

The CEDRA Corporation's COMMAND OF THE MONTH

A monthly information bulletin

February 2006

FEATURED COMMAND
Mirroring and
Repeating Features



Application Description

Have you ever been working in ArcMap and had the need to copy a group of features, which always seem to be in different layers, and position the new features in a different location. Well, if you have, you are not alone. This task is very common and yet fairly cumbersome to do using native ArcMap functionality.

In addition, you may have also had the need to create a mirror image of a group of features. Again, a fairly involved task using native ArcMap functionality when the group consists of different feature types and data sources.

Furthermore, the task of copying a group of features sometimes requires the ability to scale and/or rotate the features during the copying process. As such, we refer to this task of copying and transforming features as “*repeating*”, rather than just copying.

Repeating features, as used in this issue of Command of the Month, is the operation of: (a) copying point, polyline, polygon and/or annotation features, from one or more data sources, and (b) applying, if needed, a scale and/or rotation transformation to create new features that can be stored in a new or existing shapefile, or geodatabase.

Mirroring features, like repeating features, involves the creation of new features by mirroring or reflecting existing point, polyline, polygon and/or annotation features about the X axis, Y axis or an arbitrary baseline.

Repeating and mirroring features are typical CAD functions which when incorporated in a GIS application help bring CAD and GIS closer together, which CEDRA users have come to expect from CEDRA software.

Command Of The Month bulletin

This month's issue discusses the methodology of mirroring and repeating point, polyline, polygon and/or annotation features with the ability of applying a transformation during the repeating processing.

The CEDRA Solution

To mirror or repeat a group of selected features, the user should employ the Transformation tool, which is located in the **CEDRA-Transform-Tools** toolbar (see Figure 1), and in the **CEDRA Tool Palette**, both of which are available in the CEDRA-AVcad software. The Transformation tool is the left tool in the toolbar, the one denoted by the “wiggly” line icon.

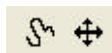


Figure 1
CEDRA-Transform-Tools Toolbar

CEDRA users probably are familiar with the Transformation tool and most likely are saying to themselves, “I never knew this command could perform these types of tasks”. Well the fact of the matter is,

the Transformation tool, until recently, could not Mirror and Repeat features.

This capability has recently been added, and at this point it is available only for ArcGIS users. The ArcView GIS implementation is currently being evaluated.

As CEDRA users are aware, the Transformation tool possesses a great deal of functionality. However, at this time we will be discussing only the mirroring and repeating functionality provided by this tool.

Repeating Features

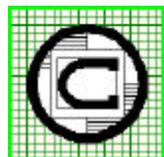
The process of Repeating features can be described as follows:

1. Set the Current Working Directory and Active Layer

In repeating one or more features, the user may face one of the three scenarios presented below. If the feature(s) to be repeated are to be placed:

- In the current active layer, the user should then proceed to Step 3 below.
- In an existing layer, but not in the current active layer, the user should then proceed to Step 2 below.
- In a new layer, rather than in an existing layer, the user should continue with this step as indicated below.

Use the [Set Working Directory] command within the {CEDRA Commands} combo-



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box (see Figure 2) to verify that the current working directory is set appropriately.

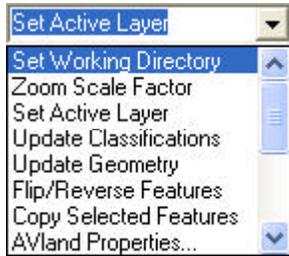


Figure 2
CEDRA Commands Combo-Box

Upon selection of the [Set Working Directory] command, a file navigation dialog box similar to that shown in Figure 3 is displayed. Double-click at the appropriate directory to display it in the top-most data field (the one to the left of the OK button), and then click the OK button to confirm the setting of the current working directory.

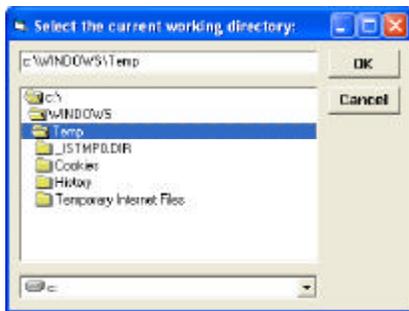


Figure 3
Set Working Directory Dialog Box

2. Set the Active Layer

In repeating features, the user has the option of storing the new features that are created in either an existing layer, or in a new layer. To set the appropriate layer, or the active layer as it is referred to, the user can activate the [Set Active Layer] command within the {CEDRA Commands} combo-box (see Figure 2).

Upon selection of the [Set Active Layer] command, a dialog box similar to that shown in Figure 4 is displayed.

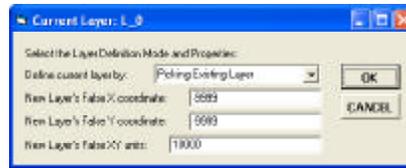


Figure 4
Set Active Layer Dialog Box

If an *existing layer* is to be selected, the user should:

- Accept the default Picking Existing Layer option;
- Click at the OK button to display a list of all of the visible feature layers;
- Click at the appropriate layer in said list, and then
- Click at the OK button.



Figure 5
Layer Definition Choice List

If a *new layer* is to be established, the user should:

- Scroll down in the top data field of Figure 4 and select the Entering New Layer Name option (see Figure 5).
- If the layer to be created is to be:
 - (a) a geodatabase, the user will need to enter the appropriate False X, False Y and False XY Units values in the appropriate three data fields of Figure 4.
 - (b) A shapefile, the user should accept the defaults in the above said three data fields.
- Click at the OK button to display the input dialog box of Figure 6.
- Enter the name of the new layer to be created, and then
- Click the OK button.



Figure 6
Entering New Layer Name Input Box

The reader is referred to the May issue of Command of the Month for detail information describing the False X, False Y and False XY Units parameters. However, summarizing, the False X and False Y values pertain to the coordinates of the low left corner of a rectangle which encloses the points being imported. These values should be such that no data will fall below or to the left of this point.

The False XY units value controls the number of digits to the right of the decimal point that are stored in the PGD for coordinate values. An adequate value for the False XY units parameter would be 10000, which indicates 4 digits to the right of the decimal point will be stored, while a value of 1000 indicates 3 digits. This parameter also controls the upper right corner coordinates of the PGD's extent. A value of 10000 for the False XY units parameter denotes that the upper right corner coordinates of the PGD's extent can be computed by adding 214,748.3647 to each of the False X and Y coordinate values (for a 32 bit computer).

3. Select the Features

With the current working directory and active layer set, the features to be repeated can now be selected. As stated at the beginning of this bulletin, the user is able to repeat point, polyline, polygon and/or annotation features. Any combination of the above mentioned features types can be processed.

In selecting the features, the user can use: (a) native ArcMap functionality, or (b) the Select Features tool, , in the **CEDRA-ArcView3-Tools** toolbar shown in Figure 7.



Figure 7
CEDRA-ArcView3-Tools Toolbar

Depending upon user preference either method can be employed, although using the Select Features tool in the CEDRA-ArcView3-Tools toolbar provides a more straightforward approach in selecting features. In using the Select Features tool , the user:

- selects the [Select Features] tool,
- activates the layer(s) in the Table of Contents containing the features to be selected, and then
- picks a feature, or defines a rectangle that encloses or intersects the feature(s) to be selected.

To add features to the selection set, the user can hold down the keyboard Ctrl key, and then pick at a specific feature or define a rectangle as described above.

4. Identify the Control Points

It was stated at the beginning that the user has the ability to repeat a feature or group of features, and (a) position the repeated feature(s) at a specified location, and/or (b) rotate them along a specified baseline direction. The positioning of the repeated feature(s) is defined by a “control point“, a “new location” and a “baseline direction”.

Figure 8 displays an example of features that have been repeated. Figure 8(a) contains the features that were selected for repetition, while Figure 8(b) contains the repeated features. Note that both sets of features are located in the same map document, with the *Baseline Point 2* being a certain distance above the *Baseline Point 1*. *Baseline Point 1* denotes the “control point” of the features selected for repetition, while *Baseline Point 2* represents the “new location” of *Baseline Point 1*. The control point could be any desired point.

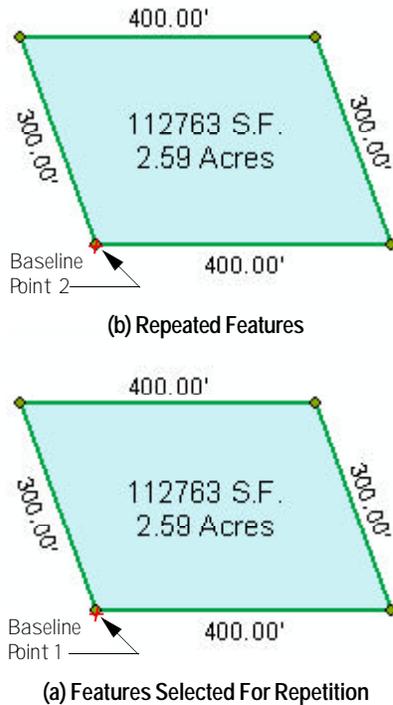


Figure 8
Baseline Points for Repeating

The “baseline direction” is defined as an imaginary line from Baseline Point 1 to Baseline Point 2. This direction is used by the command when generating multiple copies.

If the user does not wish to apply a rotation or wishes to explicitly enter a rotation angle, the user should proceed with the steps described below. However, if the user wishes to define baselines in order to have the rotation angle computed, the user should proceed to Step 5 and forego the steps described below.

There are two ways of defining the “control point“ and “new location” points:

- (a) By use of certain options, to be identified below, of the Transformation  tool, or
- (b) By entering coordinate values in the dialog box posed by the repeat command. This method requires

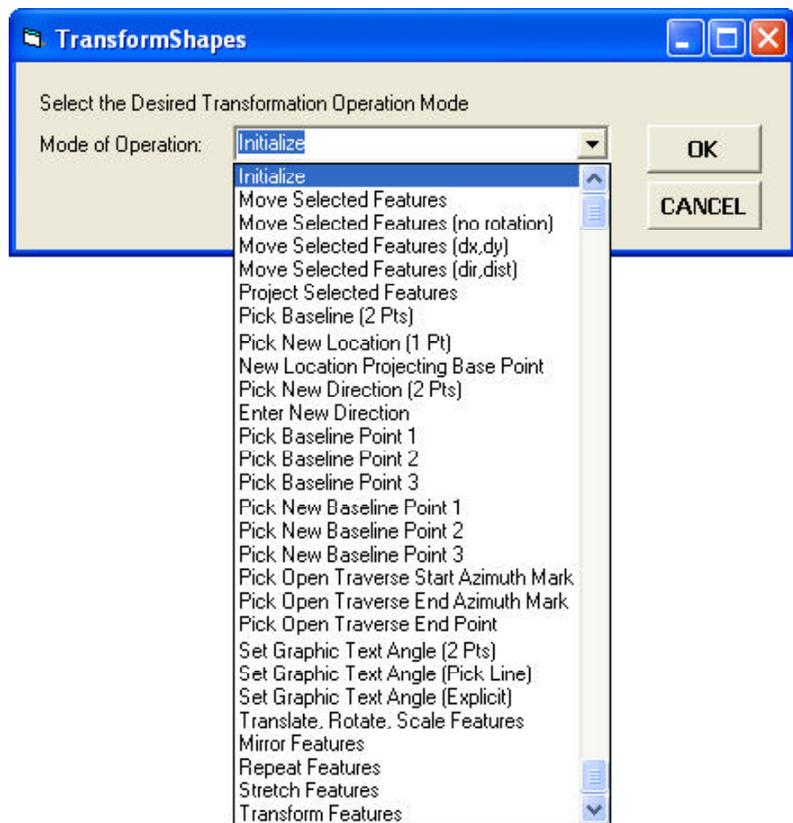


Figure 9
Available Options using the Transformation Tool

the knowledge of the coordinates of the “control point” and “new location” points.

To define the “control point” as per option (a) above, the user should:

- Click at the Transformation  tool to display the choice box of Figure 9;
- Scroll down and select the Pick Baseline Point 1 option;
- Click at the OK button, and then
- Click at the desired location in the map document to define the “control point”.

To define the “new location” of the control point of the repeated features (Baseline Point 2 in Figure 8), the user should:

- Click at the Transformation  tool to display the choice box of Figure 9;
- Scroll down and select the Pick Baseline Point 2 option;
- Click at the OK button, and then
- Click at the desired location in the map document to define the “new location” of the control point (Baseline Point 2).

The user should now proceed to Step 7. Steps 5 and 6 pertain to the case when the user wishes to define baselines in order to have the rotation angle computed by the command.

5. Identify the Baseline Points

When the rotation angle is to be computed by the command, the user will need to define the baseline of the selected feature(s) and that of the repeated feature(s). The rotation angle is then computed by taking the difference between these two baseline directions.

The baseline of the selected feature(s) is defined as an implied line commencing at Baseline Point 1 (see Figure 8), which terminates at another point, while the baseline of the repeated feature(s) commences at Baseline Point 2 (see Figure 8), and likewise, terminates at another point. As such four “picks” in the map document area are required.

To define the baselines, the user can:

- Click at the Transformation  tool to display the choice box of Figure 9;
- Scroll down and select the Pick Baseline Point 1 option;
- Click at the OK button, and then
- Click at the desired location in the map document to define the “control point” (Baseline Point 1).
- Click at the Transformation  tool to display the choice box of Figure 9;
- Scroll down and select the Pick Baseline Point 2 option;
- Click at the OK button, and then
- Click at the desired location in the map document to define the end point of the baseline of the selected feature(s).
- Click at the Transformation  tool to display the choice box of Figure 9;
- Scroll down and select the Pick New Baseline Point 1 option;
- Click at the OK button, and then
- Click at the desired location in the map document to define the “new location” of the control point (Baseline Point 2).
- Click at the Transformation  tool to display the choice box of Figure 9;

- Scroll down and select the Pick New Baseline Point 2 option;
- Click at the OK button, and then
- Click at the desired location in the map document to define the end point of the baseline of the repeated feature(s).

6. Shortcut To Baseline Definition

Presented below is a set of steps that simplifies Step 5. Note that this shortcut method can be used only if the baseline points lie within the current extent of the view.

- Click at the Transformation  tool to display the choice box of Figure 9.
- Scroll down and select the Pick Baseline Point 1 option.
- Click at the OK button.
- Click at the desired location in the map document to define the “control point” (start of the baseline or Baseline Point 1) of the selected feature(s).
- Click at the desired location in the map document to define the end point of the baseline of the selected feature(s).
- Repeat the above by clicking at the identical point a second time.
- Click at the desired location in the map document to define the “new location” (Baseline Point 2) of the repeated feature(s).
- Click at the desired location in the map document to define the end point of the baseline of the repeated feature(s).

7. Repeating The Selected Feature(s)

The user is now able to perform the Repeat operation. To do so, the user should:

- Select the Transformation  tool.
- Scroll down and select the Repeat Features option to display the dialog box of Figure 10.

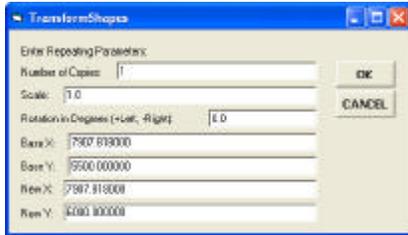


Figure 10
Parameters for Repeating

- Enter the appropriate values in the seven data fields of said dialog box. In doing so, note the following:
 - (a) In the *Number of Copies* data field enter the desired number of copies. More about this a bit further below.
 - (b) In the *Scale* data field enter the desired scale factor (not in percent form). A value of 0.50 halves the original size, while a scale of 2 doubles it.
 - (c) If a baseline was not previously defined, the default in the *Rotation in Degrees (+ Left; - Right)* data field will be zero. If a baseline was defined, the default angle will be the angle between the baseline of the selected feature(s) and that of the repeated feature(s). At this time, the user has the ability to change this angle, if so desired. In entering an angle of rotation, note that a positive angle denotes a counterclockwise rotation (Cartesian), while a negative angle denotes a clockwise rotation.
 - (d) If the user had previously defined a control point or a baseline, the default values for the *Base X*, *Base Y*, *New X* and *New Y* data fields will reflect

corresponding coordinate values. If not,

- (i) the default values for the *Base X* and *Base Y* data fields will reflect the coordinates of the low left corner of the selected feature(s), and
- (ii) the default values for the *New X* and *New Y* data fields will be zero (0.0).

- Click the OK button to begin the repeating of features process or the Cancel button to abort the command.

It is noted that the user may branch into this step at any time after the feature(s) to be repeated have been selected, and specify any missing parameters as indicated above.

As the new features are created during the Repeating process, a progress bar is displayed informing the user as to the status of the operation. Once the operation is complete, the command will display in the status bar area the number of features that were processed.

Should the user not be pleased with the results of the repeat operation, the {Edit} [Undo Repeat] command can be selected to undo the generation of the new features.

8. Comments On Multiple Copies

If the user desires to make a single copy of the selected features, then the user should enter 1 in the *Number of Copies* data field of the Figure 10 dialog box. However, if more than one copy is desired, then the appropriate value should be entered.

In generating multiple copies, the command uses the “baseline direction”, that is, the imaginary line from Baseline Point 1 to Baseline Point 2 (see Figure 8). Two examples are used for demonstration.

The ability to generate multiple copies is very useful when creating an index

grid comprised of adjacent polygons. In the example of Figure 11 a single polygon was created (the one labeled Original Polygon in the low left corner of Figure 11). The repetition process was performed as follows:

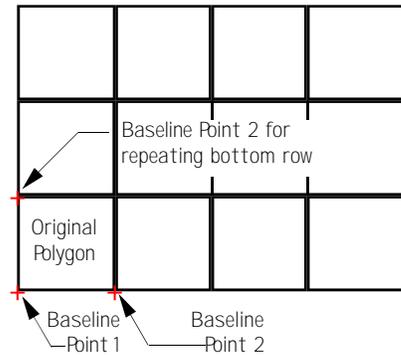


Figure 11
Example #1 of Multiple Copies

- The Original Polygon was selected for repetition.
- Its low left corner was selected as the control point (Baseline Point 1).
- Its low right corner was selected as the new location of the control point (Baseline Point 2).
- The Transformation  tool was invoked, and 3 was entered in the *Number of Copies* data field of the dialog box of Figure 10.

This resulted in the creation of the bottom row of polygons in Figure 11. Next:

- The bottom row of four polygons was selected for repetition.
- Its low left corner was selected as the control point (Baseline Point 1).
- Its upper left corner was selected as the new location of the control point (Baseline Point 2).
- The Transformation  tool was invoked, and 2 was entered in the *Number of Copies* data field of the dialog box of Figure 10.

This resulted in the creation of all polygons in Figure 11.

The red plus signs in Figure 11 denote the baseline points used in the repetition process. Thus, when the original polygon was repeated along the X axis, the low left corner of the original polygon was used as the Baseline Point 1, while the low right corner of said polygon acted as Baseline Point 2. In so doing, all of the polygons along the bottom row share a common side.

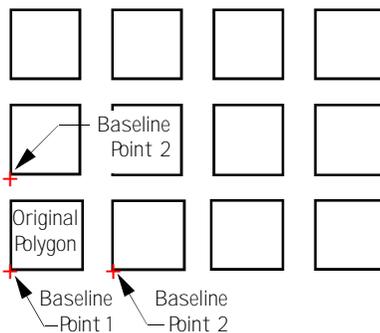


Figure 12
Example #2 of Multiple Copies

As another example consider the modification of Figure 11 as shown in Figure 12. The process of producing the result of Figure 12 is the same as that of the previous example with the exception of establishing Baseline Point 2. If the space between the features:

- **Is known**, then its coordinates may be entered in the New X and/or New Y data fields of the dialog box of Figure 10.
- **Is not known**, then a point must be established at the desired location of Baseline Point 2 prior to initiating the repetition process, and the definition of Baseline Point 2.

It is noted that if the repetition of the original polygon of Figure 12 was to be repeated along an angle, the process would have been identical. The position of the Baseline Point 2 would have dictated the orientation and positioning of the repeated features.

Mirroring Features

The process of Mirroring features is very similar to that of Repeating features. That is, the user: (a) selects the features to be mirrored, (b) defines the baseline points, (c) invokes the Transformation tool, (d) selects the Mirror Features option (see Figure 9), and (e) enters the appropriate Mirroring data.

When mirroring features, the user creates a single copy of the selected features, which are stored in the current active layer. Features can be mirrored about the X axis, Y axis or an arbitrary baseline.

The baseline points defined by the user in the mirroring operation should reflect the axis about which the mirroring is to be performed. For example, Figure 13 illustrates the sample baseline points used to mirror features about the Y axis. Figure 14 illustrates mirroring about the X axis, while Figure 15 illustrates mirroring about an arbitrary baseline.

Note that in each of the above cases, the normal distance from the original feature's extremity nearest to the axis of mirroring will be the same as the normal distance from the axis of mirroring to the nearest extremity of the mirrored image.

The process of Mirroring features can be described as follows:

1. Set the Working Directory

This step is identical to what was described before for repeating features.

2. Set the Active Layer

This step is identical to what was described before for repeating features.

3. Selecting the Features

This step is identical to what was described before for repeating features.

4. Identify the Baseline Points

Having selected the features to be processed, the Transformation tool can now be activated. In Mirroring features, the Transformation tool uses two baseline points, Baseline Point 1 and Baseline Point 2. These points, as stated above, are used to reflect the axis about which the mirroring is to be performed.

In addition to this, they also control the positioning of the new features. From Figures 13, 14 and 15, the reader can see that the baseline points are used to control the offset of the new features from the features which are mirrored. Note that the baseline points can appear at any location within the map.

Note, when mirroring about the X or Y axis it is not necessary to define the second baseline point (Baseline Point 2). Only the first baseline point (Baseline Point 1) needs to be defined. However, if the mirroring is to be performed about an inclined baseline (see Figure 15), then both baseline points need to be defined.

To pick the baseline points, the user should:

- Select the Transformation tool,
- Select the Pick Baseline Point 1 option, and then
- Make a pick in the map to identify the Baseline Point 1 location.

If the mirroring is to be performed about the X or Y axis, the user can proceed to Step 5. If the mirroring is to be performed about a baseline and the second baseline point is within the current view extent, the user should:

- make a pick in the map to identify the Baseline Point 2 location and then proceed to Step 7.

If the second baseline point is not within the current view extent, the user should:

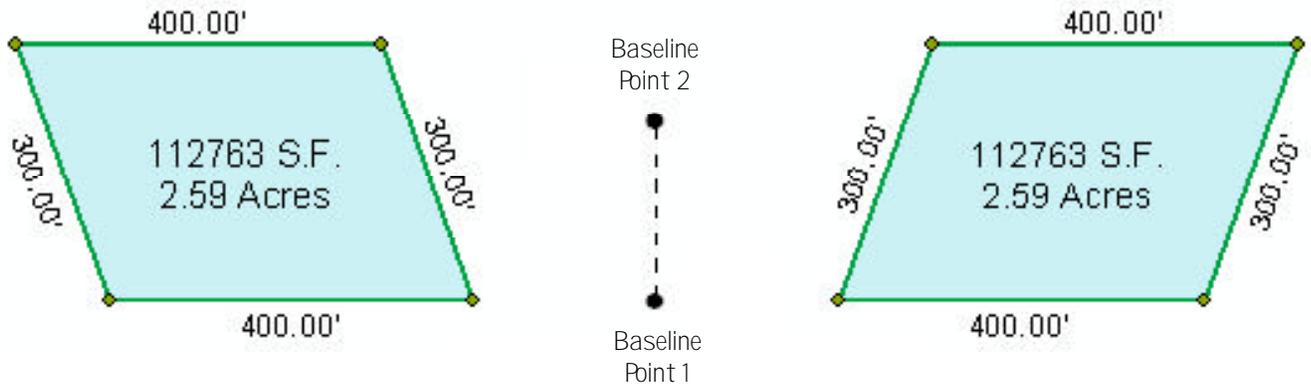


Figure 13 - Features Mirrored about the Y axis

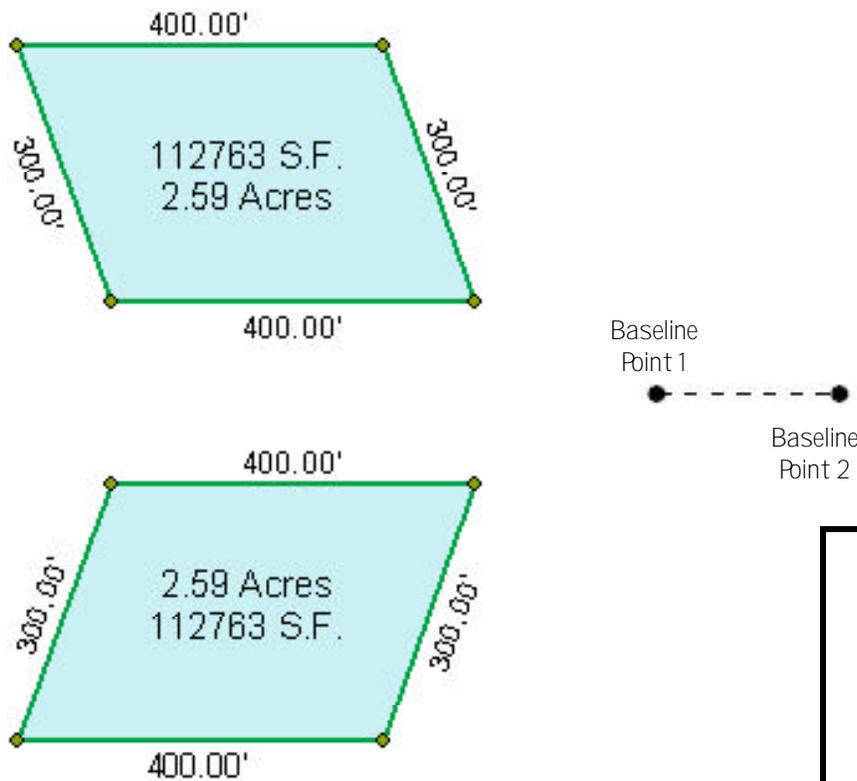


Figure 14 - Features Mirrored about the X axis

The three figures shown on this page illustrate the various axes about which features can be mirrored. Note that the location of the baseline points will control the offset of the new features from the features which are to be mirrored. The baseline points can appear anywhere in the map.

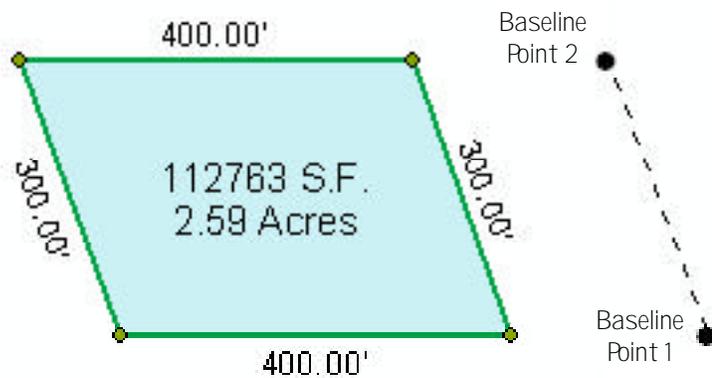


Figure 15
Features Mirrored about a Baseline

- Change the view extent to display the second baseline point location,
- Select the Transformation  tool,
- Select the Pick Baseline Point 2 option, and then
- Make a pick in the map to identify the Baseline Point 2 location.

5. Specifying the Mirroring Parameters

Once the baseline points have been identified, the user is able to perform the Mirror operation. To do so, the user should:

- Select the Transformation  tool,
- Select the Mirror Features option,
- Enter the appropriate values in the dialog box that is displayed, see Figure 16, and then



Figure 16
Parameters for Mirroring

- Click the OK button to begin the mirroring of features process or the Cancel button to abort the command.

Using this dialog box the user is able to specify:

- The axis in which the mirroring is to be performed about,
- The baseline point 1 coordinates, and
- The baseline point 2 coordinates.

As the new features are created during the Mirroring process, a progress bar

is displayed informing the user as to the status of the operation. Once the operation is complete, the command displays in the status bar area the number of features that were processed.

Creating a Personal Geodatabase

When a new layer is to be created to contain the new features that are to be generated as a result of the repeat or mirror operation, the user has the option of storing the new features in a shapefile, or in a personal geodatabase (PGD).

Note that all annotation features to be created by the Mirror Features or Repeat Features options (see Figure 9), and which are to be stored in a new layer, are stored in a personal geodatabase. As such, if the group of features being mirrored or repeated include annotation features and a new layer is to be created, it is recommended that the user store all of the new features in a personal geodatabase.

When creating a new layer, the default file type is a shapefile. However, the user can specify a personal geodatabase by selecting the Personal Geodatabases option from the *Save as type:* drop-down list, see Figure 17.

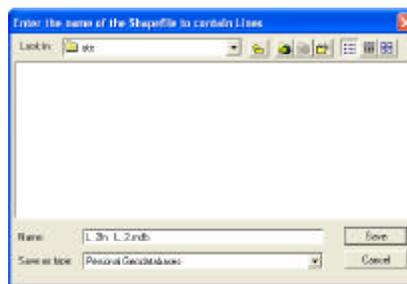


Figure 17
Specifying a FeatureClass in a PGD

In addition to changing the file type, the user needs to specify the name of the FeatureClass, and the name of the personal geodatabase to be created. Shown in Figure 17 in the *Name:* data field is the text: *L_2In L_2.mdb*.

The first item *L_2In* denotes the name of the FeatureClass to be created. This name, *L_2In*, will appear in the Table of Contents. The second item, *L_2.mdb*, is the name of the personal geodatabase that will be created.

In the case in which two items appear in the *Name:* data field, the name of the dataset that is to be created in the personal geodatabase will be identical to the name of the FeatureClass.

Note that, all personal geodatabases contain datasets, and within each dataset there are various FeatureClasses. When the name of the dataset is omitted, the name of the dataset will be identical to the name of the FeatureClass that is entered.

If the user wishes to explicitly enter the name of the dataset, three items need to appear in the *Name:* data field (see Figure 18). In this case, the user enters:

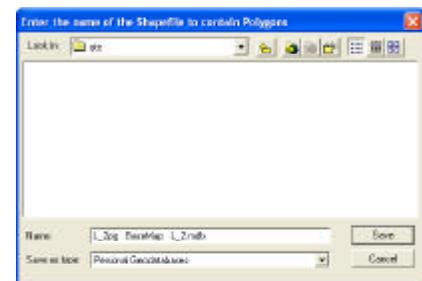


Figure 18
Specifying a Dataset in a PGD

- The name of the FeatureClass,
- The name of the Dataset, and then
- The name of the personal geodatabase with at least one space or blank character separating each item.

Note that a Dataset can contain different feature types. That is, a Dataset does not have to contain only one type of feature, but rather, it can contain multiple feature types. In Figure 18, the name of the Dataset is called *BaseMap*,

and within *BaseMap* there will be a FeatureClass called *L_2ln*.

In both cases (where two or three items appear in the *Name:* data field), at least one blank character or space must separate the items in the *Name:* data field.

If the user enters the name of an existing personal geodatabase, the command will pose a query similar to that shown in Figure 19.



Figure 19
Existing PGD Query

In this case, the user can:

- Overwrite or replace the existing personal geodatabase by clicking the Yes button,
- Add the FeatureClass to the personal geodatabase by clicking the No button, or
- Abort the command by clicking the Cancel button.

For example, in Figure 17 the *Name:* data field contained the text *L_2ln L_2.mdb*, which indicates that a FeatureClass called *L_2ln* is to appear in the *L_2.mdb* personal geodatabase.

If the user wished to add a FeatureClass called *L_2pg* to the *L_2.mdb* personal geodatabase, the user could:

- Enter the text *L_2pg L_2.mdb* in the *Name:* data field,
- Click the Save button and then
- Click the No button in response to the query shown in Figure 18.

In so doing, the software would append or add the *L_2pg* FeatureClass to the *L_2.mdb* personal geodatabase. Note

that a new dataset called *L_2pg* would also be added to the *L_2.mdb* PGD.

Thus, the process of adding data to an existing PGD is to specify the name of the existing PGD, and to click the No button when the query of Figure 18 appears.

Special Notes

As stated at the very beginning of this bulletin, the Transformation tool is located in the **CEDRA-Transform-Tools** toolbar (see Figure 1), and in the **CEDRA Tool Palette**. The “wiggly” line icon appears in both locations.

Note that when selecting this tool in the **CEDRA Tool Palette**, the command is activated every time the icon in the **CEDRA Tool Palette** is selected. However, when the tool is selected from the toolbar, the command remains active until another command is selected. That is to say, once a tool in a toolbar has been selected, it stays selected. So that, if the user wishes to re-select the tool, after the tool has already been selected, the user will need to select another tool prior to selecting the Transformation tool.

Summary

As stated in the beginning of this bulletin, the ability to Repeat and Mirror features in ArcMap takes the integration of CAD and GIS one step further. As such, the ability to utilize GIS in other types of applications increases.

If you have a request for Command Of The Month, feel free to phone, fax or e-mail your request to The CEDRA Corporation.