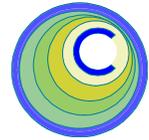


The CEDRA Corporation's COMMAND OF THE MONTH

A monthly information bulletin

February 2011

FEATURED COMMAND
Unioning and
Buffering Features



Application Description

Many of us have come across the application of having to union individual features to form a new single feature. For example, there are a group of polygons that we wish merge into one overall polygon. This is called a union operation.

Additionally, the application of creating a polygon about the perimeter of a feature or group of features arises. This is called a buffer operation. Furthermore, rather than creating a polygon feature, the user may wish to create a polyline feature.

Now wouldn't it be nice to be able to do all of the above in a single operation.

The CEDRA Solution

To address the application described above, the [Union and Buffer] command within the {CEDRA-Polygon-Tools} toolbar, shown in Figure 1, can be used. This command enables the user to union features and create a buffer about the resultant feature in a single operation.

Union and Buffer Overview

The [Union and Buffer] command can operate in a simple and advanced mode providing the user the ability to:

- select one or more point features and create a buffer zone about each selected point,
- select one or more polygon features and create a buffer zone about all selected polygon features,

- select one or more point/polyline/polygon features to create a single multipart feature, and
- select one or more polyline features and create a single overall polyline.

Under items a and b above, the product of this command is a buffer zone polygon. Under item c, the product is a single multipart point, polyline or polygon feature, while under item d, the result is a single polyline feature representing the selected features in series.

Additionally, in using this command, the user is able to create parallel or offset lines, or concentric curves, which are line, polyline or curve type features.

Command Of The Month bulletin

This month's issue discusses how to create buffer polygons for a set of selected features, be they point, polyline or polygon features.

Once the unioned feature has been created, the user is provided the opportunity to: (a) delete the original features that helped define the resultant feature, and (b) select which attributes are to be assigned to the resultant feature. The new feature(s) that are created are assigned to the current active layer.

In selecting features, point, polyline and polygon features should not be selected concurrently with each other, nor with any other feature types. If so selected, a displayed dialog box will prompt the user as to which feature type is to be



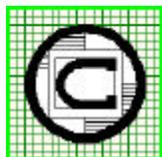
Figure 1
CEDRA-Polygon-Tools Toolbar

processed. However, line, polyline and curve features may be selected concurrently and processed as such (since they are all polyline features in actuality).

Union and Buffer Operation

To use this menu command, the user should:

- 1** Scroll down in the **Table of Contents area**, and **select the layer(s)** that contain the point, line, polyline, curve or polygon features to form the basis for the creation of the new feature(s).
- 2** **Select** with the  *Select Features from Active Layers* tool the **features** to be processed. Reference is made to the introductory comments above regarding the processing of different types of features concurrently.
- 3** **Scroll** down in the {CEDRA-Polygon-Tools} menu combo box, and **select the [Union and Buffer]** menu command (see Figure 1) to dis-



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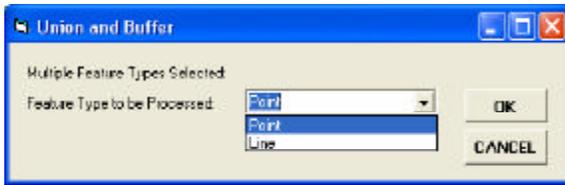


Figure 2
Multiple Feature Type Selection Query

play the following, depending on what features have been selected:

- a. *If no features have been selected* - A warning message is displayed informing the user of the fact. In this case, the user should click at the **OK** button to acknowledge the message, close the message box, and repeat the command from its beginning.
- b. *If features of different type have been selected* - The choice list dialog box of Figure 2 is displayed prompting the user to select which one of the selected feature types is to be processed. In this case, the user should scroll down in the *Feature Type to be Processed*: data field: (a) select the one single feature type to be processed, and then (b) click at the **Cancel** button to abort the command, or click at the **OK** button to confirm the feature type selection.

1. Mode of Operation

Once the features to be unioned are selected and the command has determined the feature type to be processed, the command prompts the user as to the desired mode of operation. Shown in Figure 3 is the choice list dialog box identifying the available modes of operation.

As can be seen there are two available modes of operation: simple and advanced.

The **simple** mode of operation is similar to the ArcMap Union command with the exception that the user is able to specify an attribute value, if desired, that the unioning is to be based upon. That is to say, the user can union features based upon unique attribute values. Additionally, a single multi-input dialog box is displayed from which the user specifies the various unioning parameters.

The **advanced** mode of operation performs additional processing when unioning features. Particularly in the case of unioning polyline features where the command under this mode of operation will try to merge the individual polyline features so that there are no gaps between the individual polylines. In essence, the command assumes the polylines are in series even though the polylines may not have been created sequentially.

Furthermore, the user is able to create parallel or offset lines, or concentric curves, which are line, polyline or curve type features. When processing point features, the command rather than creating a multipart point feature will create polygons about the selected point features. If a multipart point feature is desired the simple mode of operation should be selected.

- **4** Scroll down in the *Item List*: data field, and **select** the desired mode of operation.
- **5** Click at either the **OK** button, or at the **Cancel** button to abort the command.



Figure 3
Unioning Mode of Operation

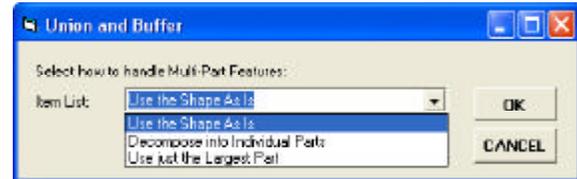


Figure 4
Multi-Part Feature Processing Mode

2. Advanced Union Mode

Under the advanced mode of operation, the command will scan the features to be processed for multipart features, as well as for point features.

- a. *If a multipart feature has been selected* The choice list dialog box of Figure 4 is displayed for the user to select how to process the selected feature or features. In this case, the user should scroll down in the *Item List*: data field,
 - (a) select the desired option,
 - (b) click at the **Cancel** button to abort the command, or click at the **OK** button to confirm the selection and then
 - (c) branch to the **Point Buffer**, **Polygon Buffer**, or to the **Line, Polyline and Curve Buffer** subsection below depending on the feature type that has been selected for processing.
- b. *If point features have been selected* The multi-input dialog box of Figure 5 is displayed. In this case, the user should branch to the **Point Buffer** subsection below.
- c. *If single part polyline and polygon features have been selected*

The multi-input dialog box of Figure 7 is displayed. In this case, branch to the **Polygon Buffer**, or to the **Line, Polyline and Curve Buffer** subsection below depending on the feature type that has been selected for processing.

Regarding the various data fields of the multi-input dialog boxes to be referenced in the subsections below, it is noted that if an invalid entry is made, a warning message is displayed, in which case click at the *OK* button to acknowledge the message, and display again the multi-input dialog box with the previously entered valid data intact. In this case make the appropriate corrections and continue.

2.1 Point Buffer

The steps described below are encountered when this command processes point features. To help describe the various data fields below, reference is made to the eight buffer zone cases presented in Figure 6.

- **6a** Enter in the *Enter the buffer ring width - ft (m)*: data field the:
 - **Width** of the buffer ring if it is to be square or rectangular in shape, or
 - **Radius** of the buffer ring if it is to be circular in shape.

Regarding the above step, reference is made to the commen-

tary in the step below for the *Center first ring (Y=yes, N=no)*: data field.

- **7a** Scroll down in the *Shape of Polygon to be Created*: data field, and **select** the:
 - **Circular** option to create a full circle about each selected point.
 - **Square** option to create a square about each selected point.
 - **Rectangle** option to create a rectangle about each selected point.

- **8a** Enter in the *Enter the number of buffer rings*: data field the **number** of buffer rings to be created. Note that each ring could be separated from another with a space, to be entered below, without this space being considered to be a ring. Refer to cases (3) and (5), and to cases (4) and (6) in Figure 6.

- **9a** Enter in the *Space between rings - ft (m)*: data field the **space** between the buffer rings to be created. Refer to the comment on the above step.

- **10a** Scroll down in the *Include the first ring (Y=yes, N=no)*: data field, and **select** the **y** or the **n** option whether to generate, or not the first ring. Note that if in Figure 6, had the response to this data field been the **n** option

for any of the eight cases, the first buffer ring about the point would have been a blank space.

- **11a** Scroll down in the *Center first ring (Y=yes, N=no)*: data field, and **select** the:
 - **y** option to treat the entry in the *Enter the buffer ring width - ft (m)*: data field as a diameter, if a circle is

to be created, or as the full width, if a square or rectangle is to be created. In Figure 6, compare case (1) with the **y** option with all of the other cases with the **n** option.

- **n** option to treat the entry in the *Enter the buffer ring width - ft (m)*: data field as a radius, if a circle is to be created, or as the half width, if a square or rectangle is to be created.

- **12a** Enter in the *Enter rectangle buffer height - ft (m)*: data field the **height** of the rectangle to be created. Note that for circular or square buffer rings, any entry in this data field is disregarded, and that for a rectangular buffer ring this entry is treated as a full or half height depending on the option selected in the *Center first ring (Y=yes, N=no)*: data field.

- **13a** Enter in the *Enter square/rectangle angle - degrees*: data field the **Cartesian angle** of the square or rectangular buffer rings to be created. Refer to cases (7) and (8) in Figure 6. Note that for a circle, this data field is disregarded.

- **14a** Click at the **OK** button to confirm the entries and selections, or click at the **Cancel** button to abort the command.

Having clicked at the *OK* button, the program begins to create the buffer zone, or zones. A progress bar is displayed in the status area, and when all buffer rings have been created, a message is displayed in the status area informing the user that the command may be used again. If desired, the resultant buffers may be annulled by invoking the {Edit} [Undo Create Buffer] menu command.

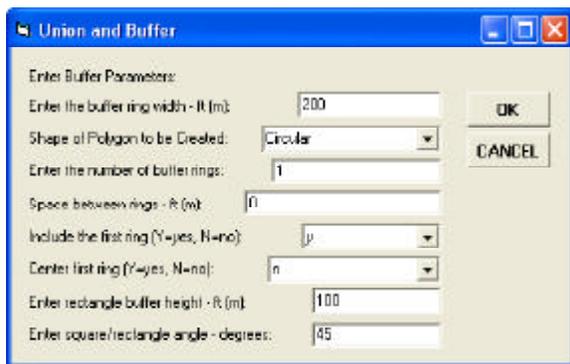


Figure 5
Buffer Dialog Box for Points

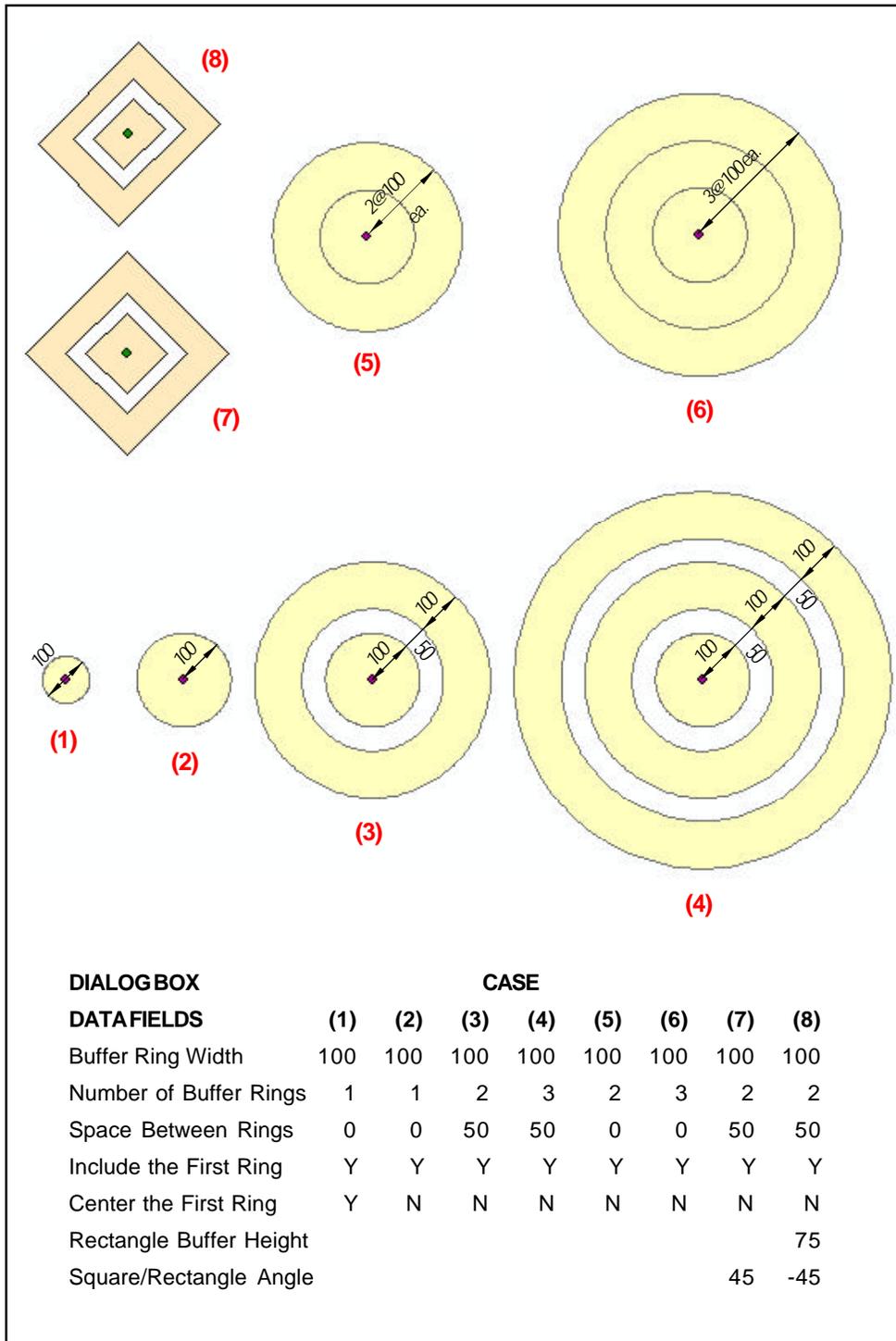


Figure 6 - Buffer Zones About a Point

It is important to note that:

a. When a single ring is created about a point, the resultant feature is a one part polygon feature.

b. When multiple ring buffer zones are created about a point, as in cases (3) through (8) of Figure 6,

- The first ring about the point is a one part polygon feature.

- All other rings are two part polygons (polygons with doughnut holes).

2.2 Polygon Buffer

Regarding the application of the {CEDRA-Polygon-Tools} [Union and Buffer] menu command to polygons, the user should note the following:

1. Although the {CEDRA-Polygon-Tools} [Union and Buffer] menu command can be used on the selection of a single polygon feature, its use is intended for two or more polygons. If it is desired to perform the tasks of this command on a single polygon, the same results may be accomplished by use of the  *Line(s) parallel to a line at a uniform offset* tool, which can be found in the CEDRA Tool Palette and the {CEDRA-Offset-Tools} toolbar.
2. When selecting two or more polygons, the program first unions the polygons, and then applies the specified offset distances to create the buffer zone.
3. According to ArcGIS terminology, if one polygon lies entirely within another polygon, and the polygons are united, a doughnut hole is not created. Thus, in using the subject command on two such polygons, the inside of the two polygons is disregarded.
4. When a buffer zone is created, the resultant polygon is a two part polygon feature with a doughnut hole.
5. As is to be seen in the operational steps below, it is possible to cre-

ate a one part polygon without a doughnut hole.

6. When the selected polygons overlap or are separated from each other, the shape of the resultant polygon is dependent upon the geometry of the selected polygons and upon the specified offset distances.
7. When the dialog box of Figure 7 is displayed, a small blue plus (+) sign is also displayed along the selected feature. If more than one feature has been selected, the blue plus sign is displayed along the first feature encountered by the program during its processing. This blue plus sign is displayed to the right side of the feature with respect to the direction of the feature.

Upon display of the multi-input dialog box of Figure 7, the user should:

- **6b Enter** in the *Enter the offset distance (+ or -)*: data field the distance to the right or left of the united outline of the selected feature at which an imaginary line is to be created. Note that:
 - The word imaginary as used above denotes a line which is to be transformed into a feature, or part of a feature depending on the response to the step below.
 - A positive entry places said imaginary line on the side at which the blue plus sign is displayed, while a negative entry places it on the opposite side.
 - A zero offset is considered a valid entry. However, if the **B** option is selected below in conjunction with a zero value for the bottommost data field, an error message will be displayed. When the **B** option is selected, a non-zero value must be entered in either or both

the topmost or bottommost data fields.

- **7b Scroll** down in the *Line Type (L=line segments, P=polyline, B=buffer)*: data field, select the:
 - **L** option to create a series of individual two point lines along the above said imaginary line about the outline of the united polygons. When selecting this option, any entry in the last data field is disregarded. Note that:
 - (i) If a zero has been entered as an offset in the above step, the user is asked whether a polygon is desired or not. A *Yes* response creates the polygon, and the command continues with **Step 11b**, while a *No* response queries the user whether a polyline should be created or not. A *Yes* response creates the polyline, and the command continues with **Step 11b**, while a *No* response aborts the command.
 - (ii) The resultant polygon or polyline, if created, is formed about the perimeter of the united polygons.
 - **P** option to create a polyline along the above said imaginary line about the outline of the united polygons. When selecting this option, any entry in the last data field is disregarded. Note that if a zero has been entered as an offset in the above step, the effect is similar to that of the **L** option above, with the exception that instead of a series of two point lines, a polyline is created.
 - **B** option to create a polygon buffer feature. If this option is selected, the entry in the next data field is used to create another imaginary polyline which will form a closed figure with the previously said imaginary

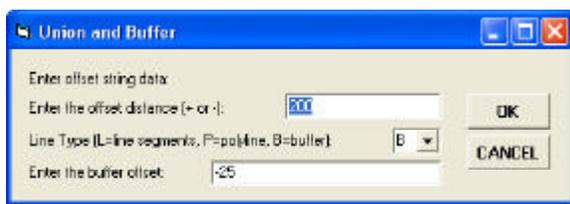


Figure 7
Buffer Dialog Box for Lines, Polylines,
Curves and Polygons

line to create the two part buffer polygon feature. Note that:

- (i) If a zero has been entered as an offset in both the *Enter the offset distance (+ or -)*: data field above and in the *Enter the buffer offset*: data field below, a warning message is displayed informing the user that erroneous offsets have been specified, and the dialog box of Figure 7 is displayed again for the user to correct the entries, and continue.
- (ii) If a zero has been entered as an offset in the *Enter the offset distance (+ or -)*: data field above, but not in the *Enter the buffer offset*: data field below, the entries are considered valid, and the user may continue.

- **8b Enter** in the *Enter the buffer offset*: data field the distance to the opposite side of the outline of the united polygons from the previously said imaginary line. Note that a zero:
 - May be entered to cause the buffer zone to abut the perimeter of the united polygons.
 - May not be entered if a zero value has also been entered in the *Enter the offset distance (+ or -)*: data field above, in which case a warning error message is displayed informing the user of erroneous entries. In this case, the user should click at the *OK* button to acknowledge the message, and display the dialog box of Figure 7 to correct the entries and continue with the work.

The continuation of the work is dependent upon which of the three options in the *Line Type (L=line segments, P=polyline, B=buffer)*: data field has been selected. If the selected option is

either **L** or **P**, the user should branch to **Step 9b**, and if it is **B**, the user should branch to **Step 10b**.

Option L or option P

- **9b Click** at the **OK** button to create the series of two point lines, or the single polyline, and display again the multi-input dialog box of Figure 7, in which case return to **Step 6b** to create another similar feature,
- or
- click** at the **Cancel** button to display the dialog box of Figure 8, in which case branch to **Step 11b**.

Option B

- **10b Click** at the **OK** button to create the specified feature, and display the dialog box of Figure 8, in which case branch to **Step 11b**,
- or
- click** at the **Cancel** button to abort the command.

Having created the specified feature, it is time to decide which attributes are to be assigned to it, and what to do with the selected features.

- **11b Scroll** down in the *Attributes*: data field, select the:
 - **Use the Default Attribute Values** option to assign to the new feature the CEDRA default attribute values for the selected type of feature.
 - **Use the Common Attribute Values only** option assign to the new feature the common values for any attribute fields, other than the standard CEDRA attribute fields for the new feature, that may exist in common be-

tween the selected and the new features. That is to say, the command will only assign to the new feature the attribute values that are identical for all of the selected features processed. So that, if all of the selected features have an attribute called A and they all have a value of 10 assigned to the attribute A. If the layer containing the new feature has an attribute called A, the value 10 would be assigned to the new feature.

- **Use the First Selected Feature's Attributes** option assign to the new feature the values for the first selected feature processed for any attribute fields, other than the standard CEDRA attribute fields for the new feature, that may exist in common between the selected and the new features.
- **12b Scroll** down in the *Selected Features*: data field, select the:
 - **Delete the X selected features** option to delete the features that had been selected to create the new feature, where X denotes the number of selected features.
 - **Do not delete the selected features** option to retain said selected features.
- **13b Click** at the **OK** button to assign the specified attributes, and terminate the command, or
- click** at the **Cancel** button to assign the default attribute val-



Figure 8
Attributes to Be Used and
Disposition of the Selected Features

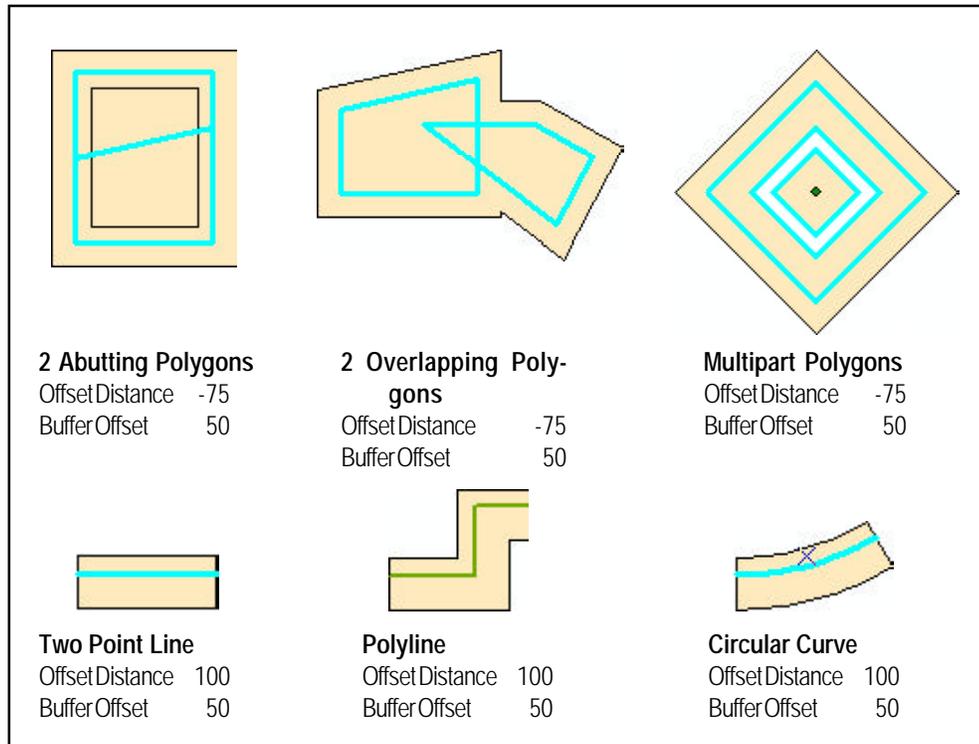


Figure 9
Sample Buffer Polygons created using various Offset Distance and Buffer Offset values (the selected features are shown in blue)

ues and to not delete the selected features.

Note that in either action in the last step above:

- The new feature has been created and is displayed. If it is desired to annul the action of the command, the user should invoke the {Edit} [Undo Create Polygon], or the {Edit} [Undo Create Offset Features] menu command depending upon which feature type was created. The user should note that if in addition to having created the new feature, the selected features had been deleted, the {Edit} [Undo Delete Features] menu command will need to be invoked prior to the {Edit} [Undo Create Polygon], or the {Edit} [Undo Create Offset Features] menu command.
- The selected features remain selected, so that the command may be invoked and repeated from its beginning. The selected features do not remain selected if either of

the undo commands has been invoked or if the selected features were deleted.

- Shown in Figure 9 are sample buffer polygons created using various offset distance and buffer offset values for different types of features.

2.3 Line, Polyline and Curve Buffer

As stated at the beginning of this section, this command under the advanced mode of operation when processing multiple polyline features will union the multiple features into a single overall polyline. If the user desires to create a multipart feature, the simple mode of operation should be selected. Under the advanced mode of operation, the command assumes that the individual polyline features are in series and as such comprise a single feature. Note that:

- When one line, polyline or curve feature is selected, the user may

proceed as per the instructions in the preceding subsection, in which case the dialog box of Figure 7 is displayed.

- When more than one feature of the same type, and/or features of different type are selected concurrently, the user may encounter certain warning or error messages without the re-display of the dialog of Figure 7. If such a warning or error message is not displayed, and the dialog of said figure is displayed, the user may proceed with said instructions, but should be aware that the results may not be as expected, depending on the geometry of the features that have been selected and their orientation in the map display.
- The dialog box of Figure 7 is the same as the dialog box of the  Establish offset element strings tool with which the user may cre-

ate features offset from a selected string of connected end to start series of features, which may be two point lines, polylines and/or curves. As such, the user may create a single offset polyline, or decompose the offset polyline into individual two point lines. In addition, the user may create a buffer zone. Thus, the use of the {CEDRA-Polygon-Tools}[Union and Buffer] menu command for line, polyline and curve features is similar to the use of the  *Establish offset element strings* tool with the exception that it is possible for the features to not be connected in series. That is, there can be gaps between the polyline features.

3. Simple Union Mode

Under the simple mode of operation, the multi-input dialog box of Figure 10 is displayed. As can be seen from the dialog box, the user, if desired, is able to specify an attribute for which the unioning is to be based upon. Additionally, the user is able to:

- a. indicate if the features being processed are to be deleted upon completion of the processing,
- b. indicate whether or not holes that may appear in the unioned feature are to be removed, and
- c. how the attributes are to be assigned to the unioned feature (see Figure 11).

The bottom three parameters refer to the exact same functionality offered under the advanced mode of operation. The main differences the user will find under the simple mode of operation versus the advanced mode of operation is that:

- a. The user can specify an attribute from which its unique values can be used in the unioning process. For example, assume there are 10

polygons with an attribute called A. Seven of the polygons have an attribute A value of 1, while the remaining three have an attribute value of 2. Specifying the attribute A in the topmost data field will result in two polygons being created. The first will be the union of the seven polygons whose attribute A value is 1, while the second will be the union of the remaining three polygons.

- b. The way the command handles noncontiguous features. Under the simple mode of operation, the command when processing polyline features does not assume that the polyline features are contiguous. In so doing, the result of unioning noncontiguous polyline features is a multipart polyline.
- c. The way the command handles point features. Under the simple mode of operation, the command will create a multipart point feature, while under the advanced mode of operation the user is able to create polygons about the selected point features.

► 6 Scroll down in the *Attribute Union is based on:* data field, and select the:

- <none> option to indicate that unique attribute values are not to be used in the processing.
- **appropriate attribute** to indicate that features are to be unioned based upon unique attributes values for the specified attribute.

► 7 Scroll down in the *Delete Selected Features:* data field, and select the:

Figure 10
Buffer Dialog Box for Points

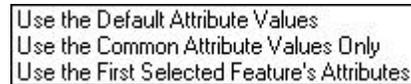
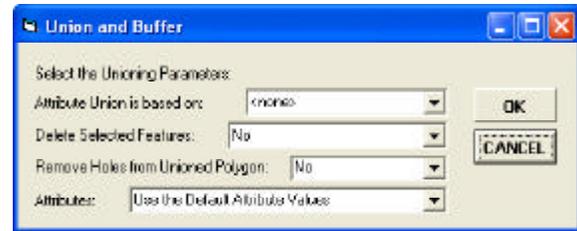


Figure 11
Buffer Dialog Box for Points

- **No** option to indicate that the selected features are not to be deleted.
- **Yes** option to indicate that the selected features are to be deleted upon completion of the processing.

► 8 Scroll down in the *Remove Holes from Unioned Polygon:* data field, and select the:

- **No** option to indicate that holes are not to be removed from the resultant feature, if present.
- **Yes** option to indicate that holes are to be removed from the resultant feature, if present.

► 9 Scroll down in the *Attributes:* data field, and select the:

- **Use the Default Attribute Values** option to assign to the new feature the CEDRA default attribute values for the selected type of feature.
- **Use the Common Attribute Values only** option assign to the new feature the common values for any attribute fields, other than the standard CEDRA attribute fields for the new feature, that may exist in common between the selected and the new features. That is to say, the command will only assign to the new feature the attribute values that are identi-

cal for all of the selected features processed. So that, if all of the selected features have an attribute called A and they all have a value of 10 assigned to the attribute A. If the layer containing the new feature has an attribute called A, the value 10 would be assigned to the new feature.

- **Use the First Selected Feature's Attributes** option assign to the new feature the values for the first selected feature processed for any attribute fields, other than the standard CEDRA attribute fields for the new feature, that may exist in common between the selected and the new features.

- **10 Click** at the **OK** button to confirm the entries and selections, or **click** at the **Cancel** button to abort the command.

Having clicked at the *OK* button, the program begins to create a multipart feature. Once the processing is complete a message in the status bar area will appear indicating the number of features that were created. If desired, the resultant feature(s) may be annulled by invoking the {Edit} [Undo Create] menu command.

Note that if the current active layer is not defined to handle multipart point features:

- The command will create a new shapefile that is defined to accommodate multipart point features, without user intervention, storing the shapefile in the current working directory. The command will append the suffix **mp** to the name of the current active layer, or if the last two characters of the current active layer name are **pn**, the **pn** characters will be replaced with **mp**. For example, if the current active layer name is L_0 the multipart point shapefile that would be created would be

named L_Omp. Additionally, if the current active layer name was L_0pn, the multipart point shapefile that would be created would be named L_0mp.

Summary

Users who have used the ArcMap Union command should check out the [Union and Buffer] menu command. You may find this command offers a little more flexibility and ease of use.

The implementation of the Simple Mode of Operation is a recent enhancement to the [Union and Buffer] menu command.

Users with a software support agreement should check with The CEDRA Corporation on how to obtain a software update so as to be able to utilize this new functionality.

As always, users who have a need for functionality that is not presently available in CEDRA software should feel free to forward these requests to CEDRA, as well as, any other comments or suggestion you may have.

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