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 2016, NRCS C3D 2016 template, ESRI ArcMap

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. If the GIS user is utilizing Toolkit, they could check out that Customer data and the CAD developed data could be placed into their C:\Customer_Files_Toolkit\Customername-------t###\Engineering directory. This data would then be maintained with that customer's Toolkit data.

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 in an ArcMap project. A coordinate projection file from CAD is used by ArcMap as a spatial reference to determine correct location.

Method A - Part I

- Using Civil 3D to Create and Export Points as Text Data

Create objects and set Coordinate system of CAD project:

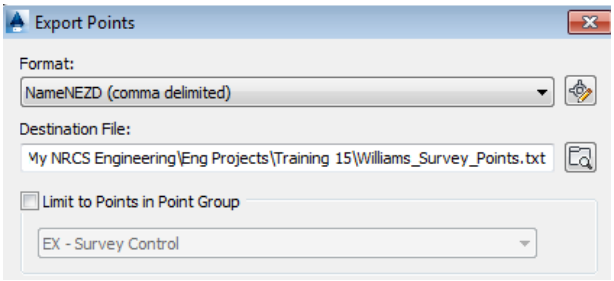
1) Create points in Civil 3D using normal CAD procedures.

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

Export points as text files: (Contains coordinates, elevation data AND survey labels.)

6) In Toolspace> Prospector… *Point Groups...* Right-click *PR – Staking …* Click *Export Points*.
7) Set *Format* to *NameNEZD*.
8) Uncheck *Limit to Point in Pt Group* if you want all points.
9) Browse to a location for saving the output file and enter a filename using ".txt" as the file type. Click Open.
10) Click OK




```
1,20.0000,0.0000,1092.3820,IP 1
2,53.8756,17.9646,1095.9600,BM 1
18,-99.9870,0.0000,1086.9720,PIN *1
19,-199.9172,0.1279,1083.6730,PIN *2
113,53.9021,17.9786,1095.9290,BM 1
182,-721.2202,-47.1929,1084.4060,IP 2
183,-725.6905,-120.2933,1083.1470,TP 2
228,-725.6777,-120.0832,1083.1480,TP 2
```

11) Using Windows Explorer, browse to the text file (e.g. *Williams_Survey_Points.txt*) and double click on it to open it in Notepad.
12) At the beginning of the file insert a line with this text:
    Pt,N,E,Elev,Description
    Make sure that the first survey point is on the 2nd line of the file.
13) Click *File… Save…*
14) Click *File… Exit…*

Create a Spatial Reference by exporting a point to a shape file:

15) Type {Mapexport} Press Enter
16) Pulldown "File of Type" to *ESRI Shape*

17) Browse to the location where you want to save this spatial reference shapefile.
18) Input a filename for the shapefile. E.g. {Williams_UTM83-15IF} Click OK
19) From the Selection Tab
    a) Select Object Type as *Text*
    b) Use *Select All*
20) Click OK The processing screen will display the numbers of objects and will disappear once the shapefile has been created.

Note: The .shp & .prj files from this export are needed with the point .txt file.

Method A - Part II

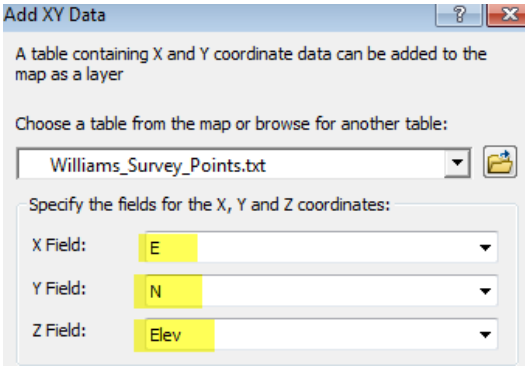
♦ Using ArcMap to Import Point Text file sent from AutoCAD

Check the GIS project's coordinate system:

21) Open your ArcMap or Toolkit Project
22) Click *View… Data Frame Properties…*
23) Click the Coordinate System tab 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.
24) Click Ok

Import the point text file data into GIS

25) Click *File…* Add Data… *Add XY Data…*
26) Browse to the text file exported from CAD (e.g. *Williams_Survey_Points.txt*) and select it.
27) Click Add
28) Set the X Field to *E*.
    the Y Field to *N*.
    the Z Field to *Elev*



Set
Set

29) Under *Coordinate System of Input Coordinates* Click Edit…
30) Click Import…
31) Browse to the spatial reference file exported from CAD and select it.
32) Click Add
33) The name of the Coordinate system from CAD should appear in the name box. E.g. (*NAD83 UTM, Zone 15 North, Intnl Foot*)
34) Click Ok
35) Click Ok
36) The text file name has been added as a layer within your project.
37) At this point a shapefile could be created from this XY Data Event to make the data more GIS transportable.
38) Continue within GIS. Displaying the data by elevation or description can be helpful.

Method B

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

- This process converts these objects into shape files to be ready for use in an ArcMap project. ArcMap 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

Save your drawing and save a copy to export from:

6) Save your current Civil 3D project drawing
7) Click *Application menu… Save As..* to create a copy of that drawing that will be used only for the exporting process. E.g *MyProject Export to GIS.dwg.*

Important: Be sure that you are now working in the drawing that is going to be used for the export process. *Not the original C3D file!*

Export contours as line shape files:

Extract polylines from surface contours.

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

Export to shapefile.

11) Type {Mapexport} Press Enter
12) Pulldown "File of Type" to *ESRI Shape (*.shp)*
13) Browse to the location where you want to save the shapefile.
14) Input a filename for the shapefile E.g. {Williams_Contours_L} Click OK
15) From the Selection Tab
    a) Select Object Type as *Line*
    b) Either (Use *Select Manually* & click **Select Objects**  to pick the contours lines in CAD) or (Use *Select All* and click **Select Layers**  to set the Layers Filter to *C.Topo.Ognd.Intr* & *C.Topo.Ognd.Indx*)
16) From the Data Tab
    a) Click Select Attributes…
    b) Expand the *Properties* list & checkmark *Elevation*, & *Layer*
    c) Click Ok
17) Click OK The processing screen will briefly display the numbers of objects and will disappear once the shapefile has been created.

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

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

Export any linear CAD feature as line shape files (such as the centerline of a dam or toe of dam):

Convert Civil 3D objects (feature lines, alignments, gradings) to plain AutoCAD objects. Polylines, 3D Polylines, and Lines do not need to be exploded.
Note: If you explode a C3D feature twice it will turn into a whole bunch of short line segments.

26) Click *Home… Modify…Explode* 
27) Select the Civil 3D objects.
28) Press Enter

Export to shapefile.

29) Type {Mapexport} Press Enter
30) Pulldown "File of Type" to *ESRI Shape*
31) Browse to the location where you want to save the shapefile.
32) Input a filename for the shapefile E.g. {Williams_CLdam_L} Click OK
33) From the Selection Tab
    a) Select Object Type as *Line*
    b) Use *Select Manually* & click **Select Objects**  to pick the lines in CAD
34) From the Data Tab
    a) Click Select Attributes…
    b) Under the Properties checkmark *Elevation*, & *Layer*
    c) Click Ok
35) 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 ArcMap to Import Shapefiles sent from AutoCAD Civil 3D

Check the GIS project's coordinate system:

36) Open your ArcMap or Toolkit Project
37) Click *View… Data Frame Properties…*
38) Click the Coordinate System tab 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.
39) Click Ok

Import shapefile data into GIS:

40) Click *File… Add Data…Add Data*
41) Browse to the shape files exported from CAD and select one or more of the shape files (e.g. *Williams_CLdam_L.shp*).
42) Click Add
43) 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.
44) 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.

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 ArcMap to Export Objects as Shapefiles for CAD use

(Note: if you are using ToolKit, set the *GIS Preferences* to *Advanced* in order to allow data export.)

Check the project Coordinate system:

1) Click *View… Data Frame Properties…*
2) Click the Coordinate System tab 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 Data…
6) Pulldown Export to *All features* to get everything on that data layer
7) Select *Use the Same Coordinate System as the data frame*
8) Browse to a location to save the shapefile for use in CAD
9) Pulldown "File of Type" to *Shapefile*
10) Input a file name for the shapefile. E.g. {WaterwayDA_NAD83Z15meters_a}
11) Click Save
12) Click OK
13) Click No when asked to add the exported data back into your GIS map.

Method C - Part II

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

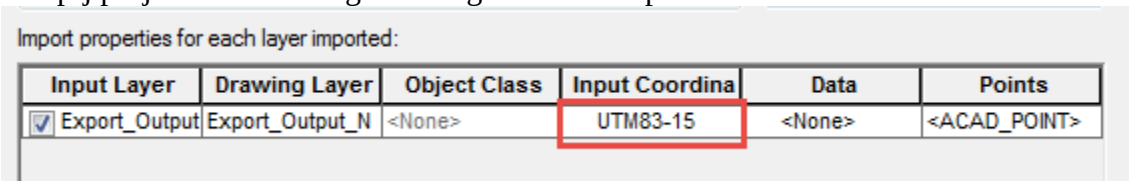
(Note: This method will NOT bring elevations into CAD.)

Set Coordinate system of CAD project:

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

18) Type {Mapimport} Press Enter
19) Pulldown "File of Type" to *ESRI Shape*
20) Browse to the shape file {E.g. *WaterwayDA_NAD83Z15meters_a.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) If you'd like to specify layer that the object should be placed on you can click *Drawing Layer* and make changes.
24) Checkmark *Import Polygons as closed Polylines*.
25) 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 ArcMap to Export Contours as Shapefiles for CAD use

(Note: if you are using ToolKit, set the *GIS Preferences* to *Advanced* in order to allow data export.)

Check the project Coordinate system:

1) Click *View… Data Frame Properties…*
2) Click the Coordinate System tab 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 Open 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 Data…
10) Pulldown Export to *All features* to get everything on that data layer
11) Select *Use the Same Coordinate System as the data frame*
12) Browse to a location to save the shapefile for use in CAD
13) Input a file name for the shapefile. E.g. {Williams_Contours_NAD83Z15meters_L}
14) Click Save
15) Click OK
16) Click No when asked to add the exported data back into your GIS map.

Method D - Part II

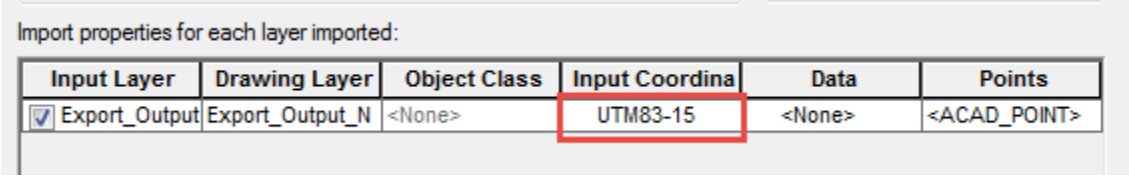
♦ Use Autodesk Civil 3D to import shapefile data as CAD objects.

Set Coordinate system of a temporary CAD file:

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

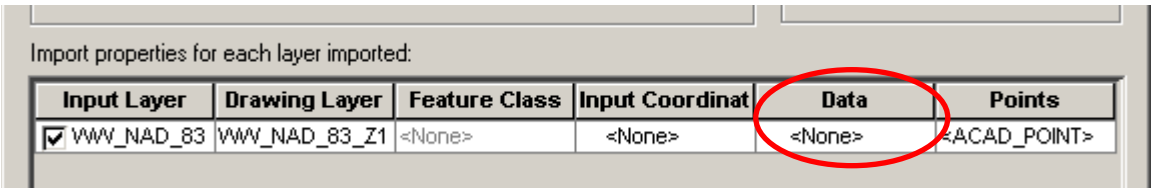
Import the contours as a CAD object with GIS Object Data:

22) Type {Mapimport} Press Enter
23) Pulldown "File of Type" to *ESRI Shape*
24) Browse to the shape file {E.g. *Williams_Contours_NAD83Z15meters_L.shp*}
25) Click OK
26) 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.

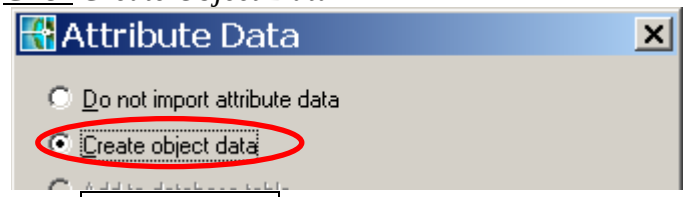


a) Pulldown Category to *UTM, NAD83 Datum*
b) Pulldown Coordinate System to *UTM with NAD 83 datum, Zone 15, Meter…*
c) Click Ok

26) Click on the *Data* :



27) Click *Create Object Data*



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

Set Coordinate system for a final CAD file:

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

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

Attach the temporary CAD drawing.

42) Type {adedrawings} Press Enter
43) Click Attach
44) 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.)
45) After selecting the file click Add
46) Click OK
47) Once the drawing link shows up in the Define/Modify Drawing Set dialog click OK.

Import the data from the temporary CAD drawing.

48) Type {adequery} Press Enter
49) In the Define Query dialog box, click Location...
50) In the Location Condition dialog box, select *All*, and then click OK.
51) In the Define Query dialog box, click Alter Properties…
52) In the Set Property Alterations dialog box, select the *Elevation* radio button and then click Expression….
53) 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
54) 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
55) In the Define Query box, select the *Draw* query mode, and click Execute Query.
56) Double Click with the Mouse wheel to do a zoom extents and view the contours.
57) Select a contour and open the properties box to verify that the Elevation property has been set correctly.

Detach the temporary CAD drawing.

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