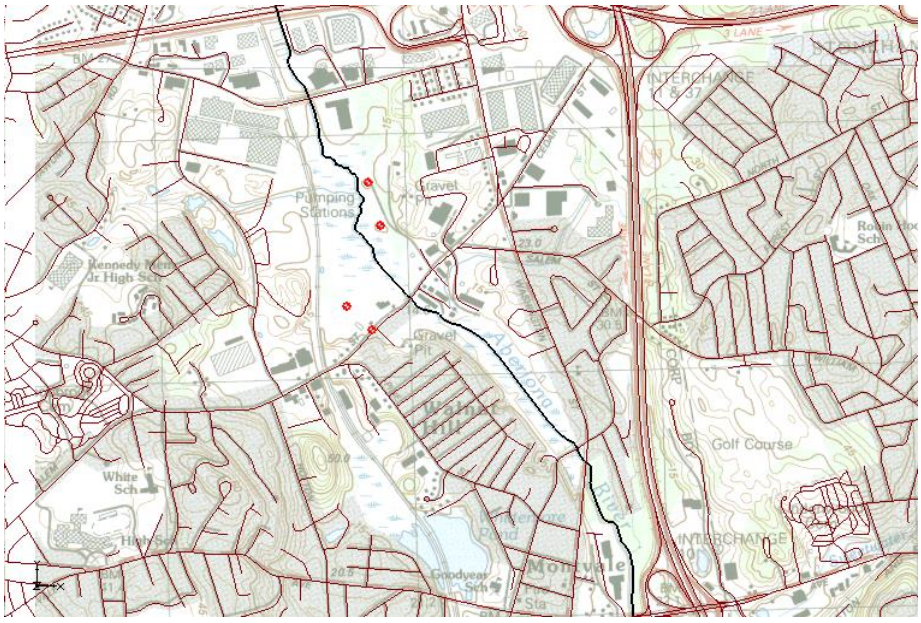
SMS

v. 12.3

*SMS 12.3 Tutorial*

# *Projections / Coordinate Systems*

Working with map projections in SMS




## Objectives

Learn how to work with projections in SMS, and how to combine data from different coordinate systems into the same SMS project.

## Prerequisite Tutorials

- Overview
- Rasters

## Required Components

- Map
- GIS

## Time

- 20–30 minutes

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# 1 Introduction

Coordinate systems and map projections provide information for locating data on the earth (georeferencing). There are two types of coordinate systems: geographic and projected.

A geographic coordinate system uses a three dimensional sphere to locate data on the Earth. Data in a geographic coordinate system is referenced using latitude and longitude. Latitude and longitude are angles measured from the Earth's center to a point on the Earth's surface.

A projected coordinate system is two dimensional based on a sphere or spheroid. Unlike a geographic coordinate system, projected coordinate systems have constant lengths, angles, and areas across the two dimensions.[1]

A PRJ file is a text file containing information describing the type coordinate system and other relevant data to position the related data on the Earth. This tutorial provides an overview of working with projected data in SMS through the following steps:

- Importing a TIFF file and assigning a projection.
- Learning about the Display Projection.
- Importing a CAD file and assigning a different projection.
- Learning about "Project on the fly".
- Importing a shapefile with an associated projection.
- Importing elevation data and edit points.

[1] Information summarized from ESRI: http://webhelp.esri.com/arcgisdesktop/9.2/index.cfm?TopicName=projection_basics_the_gis_professional_needs_to_know

 

# 2 Getting Started

To begin the tutorial, do the following:

1. If SMS is already open, select *File* | **Delete All** to restore program settings to the default state. If SMS is not open, skip to step 3.
2. If asked to save data, click **No**.
3. Launch SMS.

# 3 Importing an Image

Start by importing an image of an area where the model will be built. The image was downloaded from the state of Massachusetts.

1. Click **Open** to bring up the *Open* dialog.
2. Select "TIFF Image Files (*.tif, *.tiff)" from the *Files of type* drop-down.
3. Browse to the *Data Files*\ folder for this tutorial and select "q233914.tif".
4. Click **Open** to import the image and close the *Open* dialog.
5. Move the mouse around in the Graphics Window.

Notice that the lower right corner of the image is at x=233,000 and y=914,000 (which is where the file name "q233914" comes from). This image came with a TFW file (TIFF world file) that gives the location and size of the pixels in the image file. However, this image did not come with a PRJ (projection) file.

SMS was able to position the image at the correct coordinates using the data in the TFW file. However, SMS is not able to georeference the location of the image because no PRJ file was included. The projection of the image must be specified in order to georeference the image.

## 3.1 Setting the Projection

To set the projection in SMS:

1. Right-click on "q233914.tif" and select *Projection* | **Projection…** to bring up the *Projection* dialog.
2. In the *Horizontal* section, select *Global projection* to bring up the *Select Projection* dialog. If the dialog does not automatically appear, click **Set Projection…** to bring it up.

This dialog is used to select a projection and can also be used to export or import PRJ files.

 

3. Select "State Plane Coordinate System" from the *Projection* drop-down.
4. Select "Massachusetts Mainland (FIPS 2001)" from the *Zone* drop-down.
5. Select "NAD83" from the *Datum* drop-down.
6. Select "METERS" from the *Planar Units* drop-down.
7. Click **OK** to exit the *Select Projection* dialog.
8. Click **OK** to exit the *Projection* dialog.
9. Click **OK** at the prompt that explains that a projection file will be created.

A new PRJ file named "q233914.prj" is created in the same directory as the "q233914.tif" file. Any time this TIFF file is imported into SMS (or any GIS application) the PRJ file will also be imported and the image will be georeferenced.

Any time the projection is set on an image, shapefile, CAD file, or raster in SMS, a new PRJ file will be created to accompany the image file and any existing PRJ file will be overwritten.

10. Move the mouse around the Graphics Window and notice the coordinates are the same as before.

When data which includes a PRJ file is imported SMS, it will set the display projection to match the information in the PRJ file. The display projection can be changed to any supported projection, though some projections are not compatible. For example, data in State Plane, Massachusetts Mainland will not display in the Philippines Grid.

## 3.2 Setting Transparency

The transparency of the image must now be changed so that the other data brought into the project will be easier to see.

To do this:

1. Right-click on "  q233814.tif" and select **Transparency…** to bring up the *Layer Transparency* dialog.
2. Use the slider to set *Transparency* to "60%".
3. Click **OK** to exit the *Layer Transparency* dialog.

The project should appear similar to Figure 1.

 

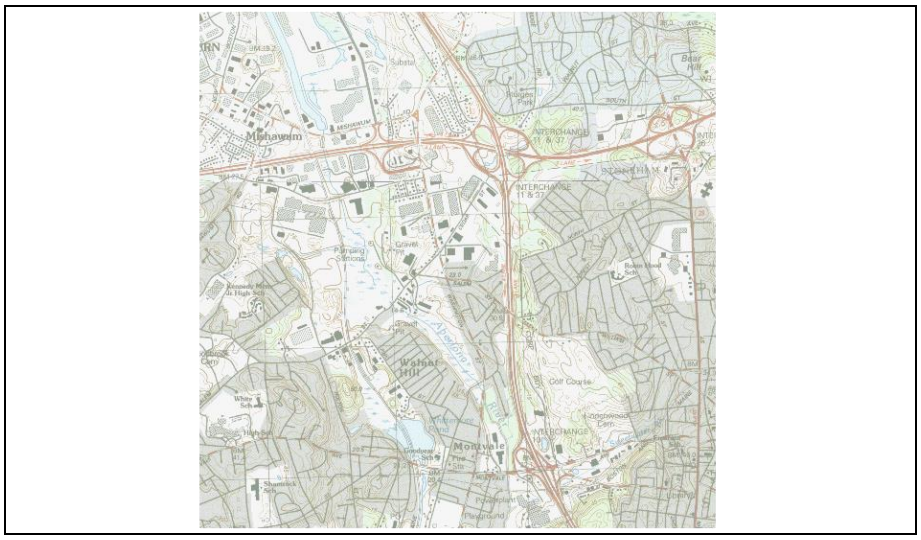

*Figure 1 Map image with 60% transparency applied*

# 4 Importing a CAD File

To import a CAD file with the roads in the study area, do the following:

1. Click **Open** to bring up the *Open* dialog.
2. Select "AutoCAD Files (*.dwg, *.dxf)" from the *Files of type* drop-down.
3. Select "roads.dwg" and click **Open** to import the file and close the *Open* dialog.
4. If the CAD data is not visible, turn off " GIS Data", **Frame** the project, then turn on " GIS Data".

The Graphics Window should appear similar to Figure 2.

*Figure 2 Imported CAD data*

Notice that the background image has disappeared. By moving the mouse around in the Graphics Window, the displayed coordinates vary from (-71.15, 42.46) to (-71.09, 42.52), and the latitude/longitude values have changed.

Because there was no PRJ file associated with this CAD file, the data is drawn at the coordinates specified in the file. A projection for the CAD data must be specified so that it will be drawn in the correct location. This particular file has coordinates in latitude/longitude.

To set the projection:

1. Right-click on "roads.dwg" and select *Projection* | **Projection…** to bring up the *Object Projection* dialog.
2. In the *Horizontal* section, select *Global projection* and click **Set Projection…** to bring up the *Select Projection* dialog.
3. Select "Geographic (Latitude/Longitude)" from the *Projection* drop-down.
4. Select "NAD83" from the *Datum* drop-down.
5. Select "ARC DEGREES" from the *Planar Units* drop-down.
6. Click **OK** to exit the *Select Projection* dialog.
7. Click **OK** to exit the *Object Projection* dialog.
8. Click **OK** at the prompt that explains that a projection file will be created.
9. **Frame** the project.

The map image should now be visible behind the CAD data (Figure 3). Even though the CAD data is in a different projection from the display projection, it is positioned in the correct location. The CAD data is "projected on the fly", which involves transforming the coordinates of the CAD data from latitude and longitude to State Plane meters.

Items with a projection different from the display projection are "projected on the fly" so that they are positioned correctly.

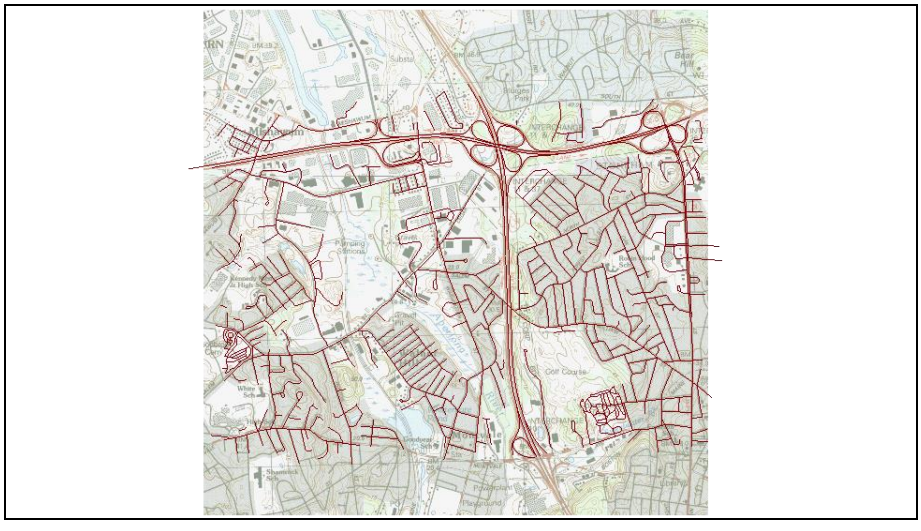

*Figure 3 CAD correctly positioned after specifying the projection*

If the CAD file had initially had an associated PRJ file, then the data would have already been correctly positioned in the current display projection.

# 5 Importing a Shapefile

A shapefile of the Aberjona River will now be imported. This shapefile uses a different projection than the display projection.

To import the shapefile:

1. Click **Open** to bring up the *Open* dialog.
2. Select "AberjonaRiver_Clip.shp" and click **Open** to import the file and close the *Open* dialog.

The Graphics Window should appear similar to Figure 4.

*Figure 4 Aberjona River shapefile overlaying the map image and CAD data*

3. Right-click on "AberjonaRiver_Clip.shp" in the Project Explorer and select **Set Layer Projection…** to bring up the *Projection* dialog.
4. Note the projection is "UTM, Zone: 18 (78°W - 72°W - Northern Hemisphere), NAD83, feet", which was imported from the PRJ file associated with the shapefile. This allowed SMS to place the shapefile in the correct location.
5. Select **Cancel** to exit the *Projection* dialog.

If a file is imported into SMS and has an associated PRJ file, the projection is imported with the file.

# 6 Importing Elevation Data

Next, import surface elevations into the project from a text file by doing the following:

1. Click **Open** to bring up the *Open* dialog.
2. Select "elev.txt" and click **Open** to exit the *Open* dialog and bring up the *Open File Format* dialog.
3. Select *Use Import Wizard* and click **OK** to exit the *Open File Format* dialog and open the *Step 1 of 2* page of the *Text Import Wizard* dialog.
4. Below the *File import options* section, turn on *Heading row*.
5. Click **Next** to go to the *Step 2 of 2* page of the *Text Import Wizard* dialog.
6. Click **Finish** to close the *Text Import Wizard* dialog.
7. **Frame** the project.

The background image and the CAD data will disappear and a small square should be visible near the top of the Graphics Window. As with the CAD data, the elevation data is in a different projection than the display projection.

To set the projection to make the scatter set display correctly, do the following:

1. Right-click on "elev" in the Project Explorer and select **Projection…** to bring up the *Object Projection* dialog.
2. In the *Horizontal* section, select *Global projection* and click on **Set Projection…** to bring up the *Select Projection* dialog.
3. Click **Load From File…** to bring up the *Open* dialog.
4. Browse to the *Data Files* directory for this tutorial and select "elev.prj".
5. Click **Open** to exit the *Open* dialog.
6. Click **OK** to close the *Select Projection* dialog.
7. Click **OK** to close the *Projection* dialog.
8. Select "elev" to make it active.
9. **Frame** the project.
10. Click **Display Options** to bring up the *Display Options* dialog.
11. Select "Scatter" from the list on the left.
12. On the *Scatter* tab, click on the color selector button to the left of *Points* to bring up the *Symbol Attributes* dialog.
13. Enter "2" as the *Size* and click **OK** to close the *Symbol Attributes* dialog.
14. Click **OK** to close the *Display Options* dialog.

The Graphics Window should appear similar to Figure 5.

 

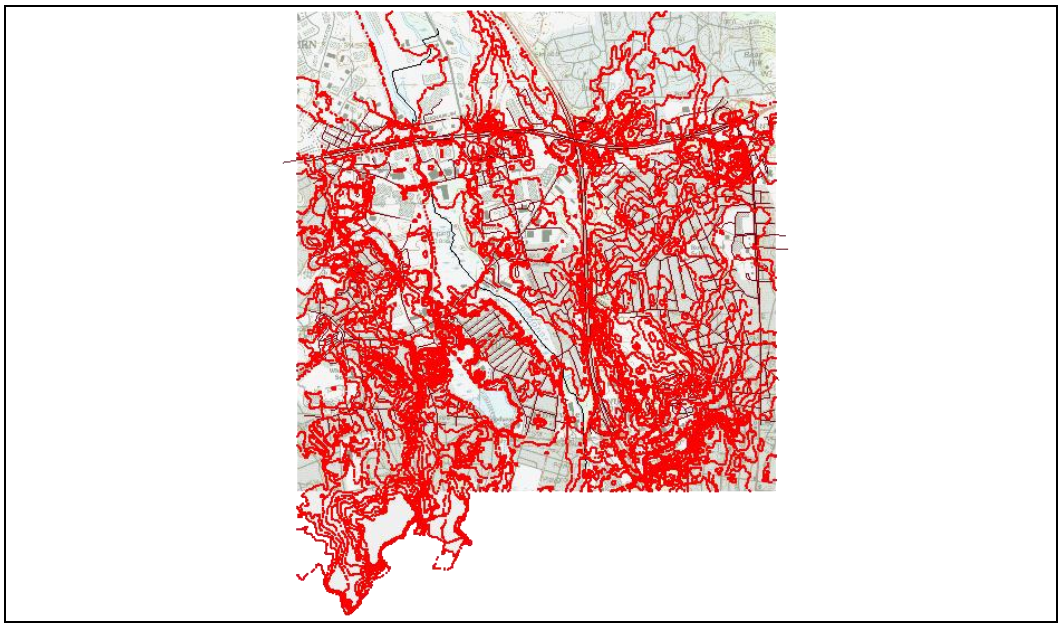

*Figure 5 Imported elevation data*

## 6.1 Editing the Scatter Points

The elevations that are in the project can be edited as follows:

1. Select "elev" in the Project Explorer to make it active.
2. Using the **Select Scatter Point** tool, select one of the scatter points in the Graphics Window by clicking on it.
3. Press the *Delete* key to delete the selected point.

A prompt appears that explains that the projection of the "elev" scatter set does not match the display projection. In order to edit the points, the scatter set's projection must be the same as the display projection.

4. Click **Yes**.

SMS may take a few moments to change the display projection.

5. **Frame** the project.
6. Press the *Delete* key again to delete the selected point.
7. When asked to confirm deletion of the scatter vertex, click **Yes**.

An item in a project can be edited only if its projection matches the display projection.

# 7 Creating a Coverage

A coverage can be created by doing the following:

1. Right-click on "Map Data" in the Project Explorer and select **New Coverage…** to bring up the *New Setup* dialog.
2. Select *Generic* | **Mesh Generator** as the *Coverage Type* and click **OK** to exit the *Coverage Setup* dialog.
3. Right-click on "Mesh Generator" and select **Projection…** to bring up the *Object Projection* dialog.
4. Notice that the projection for this coverage is the same as the display projection. Click **OK** to exit the *Object Projection* dialog.

When a new item is created in a SMS project, the projection of the new item will be set to match the display projection.

# 8 Conclusion

This concludes the "Projections / Coordinates Systems" tutorial. The following key topics were discussed in this tutorial:

- SMS supports many different projections.
- SMS has a user-defined display projection.
- An item's projection can be specified in SMS and a PRJ file will be created or overwritten.
- All georeferenced data in an SMS project is drawn in the display projection; this requires "projecting on the fly".
- To edit an item in a SMS project, the item's projection must match the display projection.
- Newly created items in a SMS project are assigned the display projection by default.