Workflow MS 3 - Setting a Project Geographic Coordinate System

This document guides you through the steps required to create a project or local datum MicroStation Geographic Coordinate System (GCS). This will facilitate the integration of images, GIS data, and design files that use different coordinate systems.

These instructions are intended to be used by the Survey department at the beginning of a project, allowing other divisions, like Design, to coordinately attach imagery and shape files later in the project. Without this information, it is unlikely that imagery which is typically in a different coordinate system (like State Plane Coordinates or UTM) will line up with the MicroStation design files created by ROW Survey.

The following steps describe how to create a project specific datum in MicroStation followed with an example of how to attach imagery and GIS information from different coordinate systems.

It is very important that the projection information for all files is known!

CDOT Survey Project Files

MicroStation design files created by CDOT Survey are created in a project specific, local datum plane (project coordinate system). This coordinate system is typically defined by multiplying known coordinates by a scale factor or conversion factor. This factor is project specific and published in the Project Control Diagram created by Survey. Once created, the project GCS can be assigned to the individual models within the MicroStation design file. This means files with different GCS assignments can be reprojected to fit the project GCS.

Creating a Project Geographic Coordinate System in MicroStation

In order to create a project specific GCS the coordinate datum instructions must be obtained. These can be found on the ***Project Control Diagram*** sheet included in CDOT plan sets.

COORDINATE DATUM: Project coordinates are modified Colorado State Plane North Zone NAD 83(2007) coordinates. The CHARN is based on NAD 83(2007) datum. The project seed point coordinates are: Northing = 377204.827m, Easting = 937274.019m, and Elevation = 1618.990m. The ground scale factor used to modify the coordinates is 1.00028596071914. Project Coordinates are truncated by 300,000m in the Northing and 900,000m in the Easting.

To get from Project to State Plane coordinates: add the truncation, subtract the seed point northing and easting, divide by the ground scale factor, then add the seed point northing and easting.

Factor Computation Worksheet

A worksheet has been created to assist the user in computing the necessary information for the custom project coordinate system. This file is called ***Factor Computation Worksheet.xlsx*** and can be found in the CDOT workspace under ***Standards-Global\MicroStation\Data***. The worksheet is intended to help automate the process of creating a project specific Geographic Coordinate system in MicroStation. Information entered into this worksheet should be obtained from the Project Control Diagram or the Surveyor when a PCD sheet is not available. The worksheet computes parameter information used in MicroStation to create a Geographic Project Coordinate System. Instruction on how to use the worksheet can be found on the first tab.

FACTOR COMPUTATION WORKSHEET Compiled by: Patrick Williams

Using Project Seed Points

Date:	2-Nov-11
Project Number:	BR 157A-011
Project Location:	SH 157 at US 36 Bridge Deck Replacement
Description:	

Colorado State Plane Grid Zone:	North
Datum:	NAD83(2007)
Scale Factor:	1.00028596071914
Meters to Feet:	3.280833333

Project Seed Point	**Meters**
Norting:	377204.827
Easting:	937274.019

Truncation	**Meters**		
Norting:	300000	**Truncation Adjusted to**	300022.071236
Easting:	900000	**Seed Coordinates**	900010.655858

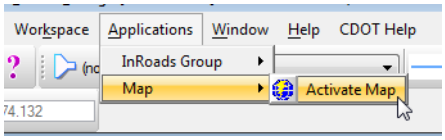
Geographic Coordinate System Parameters	
Affine A0 Parameter	-2953629.340605
Affine B0 Parameter	-984603.889593
Affine A1 Parameter	1.00028596071914
Afine B2 Parameter	1.00028596071914

1. Using the information from ROW Survey on the Project Control Diagram, the first step will be to complete the Factor Computation Worksheet.
2. Next, the appropriate information from the yellow highlighted area will be used to create a Project Coordinate System in MicroStation using the Geographic Coordinate System tools.
3. First the program Bentley Map must be activated from within InRoads.

Activating Bentley Map

In order to create and save a Geographic Project Coordinate system that can be assigned to a MicroStation design file, the program Bentley Map must be activated. Once Bentley Map has been activated, a customized GCS can be created. Otherwise the files are read only.

1. Begin by opening ***InRoads***. Within InRoads, there is an application that needs to be activated called **Bentley Map**.
2. From the MicroStation menu bar, select **Applications > Map > Activate Map**.



3. A dialog box requesting a connection to a database will appear. ***Click*** the **Cancel** button to ***close***. Map is now activated.

Once ***Bentley Map*** is activated, a customized geographic coordinate system can be created.

Project Geographic Coordinate File Creation

Geographic Coordinate Projections are created within MicroStation. A file located in the CDOT Data folder called CDOT-Projects.dty can be used as a template to store custom systems.

The CDOT-Projects.dty file is found in the following location:

C:\Workspace\Workspace-CDOT_V8i\Standards-Global\MicroStation\Data.

This file needs to be copied into the users local folder in order to be edited. A variable has been set in the CDOT configuration to access this file. Once this file has been edited, it can be copied to other computers.

The CDOT-Projects.dty file should be copied from the CDOT Data folder to the following location before editing:

C:\Workspace\Workspace-CDOT_V8i\Standards-Local\Users\CDOT User

When creating a project file, a copy of an existing coordinate system is used to create the Project Coordinate System. The following example lab takes you through the steps.

Example - Setting Project Geographic Coordinate System

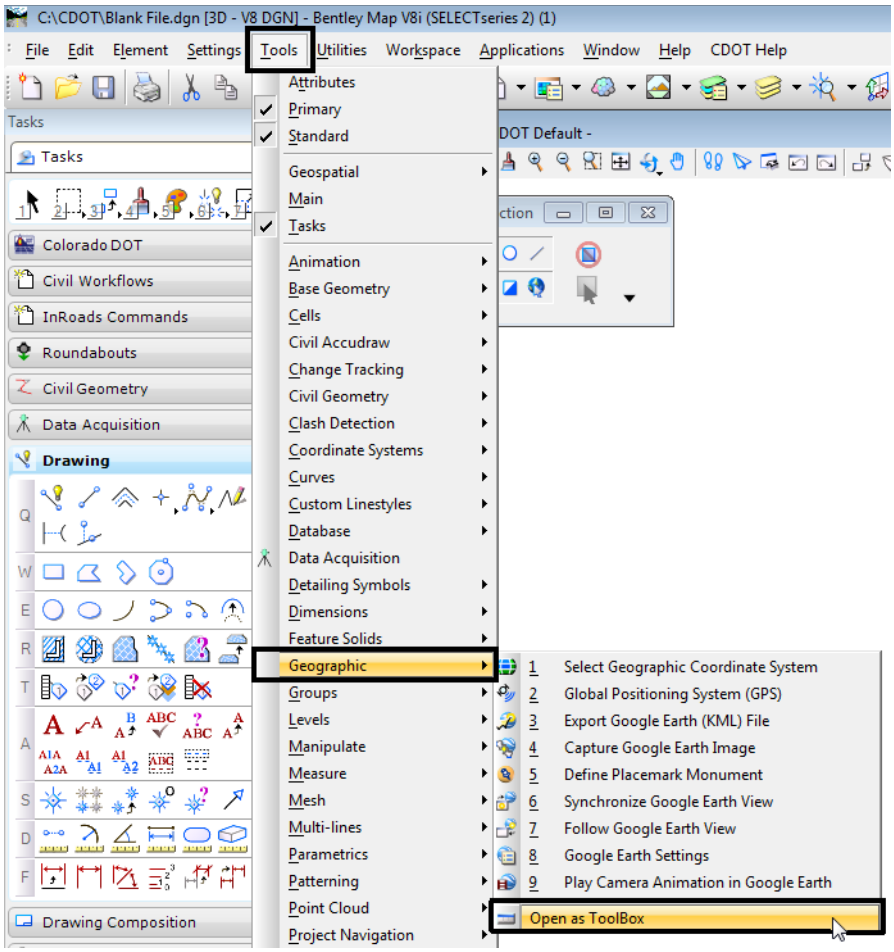
The following is an example of setting up and using a Project Geographic Coordinate System. In this example a project coordinate system is setup using information from ROW Survey. The project coordinate system is then assigned to a MicroStation design file.

Once the project coordinate system has been assigned to the design file, a survey file is referenced, a project point control file is referenced which is in UTM coordinates, an image file is referenced which is UTM coordinates, and lastly GIS data is referenced into the design file.

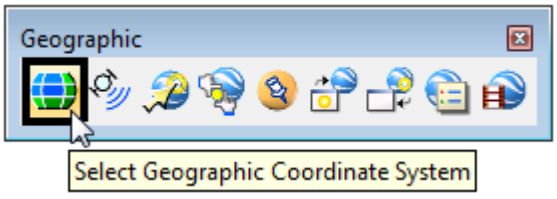
Create Project Geographic Coordinate System

1. Open InRoads and create a new MicroStation design file. In this example the file will be called 12345Des_Model.dgn.
2. From the Applications pulldown, activate Map and then cancel the window.
3. Create a Project Geographic Coordinates System using the information from this workflow. This data can also be found in the ***Factor Computation Worksheet*** using the ***Sample -Seed Points*** tab calculations.

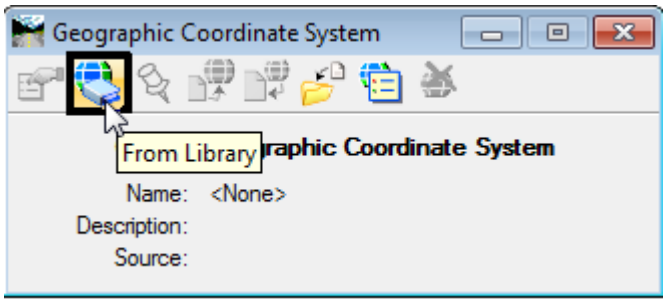
4. Open the ***Geographic Toolbox*** from the **Tools** pulldown menu. Select **Tools > Geographic** and then the **Open as Toolbox**.



5. This will open up the **Geographic** toolbox. **<D>** the **Select Geographic Coordinate System** icon from the toolbox.

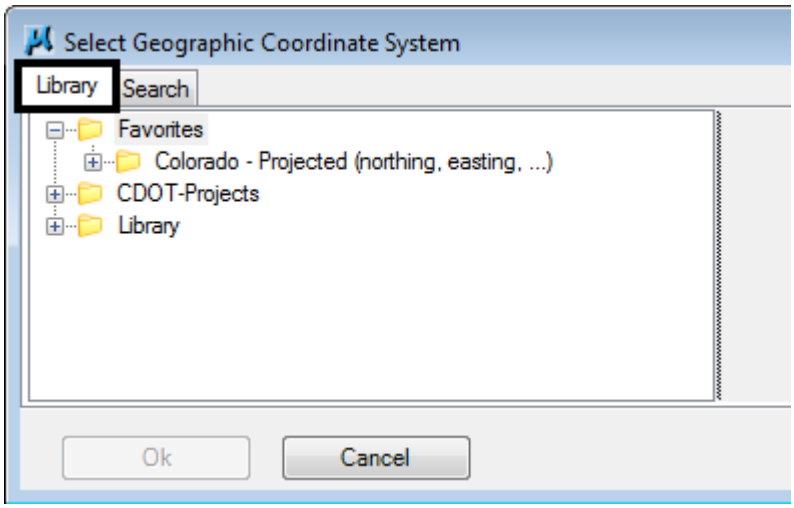


6. This opens up the ***Geographic Coordinate System*** dialog box. **<D>** the **From Library** icon (the second icon from the left) to open the ***Select Geographic Coordinate System*** dialog box (this contains the library of geographic coordinate systems).

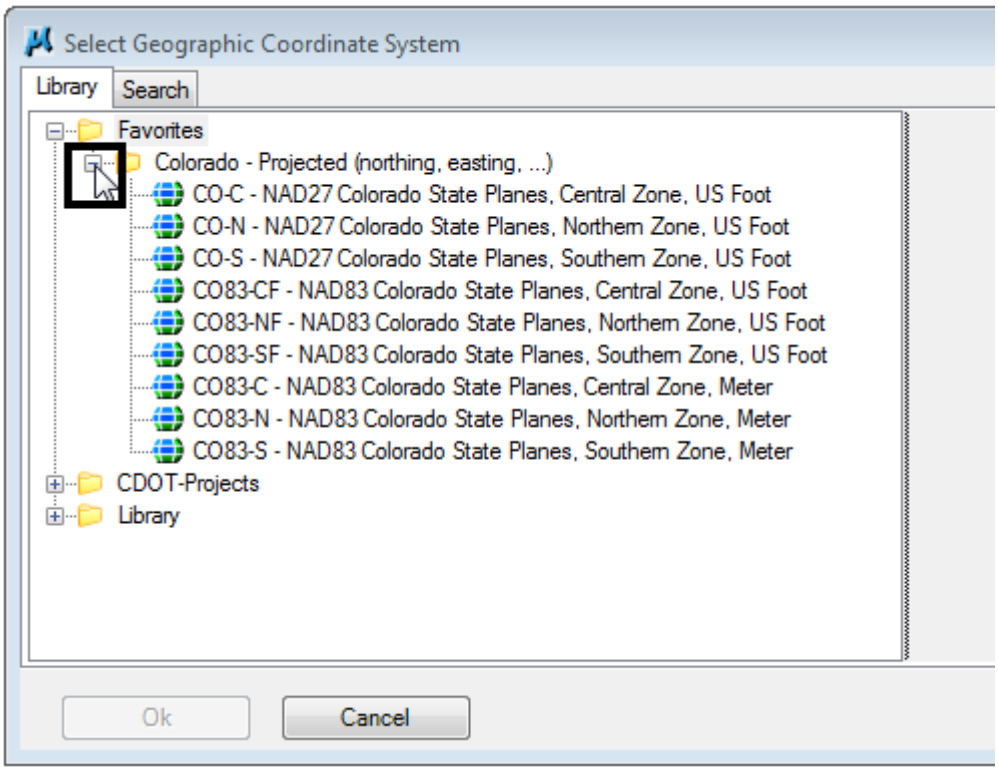


Note: If the model you are in does not have a GCS assigned to it, the first icon is displayed diluted and will be unusable.

7. Select the ***Library*** tab to see all the available systems.



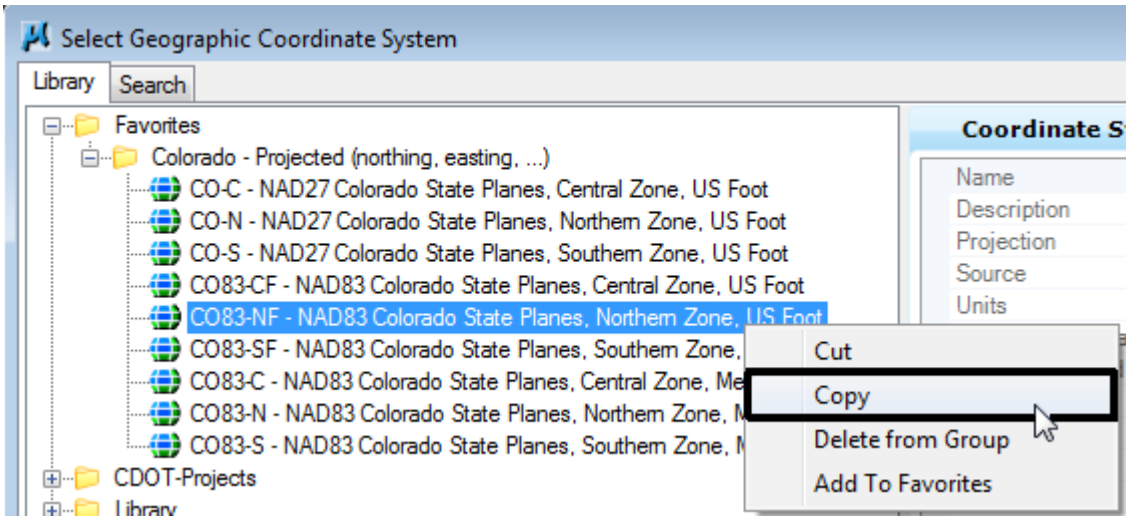
8. Expand the **Favorites** folder by clicking on the plus box and then expand the Colorado folder the same way. Default Colorado geographic coordinate systems can be accessed from this folder.



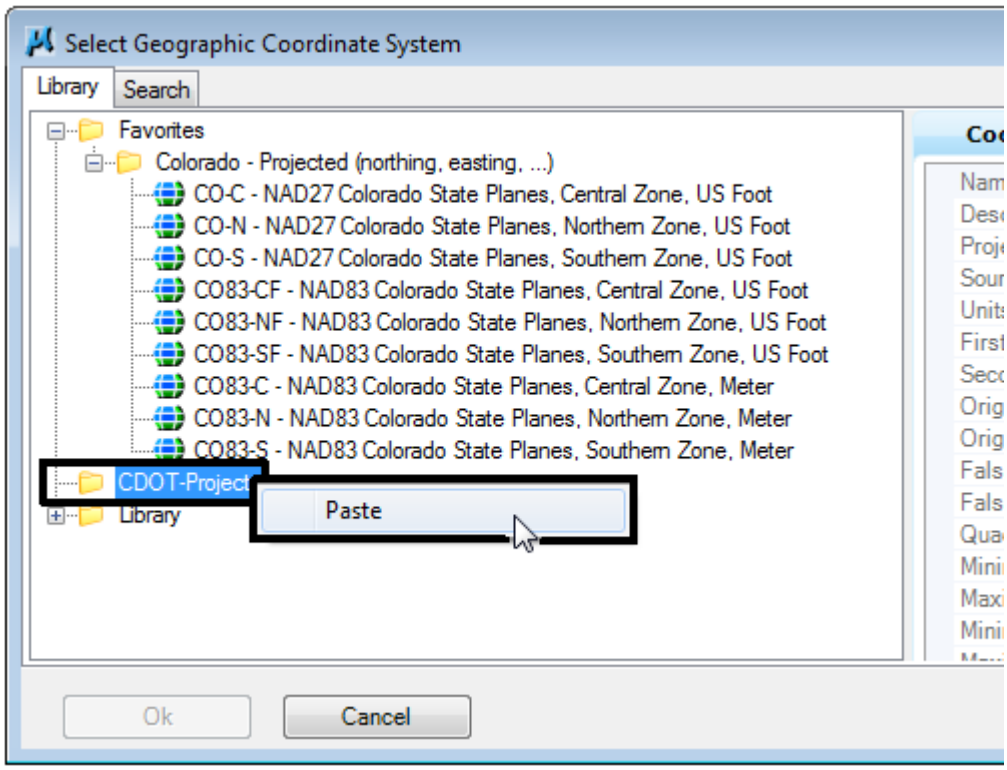
9. A copy of a base coordinate system is used to create the project coordinate system.

   Note: CDOT Project coordinates created by ROW Survey are generally modified Colorado State Plane NAD 83 coordinate systems in one of three zones (Northern, Central, and Southern).

10. Select the coordinate system to be copied and right click over it.



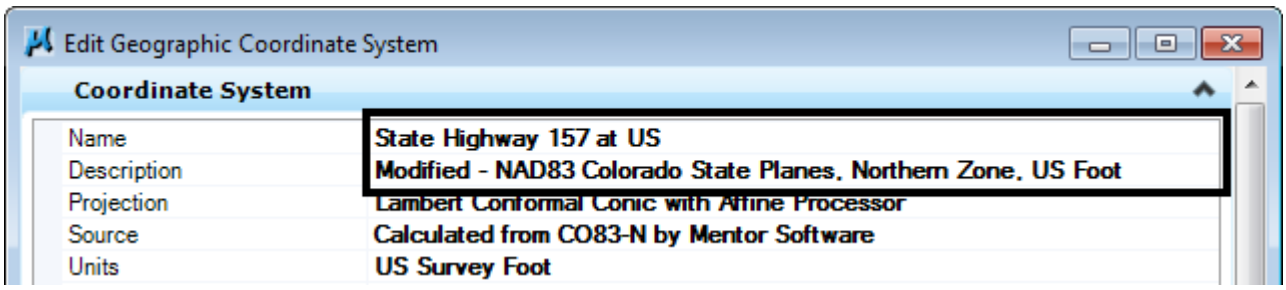
11. **<D>** on the **CDOT-Projects** folder and **Paste** the copy into the folder.



After pasting the file in the ***CDOT-Project*** folder it should be edited with project specific information.

12. **<R>** on the copied file and select **Edit Coordinate System Properties.**

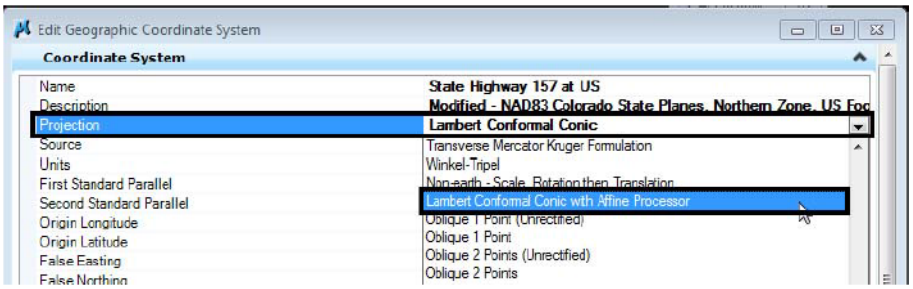
13. Edit the **Name** and **Description** to represent the project. **<D>** in the right hand column to edit.



Do not close the ***Edit Geographic Coordinate System*** dialog box. Additional information is required for the project coordinate system before it can be saved. This information is obtained from the ***Factor Computation Worksheet***.

14. The base system for the copied NAD83 Colorado State Plane system has a Projection of Lambert Conformal Conic. It is important to select a system similar to the original when modifying the project system. For example: ***Lambert Conformal Conic with Affine Processor*** is used to modify a ***Lambert Conformal Conic*** projection.

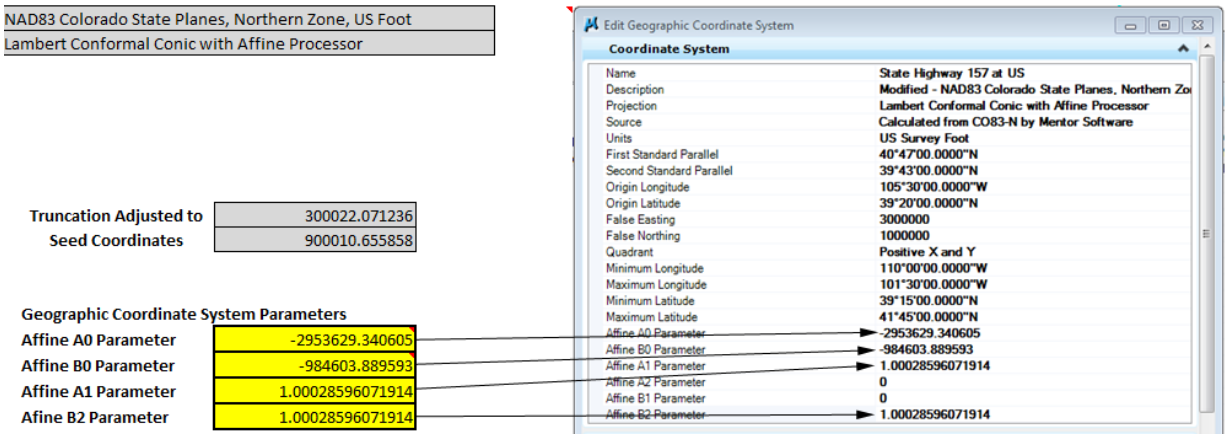
15. **<D>** in the right had column over the projection. Using the down arrow, navigate to the appropriate ***Affine Processor***.



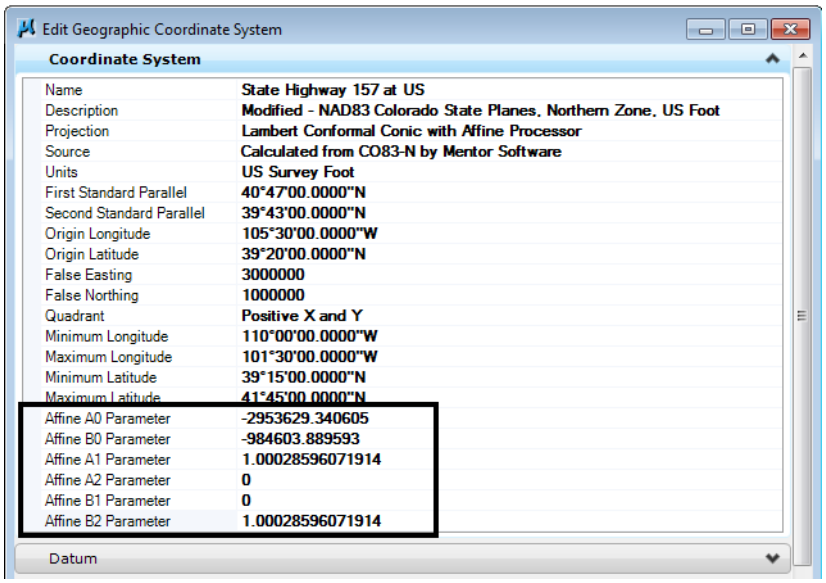
16. Next the information from the worksheet tab for Seed Point's should be entered. The information from the yellow highlighted area into the ***Edit Geographic Coordinate System*** dialog box.

17. ***Affine A0 Parameter*** is the ***Easting*** adjustment and the ***Affine B0 Parameter*** is the ***Northing*** adjustment.

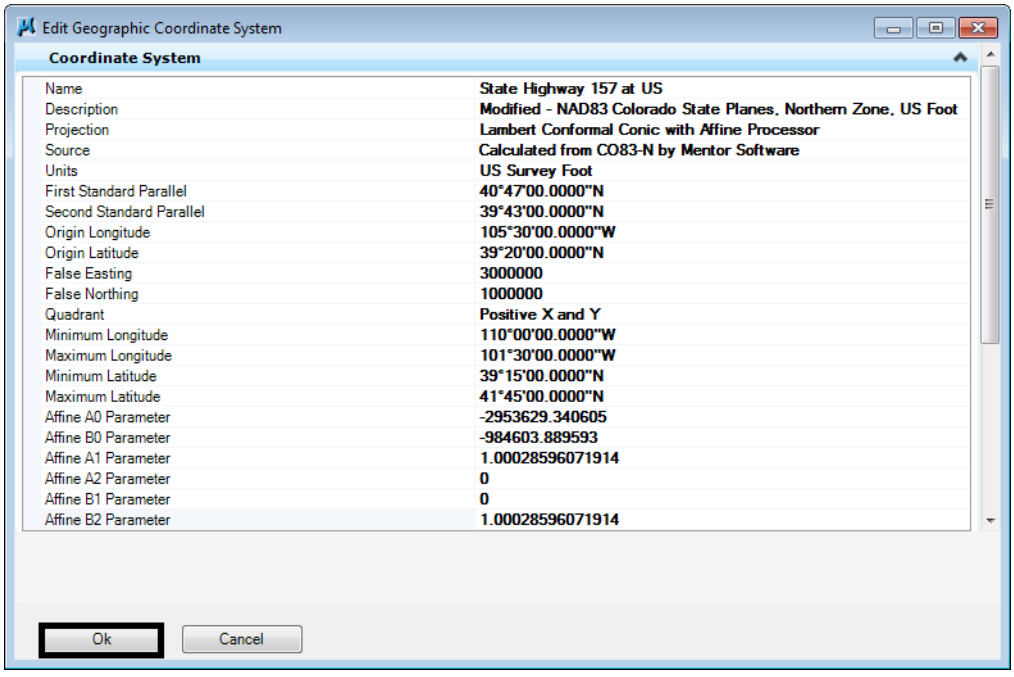
18. ***Affine A1 Parameter*** and ***Affine B2 Parameter*** are the ***Scale*** parameters.



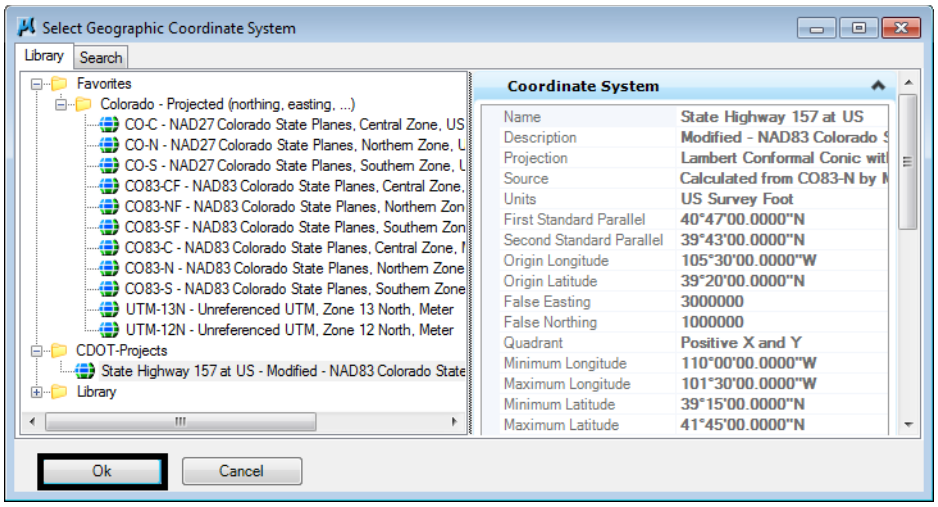
19. In those cases when there is a rotation value, this would be entered in the ***Affine A2*** and ***Affine B1*** parameter area.



20. Once the values have been entered they can be saved by selectin **Ok** to accept the changes and dismiss the ***Edit Geographic Coordinate System*** dialog box.



21. Select **Ok** in the ***Select Geographic Coordinate System*** dialog box to apply the custom project system. This project coordinate system can now be assigned to any design file within the project.



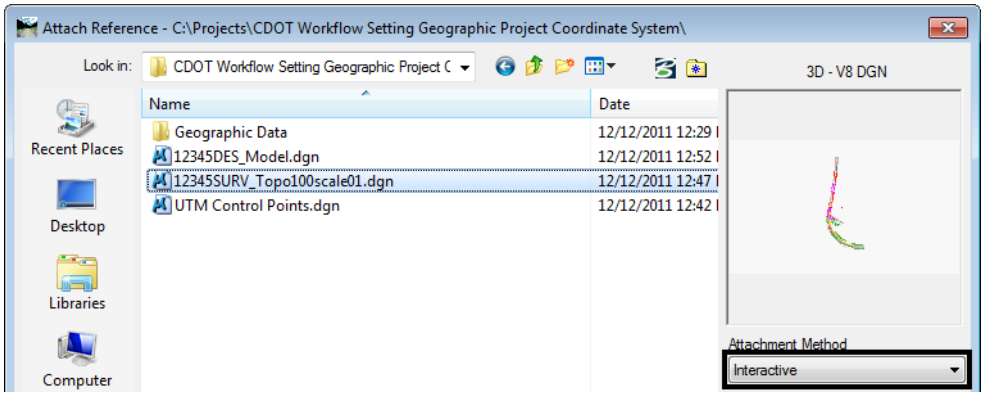
Attach Survey Topo File

Once the Project Coordinate System has be defined and assigned to the new design file, it is time to reference files.

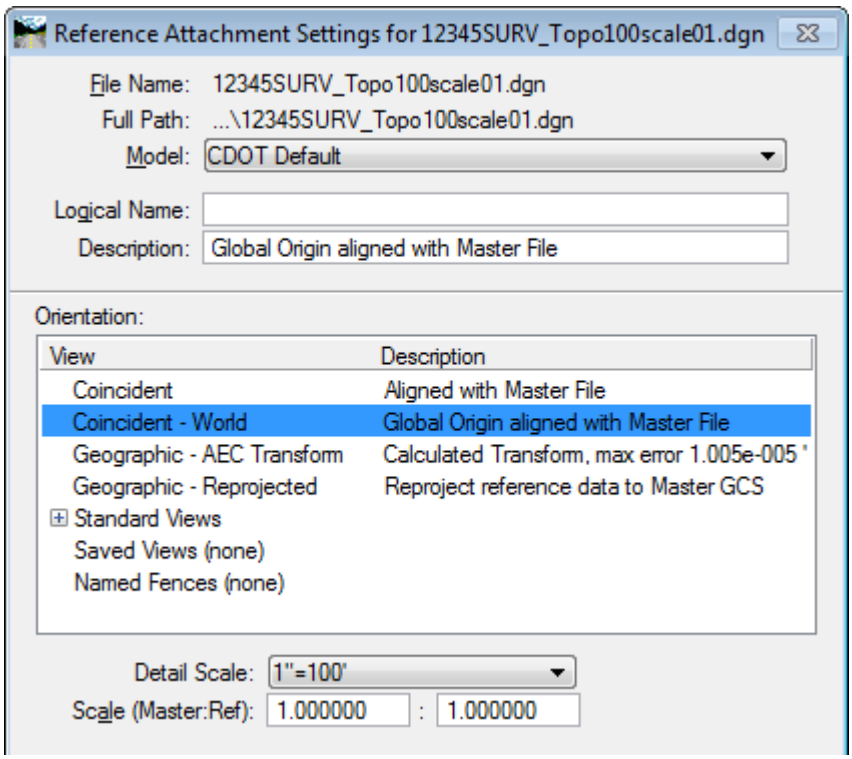
Note: For more information on attaching imagery, review the workflow Using Geographic Images in Raster Manager.

1. Begin by referencing the survey existing data. This file is called ***12345SURV_Topo100scale01.dgn***.

2. Set the ***Attachment Method*** do **Interactive**.



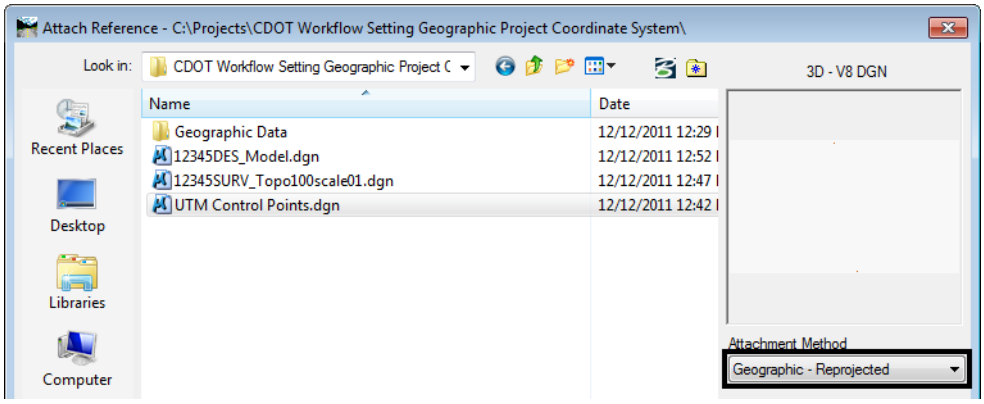
3. Select ***Coincident - World*** for the **Orientation**.



Reference UTM Control Points

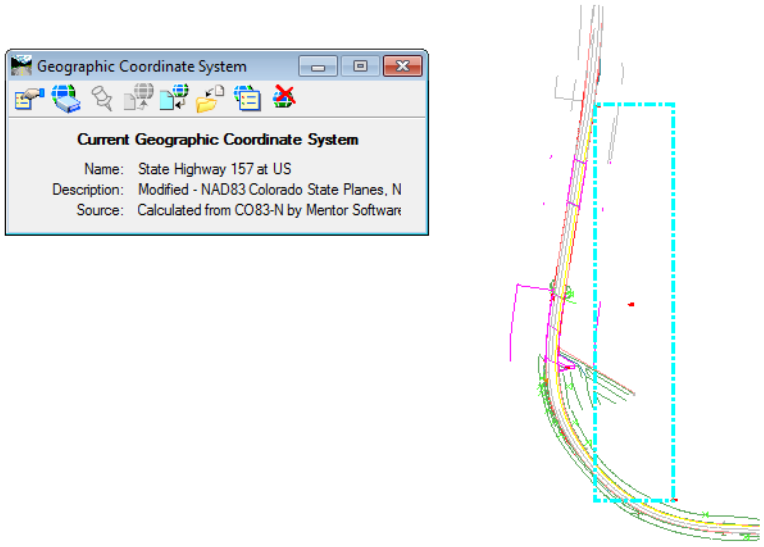
Reference the file containing control points which are in UTM coordinates. This file has a UTM-13N Geographic Coordinate System assigned to it.

1. Attach reference the file ***UTM Control Points.dgn*** and set the ***Attachment Method*** to **Geographic - Reprojected**.

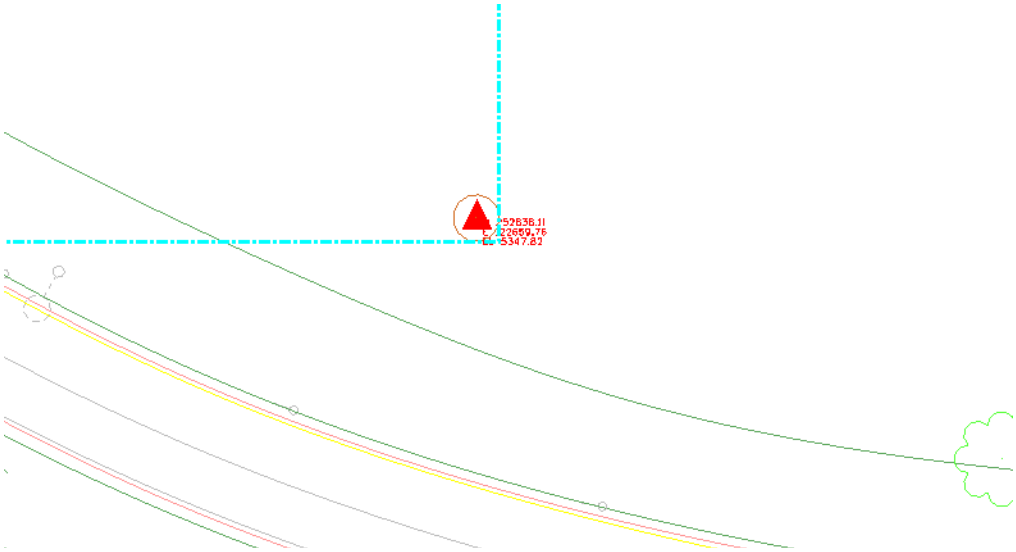


The UTM Control Points.dgn file appears as shown below represented by the blue dashed box.

Note: If the box does not appear, **<D>** the **Fit** view command (***Files*** set to **All** and ***Expand Clipping Planes*** toggled on).



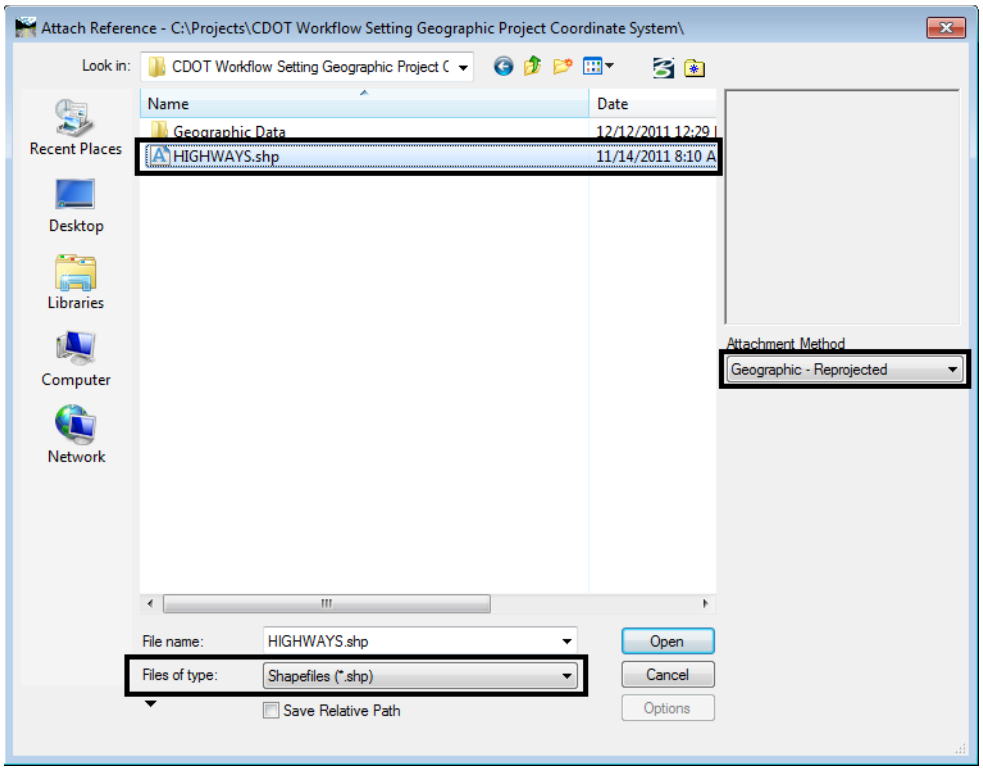
2. The control points in the referenced files should line up. The triangle is a control point in the Survey file and the circle is the same control point in the UTM control point file.



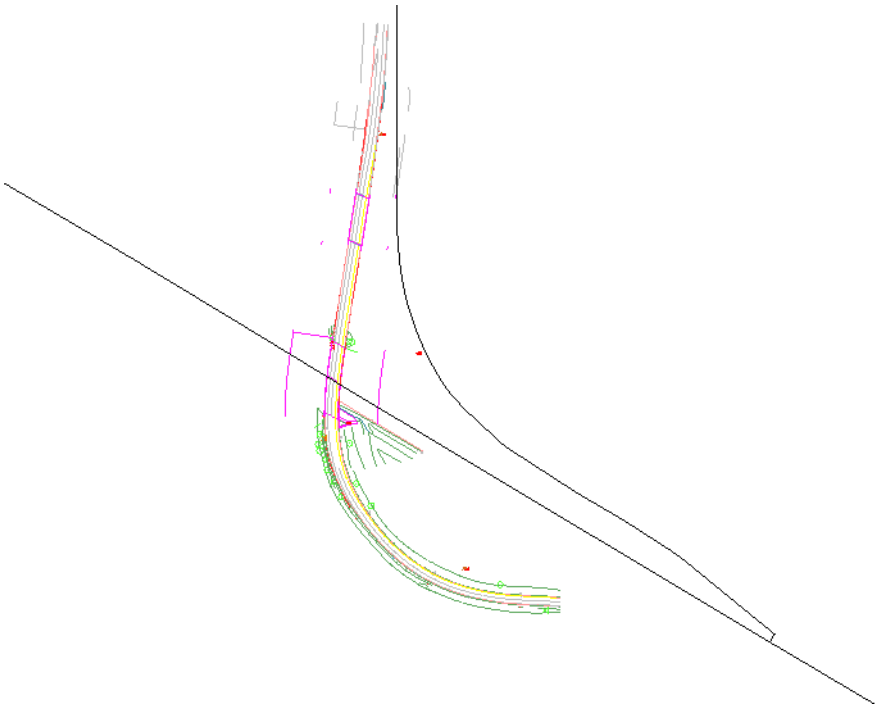
Reference GIS Shapefiles

Shape (shp) files created from GIS can be referenced in. In this example, highway linework in UTM coordinates will be referenced.

1. Attach reference the ***HIGHWAYS.shp*** being sure to change the ***Files of type:*** to **Shapefiles (*.shp)** and setting the ***Attachment Method*** to **Geographic - Reprojected**.



2. Notice that after attaching the files, they all be line up even though there are two separate coordinate systems being used.

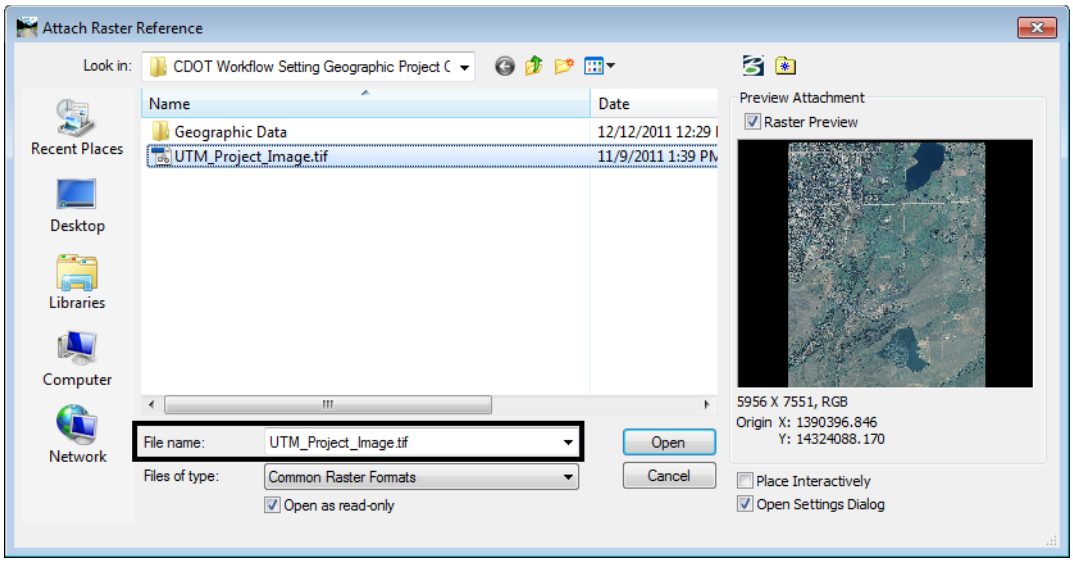


Reference Image Files

CDOT has imagery covering the state of Colorado. This imagery is in two different coordinate systems. The greater Denver area is in NAD83Colorado State Plane coordinates and the rest of Colorado is in UTM coordinates. Either system can be referenced into a design file and reprojected to the project coordinate system.

Refer to the workflow ***CDOT Workflow Accessing Imagery Files*** to learn more on how to find images within the state of Colorado.

1. Using ***Raster Manger***, attach the file ***UTM_Project_Image.tif***.



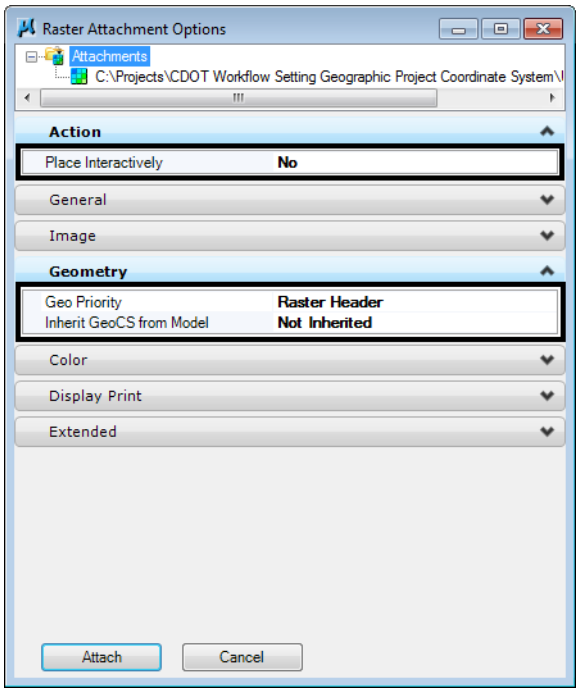
In this example, the image is from a portion of Colorado where the coordinate system is UTM. These files are GeoTIFF files with the coordinate system written into the header of the file. There is no sister file accompanying the image.

Note: The same setting used below are also used for images that have a sister file.

2. In the ***Raster Attachment Options*** dialog box, set the ***Action*** tab setting - ***Place Interactively*** to **No**.

3. Under the ***Geometry*** tab, set the ***Geo Priority*** setting to **Raster Header** since the coordinate assignments are in the file.

4. Set the ***Inherit GeoCS from Model*** to **Not Inherited** since the coordinate system of the design file is different from that of the image.



5. Select **Attach** to reference the image.