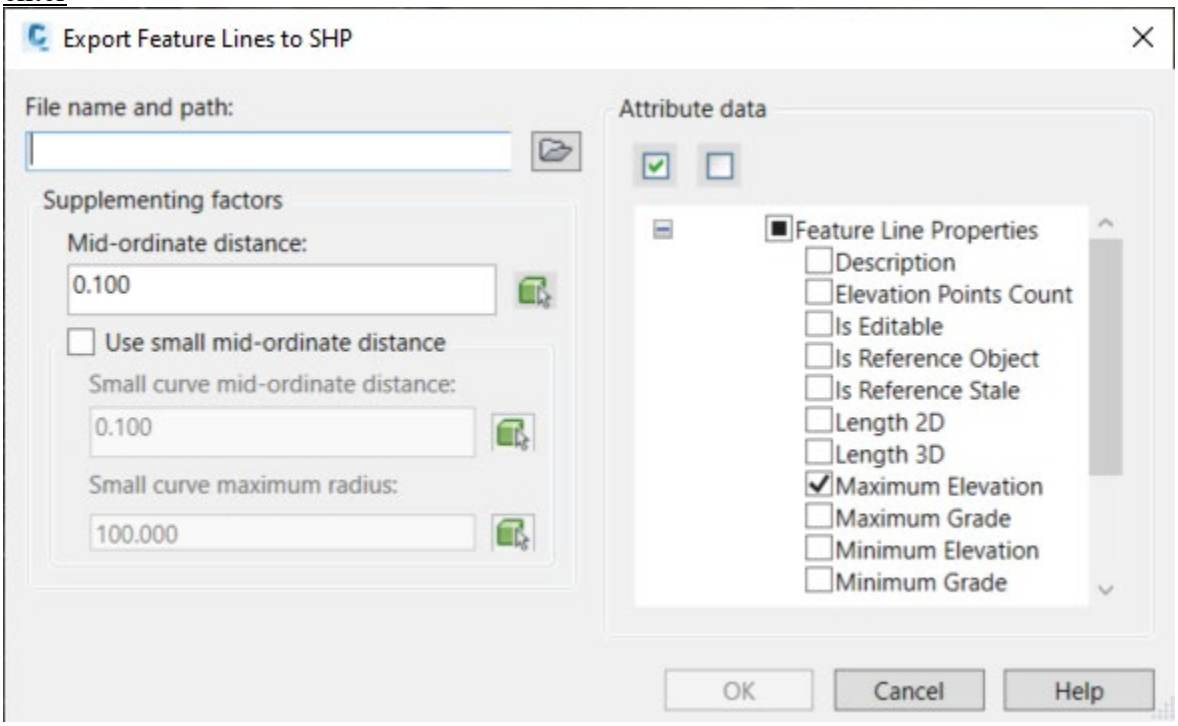
Extract polylines from surface contours.

6) Select the Surface Model for contour exporting.
7) Click *Tin Surface… Surface Tools…Extract from Surface…Extract Objects…*
8) Click Ok

Export to shapefile.

9) Toolspace>Toolbox…expand *SHP Import/Export Utilities…*expand *SHP Import/Export…*right click *Export Feature Lines to SHP…*click *Execute*

10) Select feature lines, polylines, or 3D polylines to be exported…press enter…press enter



11) Click on folder and browse and save to desired location.
12) Change the mid-ordinate distance to *0.1*…
13) Under *Attribute data* select *Maximum Elevation*… click OK

Export CAD closed polylines as Area shape files (such as the construction work limits):

14) Type {Mapexport} Press Enter
15) Pulldown "File of Type" to *ESRI Shape*
16) Browse to the location where you want to save the shapefile.
17) Input a filename for the shapefile E.g. {Williams_worklimit_a} Click OK
18) From the Selection Tab
    a) Select Object Type as *Polygon*
    b) Use *Select Manually* & click **Select Objects** to pick the lines in CAD
19) From the Data Tab
    a) Click Select Attributes…
    b) Under the Properties checkmark *Elevation*, & *Layer*
    c) Click Ok
20) From the Option Tab
    a) Checkmark *Treat Closed Polyline as Polygons*
21) Click OK The processing screen will display the numbers of objects and will disappear once the shapefile has been created.

Method B - Part II

♦ Using ArcGIS Pro to Import Shapefiles sent from AutoCAD Civil 3D

Check the GIS project's coordinate system:

22) Open your ArcGIS Pro Project
23) Click *View… Data Frame Properties…*
24) Click Coordinate System on left and make sure that a Current Coordinate System has been set. A typical setting would be NAD_1983_UTM_Zone_15N. Consult your GIS specialist for more info. You may need to browse to *Predefined… Projected Coordinated Systems… UTM… NAD83…* and select your UTM Zone. If you want information displayed in feet make sure to select a coordinate system accordingly.
25) Click Ok

Import shapefile data into GIS:

26) Click *Map Tab… Add Data (layer panel)… Data*
27) Browse to the shape files exported from CAD and select one or more of the shape files (e.g. *Williams_CLdam_L.shp*).
28) Click OK
29) You may get a warning message stating that the coordinate system of your file is different from the current map projection. If so click OK.
30) The shapefile name has been added as a layer within your project. Continue within GIS. Displaying the data by elevation range can be helpful. Labels can be associated with the Elevation field of contours. Displaying the data by elevation range can be helpful. Labels can be associated with the Elevation field of contours. If the SHP Import/Export Utility Tool was used to create the shapefile the elevation data is in the geometry section of the attributes. To create an elevation attribute from the geometry data, use the following optional steps.
31) Click *View Tab… Geoprocessing*
32) In the Geoprocessing search window type *calculate geometry attributes*
33) Select *Calculate Geometry Attributes*
34) Pull down *Input Features* and select the CAD exported shapefile
35) Pull down *Field* and select *MaxElev*
36) Pull down *Property* and select *Maximum z-coordinate*
37) Pull down *Coordinate System* and select *Current Map…* click *Run.*
38) To change the name of the attribute from MaxElev to Elevation open the attribute table (right click the shapefile layer… *Attribute Table)*
39) Right Click *MaxElev…Fields…*double click *MaxElev* under Alias and type *Elevation…*click *save* in Changes panel of contextual ribbon.

Note: These elevations are displayed to the nearest foot. To see the elevation to the nearest tenth or hundredth you will need to look at the Geometry section of attributes (select the feature, right click *attributes*, click geometry tab and the third column shows Feet).

Method C

Output objects from ArcGIS for use in AutoCAD Civil 3D.

- This process exports objects into shape files to be ready for use in a CAD project. The coordinate projection of the shape file needs to be known so that it can be selected within Civil 3D. Elevations of an object are NOT brought into CAD.

Method C - Part I

- Using ArcGIS Pro to Export Objects as Shapefiles for CAD use

Check the project Coordinate system:

1) Right click *Map* in *Contents… Properties…*
2) Click Coordinate System on left and note whether a Projected Coordinate System has been set. If not browse to *Predefined… Projected Coordinated Systems… UTM… NAD83…* and select your UTM Zone. The typical setting would be NAD_1983_UTM_Zone_15N. Consult your GIS specialist for more info.
3) Click Ok

Export any feature (such as a drainage area or project boundary):

4) Right click the Data layer to be exported
5) Click *Data… Export Features…*
6) Click folder next to *Output Feature Class*, name and save *to desired location.*
7) Select *Environments Tab*
8) Pull down *Output Coordinate System,* select *Current Map*
9) Click *Parameters Tab* and click OK

Method C - Part II

♦ Use AutoCAD Civil 3D to import shapefile data as CAD objects.

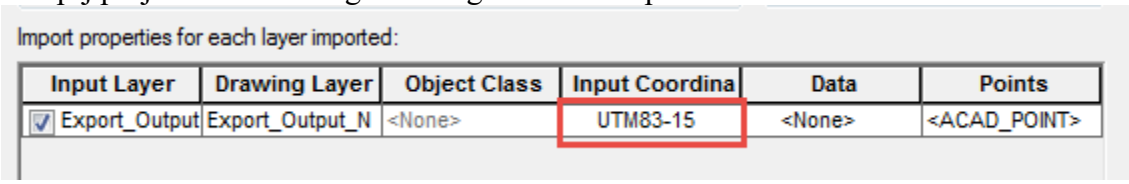
(Note: This method will NOT bring elevations into CAD.)

Set Coordinate system of CAD project:

10) Toolspace>Settings… Right click on the current Drawing name…
11) Click *Edit Drawing Settings… Units and Zone* tab
12) Click into the *Selected coordinate system code* and input {UTM83-15if}for IA.
13) Click OK

Import the feature as a CAD object (such as a drainage area or project boundary):

14) Type {Mapimport} Press Enter
15) Pulldown "File of Type" to *ESRI Shape*
16) Browse to the shape file {E.g. *WaterwayDA_NAD83Z15meters_a.shp*}
17) Click OK
18) If the *Input Coordinates* is set to <None> click into it to specify the spatial reference of the shape file. It is important that you know the correct coordinate projection that was used from the ArcGIS data export. You may be able to determine this from the .prj projection file that goes along with the shapefile.



a) Pulldown Category to *UTM, NAD83 Datum*
b) Pulldown Coordinate System to *UTM with NAD 83 datum, Zone 15, Meter…*
c) Click Ok

19) If you'd like to specify layer that the object should be placed on you can click *Drawing Layer* and make changes.
20) Checkmark *Import Polygons as closed Polylines*.
21) Click OK and the objects will be placed into CAD.

Method D

Output contours from ArcGIS for use in AutoCAD Civil 3D with Elevation.

- This process exports objects into shape files to be ready for use in a CAD project. The coordinate projection of the shape file needs to be known so that it can be selected within Civil 3D. Elevations of these objects are brought into CAD if a GIS field containing the Elevation value exists.

Method D - Part I

- Using ArcGIS Pro to Export Contours as Shapefiles for CAD use

Check the project Coordinate system:

1) Right click *Map* in *Contents… Properties…*
2) Click Coordinate System on left and note whether a Projected Coordinate System has been set. If not browse to *Predefined… Projected Coordinated Systems… UTM… NAD83…* and select your UTM Zone. The typical setting would be NAD_1983_UTM_Zone_15N. Consult your GIS specialist for more info.
3) Click Ok

Export contours:

4) Right click the Data layer to be exported
5) Click Attribute Table…
6) Verify that a field containing the elevation exists and make note of the name (E.g. *Elevation*). If it does not exist, you will need to take steps to add that information.
7) Close the Attribute Table
8) Right click the Data layer to be exported
9) Click *Data… Export Features…*
10) Click folder next to *Output Feature Class*, name and save to desired location.
11) Click *Environments* tab and set Output Coordinate System to *Current Map*
12) Click *Parameters* Tab and click OK

Method D - Part II

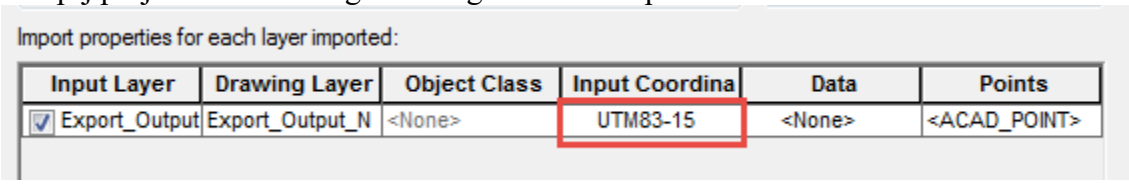
- Use Autodesk Civil 3D to import shapefile data as CAD objects.

Set Coordinate system of a temporary CAD file:

13) Open a new AutoCAD Civil 3D drawing from a template file.
14) Toolspace>Settings… Right click on the current Drawing name…
15) Click *Edit Drawing Settings… Units and Zone* tab
16) Click into the *Selected coordinate system code* and input {UTM83-15if}for IA.
17) Click OK

Import the contours as a CAD object with GIS Object Data:

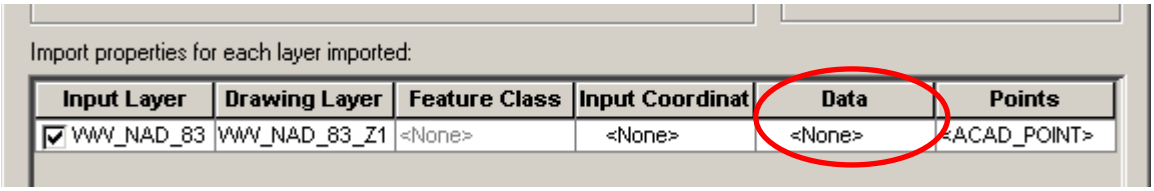
18) Type {Mapimport} Press Enter
19) Pulldown "File of Type" to *ESRI Shape*
20) Browse to the shape file {E.g. *Williams_Contours_NAD83Z15meters_L.shp*}
21) Click OK
22) If the *Input Coordinates* is set to <None> click into it to specify the spatial reference of the shape file. It is important that you know the correct coordinate projection that was used from the ArcGIS data export. You may be able to determine this from the .prj projection file that goes along with the shapefile.



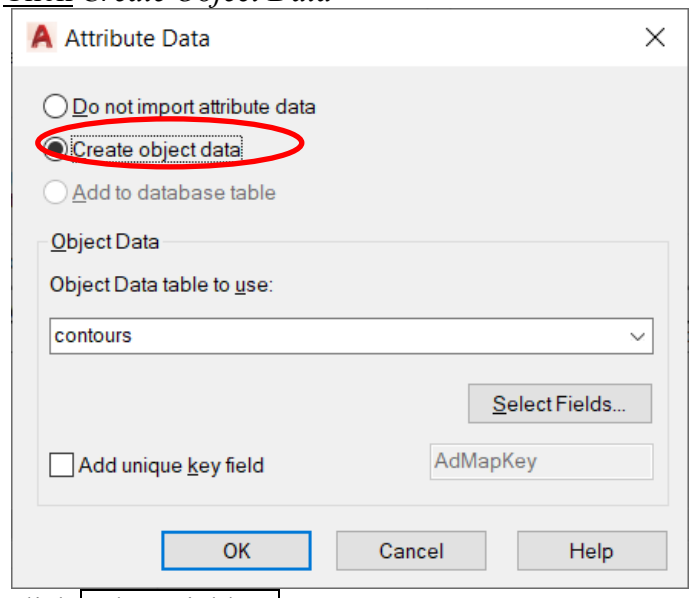
a) Pulldown Category to *UTM, NAD83 Datum*
b) Pulldown Coordinate System to *UTM with NAD 83 datum, Zone 15, Meter…*

c) Click Ok

23) Click on the *Data* :



24) Click *Create Object Data*



25) Click Select Fields…
26) Checkmark the Field that contains the Elevation data (E.g. Elevation).
27) Click OK Click OK
28) If you'd like to specify layer for the object click *Drawing Layer* and make changes.
29) Checkmark *Import Polygons as closed Polylines*.
30) Click OK and the objects will be placed into CAD.
31) Double Click with the Mouse wheel to do a zoom extents and view the contours.
32) Click *File… Save…* and give the file a name indicating that the drawing has GIS Object Data. E.g. {Williams Contours Object Data.dwg}.
33) Close out of this drawing file.

Set Coordinate system for a final CAD file:

34) Open the final AutoCAD Civil 3D drawing from a template file or existing drawing.
35) Toolspace>Settings… Right click on the current Drawing name…
36) Click *Edit Drawing Settings… Units and Zone* tab
37) Click into the *Selected coordinate system code* and input {UTM83-15if}for IA.
38) Click OK

Transfer contours from the temporary CAD file with the Elevation property:

Attach the temporary CAD drawing.
39) Type {adedrawings} Press Enter

40) Click Attach
41) Browse to the drawing that has the Contours with GIS Object Data. (E.g. *Williams Contours Object Data.dwg*). (If the file is on a network drive you may need to click the **Create/Edit Alias** button and add an alias that represents the network path.)
42) After selecting the file click Add
43) Click OK
44) Once the drawing link shows up in the Define/Modify Drawing Set dialog click OK.

Import the data from the temporary CAD drawing.
45) Type {adequery} Press Enter
46) In the Define Query dialog box, click Location...
47) In the Location Condition dialog box, select *All*, and then click OK.
48) In the Define Query dialog box, click Alter Properties…
49) In the Set Property Alterations dialog box, select the *Elevation* radio button and then click Expression….
50) In the Set Property Expression dialog box, expand the Object Data list, and within the object data select the field you want to use as your elevation data. (E.g. *Elevation*) Click OK
51) In the Set Property Alterations dialog box, click Add, and make sure that the *Elevation::Contour@...* expressions shows up in the Current list. Click OK
52) In the Define Query box, select the *Draw* query mode, and click Execute Query.
53) Double Click with the Mouse wheel to do a zoom extents and view the contours.
54) Select a contour and open the properties box to verify that the Elevation property has been set correctly.

Detach the temporary CAD drawing.
55) Type {adedrawings} Press Enter
56) Highlight the attached drawing.
57) Click Detach
58) Click OK
59) Click *File… Save…* and give the file a normal project name. E.g. {Williams Contours.dwg}.