Application Description

GIS users, no matter what their application may be, all deal with points, lines and polygons. We are not omitting curves, because they are treated pictorially as lines (polylines) with rather small chords. Although ArcGIS® and ArcView® GIS, as well as CEDRA-AVcad™, offer tools which a user can employ to ascertain: (a) the coordinates of points, (b) the length and direction of a line, or (c) the area and perimeter of a polygon, a user may wish to include this geometric information in a layer's attribute table.

If all went well always, and if all GIS users operated in a similar fashion, there would not have been a need for the discussion presented in this month's bulletin. But, as is inevitable, something goes astray at one time or another, and the contents of the attribute fields that contain such geometric information may not agree with a feature's actual geometric representation.

Additionally, some GIS users may receive a shapefile or geodatabase that does not have attributes containing a feature's geometric data. In this case, it may be desirable to introduce fields in the layer's attribute table that contains the feature's geometric data.

Furthermore, a user may wish to change the graphic representation of point and line features to reflect the coordinate values stored in the layer's attribute table.

So, what is a user to do in these situations?

Figure 1 - CEDRA-AVcad-Menus Toolbar for ArcGIS Users

The CEDRA Solution

To address this issue, the [Update Geometry] menu command has been introduced in the {CEDRA Commands} menu combo box (third from the left) of the CEDRA-AVcad-Menus toolbar shown in Figure 1. Scrolling down in the {CEDRA Commands} menu combo box, the [Update Geometry] menu command is the fifth in the scroll down list (see Figure 2).
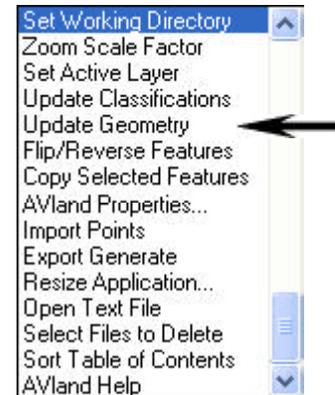
> **Command Of The Month bulletin**
>
> *This month's issue discusses the process of updating a layer's attribute table to reflect the geometric representation of one or more features.*

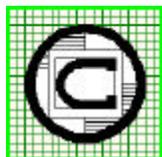### Command Function and Invocation

Using the [Update Geometry] command, the user is able to:

(a) update specific attributes within a layer's attribute table with a feature's geometric data (coordinates, length, direction and area),

(b) check polylines and polygons for duplicate vertices, or vertices that are very close together, and replace them with one,

Figure 2
{CEDRA Commands} Combo-Box

(c) change the shape of one or more features to reflect the coordinate values that are stored in the layer's attribute table,

(d) check for null or empty geometries that may be present in a layer, and

(e) delete any invalid geometries that may be present in a layer or a set of features based upon a range of object IDS (OIDs).

This command will process all visible or all active layers depending on the option selected in the dialog box as indicated below. However, if a layer that is being processed contains selected features, then only the selected features will be processed; otherwise all features within the layer will be processed.

Prior to invoking this command, the user must decide what is desired to be accomplished. The novice user should first read this entire section to see how this command operates, and then return to this point to use the command. Having done so, the user should proceed as follows:

➤ 1   **Activate** all desirable layers, if it is desired for the command to operate on all active layers,
or
make visible only the desired layers, if it is desired for the command to operate on all visible layers,
or
activate the layer, the shapes of which are to be changed to reflect the coordinate values stored in the layer's attribute table,
or
activate the layer which is to be checked for dirty features.

➤ 2   **Scroll** down in the {CEDRA Commands} menu combo box, and **select** the [Update Geometry] command to display the dialog box of Figure 3.

It is noted that if there are no visible layers when the subject command is invoked, a warning message box is displayed informing the user of this fact. In this case the user should click at the OK button to acknowledge, make the pertinent layers visible, and then invoke the subject command again.

Figure 4
Update Geometry
Processing Options

➤ 3   **Scroll** down in the *Mode of Operation:* data field (see Figure 4), and **select** the:
- **Update Active Themes** option
- **Update Visible Themes** option
- **Update Shapes using Coordinates** option, or the
- **Dirty Features Check** option.

In selecting one of the above options, the user should note the following:

• The *Update Active Themes* option, and the *Update Visible Themes* option operate similarly (the former on all active layers, and the latter on all visible layers).

• The *Update Active Themes* option, and the *Update Visible Themes* option, with the *Check for Duplicate Points:* parameter set to *No*, update the geometric attributes in the layer's attribute table to reflect the current graphic representation of the feature being processed.

• The *Update Active Themes* option, and the *Update Visible Themes* option, with the *Check*

Figure 3 - Update Geometry Dialog Box

for Duplicate Points: parameter set to *Yes*, update the geometric attributes in the layer's attribute table to reflect the current graphic representation of the feature being processed, and in addition, check to see which polyline vertices are near each other within the distance specified in the *Proximity Tolerance - ft(m):* data field. Of those vertices that are within this tolerance, the second vertex is removed.

• The *Update Shapes using Coordinates* option changes a feature's graphic representation to reflect the coordinate values stored in the **active** layer's attribute table. That is to say, the shape of the feature is changed using coordinate data stored in the attribute table.

• The *Dirty Features Check* option provides the user the ability to:

1. Check the **active** layer for any features containing null or empty geometries. If any are found, a list is presented to the user in the form of a choice list dialog box. The user should peruse the list and then click at the OK button to close the dialog box. The user may then re-invoke the command and proceed to delete those records with null or empty geometry.

2. Delete features in an **active** layer by specifying a range of object IDs (OIDs).

3. Delete all features containing null or empty geometries in an **active** layer.

• The diagram shown in Figure 5 displays the work flow of the subject command. Depending on what is desired, the user may continue with the steps of the pertinent subsection below.

Updating the Geometric Attributes

If the user's objective is to update the geometric attributes of all active or all visible layers so as to reflect a feature's graphic representation, the user may disregard the second and third parameters of the dialog box shown in Figure 3, and continue with the step below.

➤ 4a **Click** at the **OK** button to execute the command,
or
click at the **Cancel** button to abort the command.

Figure 5 - Operational Schematic of the Update Geometry Menu Command

Having clicked at the OK button, the program processes the active or visible layers, depending on which option has been selected, displaying a progress bar in the status bar area. As each feature is examined, the command searches for specific fields in the layer's attribute table. If a field is found, the corresponding geometric data is stored in the feature attribute table.

The attribute fields that are searched vary based upon the type of feature and include the following:

For Point Feature Layers
* The coordinate pair fields that are updated are the following:

X	Y
NODEX	NODEY
EASTCX	NORTHY
CORNERX	CORNERY

CENTROIDX   CENTROIDY
TIEPOINTX   TIEPOINTY

• In addition to the above geometric attribute fields, and if the layer that is being processed is called *ParcelCorners* or *ParcelCenters*, the program searches for the record number field called PNT. If the field PNT exists, the command updates this field with a value equal to the **sequential record number of the feature** for ArcView GIS users, or the **feature's object ID** (OID) for ArcGIS users.

As an ArcView GIS example, the value that would be stored in the PNT field for the first feature in the *ParcelCorners* or *ParcelCenters* layers would be zero (0), for the second feature (1), the third (2) and so forth.

For ArcGIS users, the value that is stored in the PNT field is whatever the OID value ArcGIS assigns to the feature.

For Line Feature Layers
• The coordinate pair fields that are updated include:
SX, SY, EX and EY

• The length or perimeter attribute fields include one of the following:
LEN, LENGTH or PLONG

• The area attribute fields, if a polyline forms a closed figure, include one of the following:
ARA or AREA

• The Arc/Cogo direction attribute field updated is:
DIRECTION

• The Arc/Cogo length attribute field updated is:
DISTANCE

• In addition to the above geometric attribute fields, if the record number fields SLN, PLINE, CNT or CUV are found, the command updates them

with a value equal to the **sequential record number of the feature plus one** for ArcView GIS users, or the **feature's object ID** (OID) **plus one** for ArcGIS users. Note that record numbers for ArcView GIS users begin at zero, not one.

As an ArcView GIS example, the record number for the first feature in a layer is zero (0). As such, the value that would be stored in the SLN, PLINE, CNT or CUV field, if present, as a result of executing this command would be one (1). Likewise, for the second feature in the layer the value would be two (2), and so forth.

For ArcGIS users, the value that is stored in the SLN, PLINE, CNT or CUV field is whatever the OID value ArcGIS assigns to the feature plus one.

• If the line layer being processed is named *ParcelSides* and the SLN field exists, this command will store, for ArcView GIS users, the record number of the feature, not the record number plus one value. For ArcGIS users, the value that is stored in the SLN field is whatever the OID value ArcGIS assigns to the feature.

As an ArcView GIS example, the value that would be stored in the SLN field for the first feature in the *ParcelSides* theme would be zero (0), for the second one (1), the third (2) and so forth.

For Polygon Feature Layers
• The perimeter attribute fields include one of the following:
LEN, PERIMETER or PERIMcalc

• The area attribute fields include one of the following:
ARA, AREA or AREAcalc

Once the tables have been updated, the command terminates, and it can be executed again from the very beginning of these instructions.

Removal of Duplicate Polyline/ Polygon Vertices

If the user's objective is to remove duplicate vertices of all active or visible layers, in addition to updating the geometric attributes, the user should continue with the steps below.

➤ **4b** **Scroll** down in the *Check for Duplicate Points:* drop-down list, and **select** the **Yes** option.

➤ **5b** **Enter** in the *Proximity Tolerance - ft (m):* data field the **distance** to be used as the criteria for selecting duplicate vertices.

➤ **6b** **Click** at the **OK** button to execute the command,
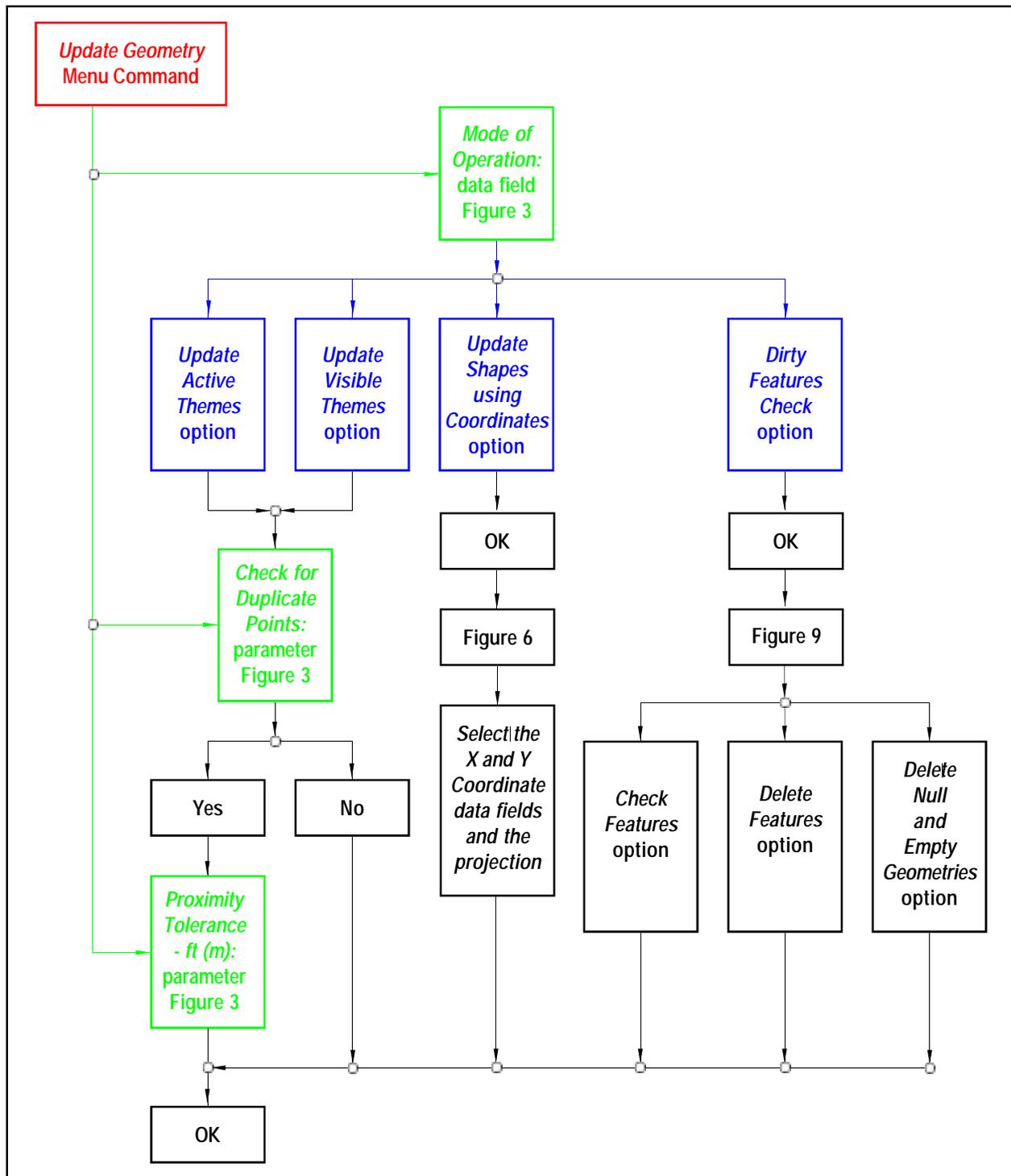or
click at the **Cancel** button to abort the command.

Having clicked at the OK button, the command proceeds to update the geometric attributes and remove all duplicate vertices, after which the command terminates.
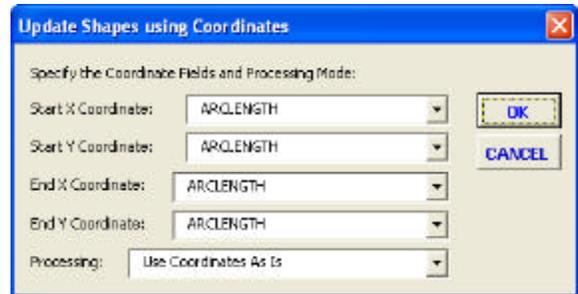
Updating Features Shapes Using Coordinates

If the user's objective is to update the graphic representation of features in the **active** layer so as to reflect the coordinates that are stored in the layer's attribute table, the user may disregard the second and third parameters shown in the dialog box of Figure 3, and continue with the steps below. Note that if there is no active layer, or if there are more than one active layer, a warning message is displayed to that fact. In this case, the user should click at the OK button to acknowledge, correct the situation, and execute the command from the beginning.

Note that this command operates only on point or single line or polyline feature layers. If a polyline feature layer is selected, the command will function, but it will only affect the start and the end points of the polyline, and not any of the in-between vertices.

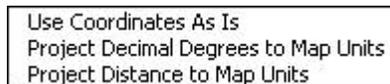**Figure 6 - Data Fields of X and Y Coordinates (Point Layer)**

Figure 7 - Data Fields of X and Y Coordinates (Line Layer)

➤ **4c** **Click** at the **OK** button to display the dialog box of Figure 6 or Figure 7,
or
click at the **Cancel** button to abort the command.

Regarding the dialog box of Figure 6, note that there is only one set of coordinate pairs, while in Figure 7 there are two coordinate pairs. When a point layer is processed, the dialog box shown in Figure 6 will be presented, while the dialog box shown in Figure 7 will appear when a line/polyline layer is processed.

➤ **5c** **Scroll** down in the *X Coordinate:* and *Y Coordinate:* drop-down lists, and **select** the data field that contains the corresponding **X and Y coordinates**, if the selected layer is that of point features,
or
scroll down in the *Start X Coordinate:*, *Start Y Coordinate:*, *End X Coordinate: and End Y Coordinate:* drop-down lists, and **select** the data field that contains the corresponding **X and Y coordinates**, if the selected layer is that of single line or polyline features.

➤ **6c** **Scroll** down in the *Processing:* drop-down list (see Figure 8), and **select** the:
• *Use Coordinates As Is* option to use the coordinates stored in the attribute table without any further processing but rather as is.

Figure 8 - Processing Options

• *Project Decimal Degrees to Map Units* option to convert coordinates stored in the attribute table from decimal degrees into the current map's Map Units. This option assumes that the coordinate values in the attribute table are in decimal degrees and that a projection has been assigned to the current map.

• *Project Distance to Map Units* option to convert the coordinates stored in the attribute table into the current map's Map Units. This option assumes that the coordinate values in the attribute table are in distance units and that a projection has been assigned to the current map.

➤ **7c** **Click** at the **OK** button to execute the command,
or
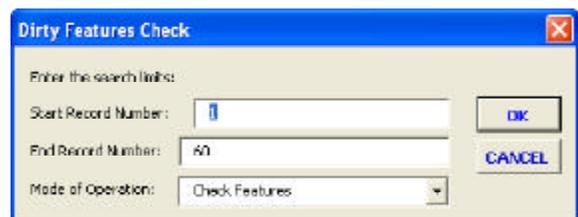**click** at the **Cancel** button to abort the command.

Having clicked at the OK button, the program processes the active layer . As each feature is examined, the command searches for the user-specified coordinate fields in the layer's attribute table, and changes the corresponding graphic representation (shape) of the feature.

When all features have been processed, the command terminates.

Check for Dirty Features

If the user's objective is to determine if there are any features containing null or empty geometries, the user may disregard the second and third parameters shown in the dialog box of Figure 3, and continue with the steps below. Note that this option may also be used as an alternate method for removing all or some of the features from a point, polyline, polygon or annotation layer.

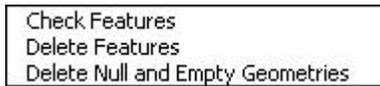➤ **4d** **Click** at the **OK** button to display the dialog box of Figure 9,
or
click at the **Cancel** button to abort the command.

➤ **5d** **Enter** in the *Start Record Number:* data field the record number (OID) of the start of a range of records to be processed,

Figure 9 - Check for Dirty Features

or
accept the default record number, said number being that of the first OID in the table.

➤ **6d** **Enter** in the *End Record Number:* data field the record number (OID) of the end of a range of records to be processed,
or
accept the default record number, said number being that of the last point in the table.

➤ **7d** **Scroll** down in the *Mode of Operation:* drop-down list (see Figure 10), and **select** the:

Check Features
Delete Features
Delete Null and Empty Geometries

Figure 10 - Processing Options

• *Check Features* option to check the active layer to determine if there are any features with null or empty geometries.

• *Delete Features* option to delete a set of features given a range of object IDs (OIDs).

• *Delete Null and Empty Geometries* option to delete all features within the active layer that have null or empty geometries.

➤ **8d** **Click** at the **OK** button to execute the command,
or
click at the **Cancel** button to abort the command.

Having clicked at the OK button, and if the:
• *Delete Features* option or the *Delete Null and Empty Geometries* option has been selected above, the program processes the range of records in the active layer, after which the command terminates.

• *Check Features* option has been selected above, a list dialog box is displayed containing the records numbers of the features containing null or empty geometries. In this case, continue as indicated below.

➤ **9d** **Peruse** the list and then click at the **OK** or **Cancel** button to close the dialog box.

➤ **10d** **Repeat** the preceding steps, but this time **select** the *Delete Null and Empty Geometries* option in Step 8d to delete the dirty features.

Add Geometric Attributes to Table

A user who has a layer that does not have attributes that contain geometric data has the ability to introduce the geometric attributes discussed previously and mass populate them with the corresponding geometric data. This is done by:

(a) introducing in the appropriate attribute table the applicable attribute or attributes to be populated, and

(b) invoking the [Update Geometry] command.

The geometric attributes that should be introduced have been identified above under the section titled *Updating the Geometric Attributes*. Tables 1 through 3 contain the field type and size for all of the attributes that are updated with the [Update Geometry] command.

In addition to the above geometric attributes, the user may introduce an attribute labeled SLN for lines only. If this attribute is encountered by the program, the attributes DISTANCE, AZIMUTH, BEARING and CARTESIAN are added to the attribute table, if they do not exist automatically by the [Update Geometry] command. These attributes are added only for layers containing line features.

Thus to introduce the above referenced attributes and mass populate them, the user should:

➤ **4e** **Introduce** in the appropriate layer's attribute table the desired of the above reference **attribute fields** with conventional ArcView GIS or ArcGIS functionality.

➤ **5e** **Activate** all desirable layers, if it is desired for the command to operate on all active layers,
or
make visible only the desired layers, if it is desired for the command to operate on all visible layers

➤ **6e** **Scroll** down in the {CEDRA Commands} menu combo box, and **select** the [Update Geometry] command (see Figure 2) to display the dialog box of Figure 3.

It is noted that if there are no visible layers when the subject command is invoked, a warning message box is displayed informing the user of the fact. In this case the user should click at the OK button to acknowledge, make the pertinent layers visible, and then invoke the subject command again.

➤ **7e** **Scroll** down in the *Mode of Operation:* drop-down list, and **select** the:
• **Update Active Themes** option, or the
• **Update Visible Themes** option.

➤ **8e** **Click** at the **OK** button to execute the command,
or
click at the **Cancel** button to abort the command.

Having clicked at the *OK* button, the program processes the active or visible layers, depending on which option has been selected, displaying a progress bar in the status bar area. As each feature is examined, the command searches for specific attribute fields in the layer's attribute table. If a field is found, the corresponding geometric shape information is stored in the feature attribute table.

Regarding the attribute population note the following:
• The SLN attribute field is a long numeric field that contains the sequential number or OID of the line features.

	Field	Description	Field Type	Field Size
1	PNT	Point Number	Long	8.0
2	X	East (X) Coordinate in feet (m)	Double	18.6
3	Y	North (Y) Coordinate in feet (m)	Double	18.6
4	NODEX	East (X) Coordinate in feet (m)	Double	18.6
5	NODEY	North (Y) Coordinate in feet (m)	Double	18.6
6	EASTCX	East (X) Coordinate in feet (m)	Double	18.6
7	NORTHY	North (Y) Coordinate in feet (m)	Double	18.6
8	CORNERX	East (X) Coordinate in feet (m)	Double	18.6
9	CORNERY	North (Y) Coordinate in feet (m)	Double	18.6
10	CENTROIDX	East (X) Coordinate in feet (m)	Double	18.6
11	CENTROIDY	North (Y) Coordinate in feet (m)	Double	18.6
12	TIEPOINTX	East (X) Coordinate in feet (m)	Double	18.6
13	TIEPOINTY	North (Y) Coordinate in feet (m)	Double	18.6

Table 1 - Point Fields Updated with the Update Geometry Command

	Field	Description	Field Type	Field Size
1	SLN	Line Number	Long	8.0
2	CUV	Line Number	Long	8.0
3	CNT	Line Number	Long	8.0
4	PLINE	Line Number	Long	8.0
5	SX	Start East (X) Coordinate in feet (m)	Double	18.6
6	SY	Start North (Y) Coordinate in feet (m)	Double	18.6
7	EX	End East (X) Coordinate in feet (m)	Double	18.6
8	EY	End North (Y) Coordinate in feet (m)	Double	18.6
9	LEN	Length of line in feet (m)	Double	14.4
10	LENGTH	Length of line in feet (m)	Double	14.4
11	PLONG	Length of line in feet (m)	Double	14.4
12	ARA	Area of Polyline in sf. (sm), if closed; otherwise 0.00	Double	18.4
13	SQR_ARA	Area of Polyline in sf. (sm), if closed; otherwise 0.00	Double	18.4
14	DIRECTION	Cartesian rotation of line or chord direction of curve in radians from (SX,SY) to (EX,EY)	Text	10
15	DISTANCE	Length of line or chord length of curve	Text	8
16	RADIUS	0 for line, or radius of curve	Text	8
17	DELTA	0 for line, or central angle for curve in radians	Text	10
18	TANGENT	0 for line, or tangent length for curve	Text	8
19	ARCLENGTH	0 for line, or arc length for curve	Text	8
20	SIDE	0 for line, or L for clockwise - R for counterclockwise	Text	1
21	RADIUS2	0 for line and curve	Text	8
22	TANGENT2	0 for line and curve	Text	8
23	AZIMUTH	Azimuth of line (chord) in degrees, minutes and seconds	Text	12
24	BEARING	Bearing of line (chord) in quadrant, degrees, minutes and seconds	Text	15
25	CARTESIAN	Cartesian direction of line (chord) in decimal degrees	Text	12
26	ANG	Central angle for curve in degrees, minutes and seconds	Text	12

Table 2 - Line/Polyline Fields Updated with the Update Geometry Command

	Field	Description	Field Type	Field Size
1	LEN	Perimeter of the Polygon in feet (m)	Double	14.4
2	LENGTH	Perimeter of the Polygon in feet (m)	Double	14.4
3	PERIMETER	Perimeter of the Polygon in feet (m)	Double	14.4
4	PERIMcalc	Perimeter of the Polygon in feet (m)	Double	14.4
5	ARA	Area of the Polygon in sf. (sm)	Double	18.4
6	AREAcalc	Area of the Polygon in sf. (sm)	Double	18.4
7	SQR_ARA	Area of the Polygon in ac. (ha)	Double	18.4

Table 3 - Polygon Fields Updated with the Update Geometry Command

• A polyline feature will be treated as a curve if:

i. the attribute table contains the RAD or RADIUS field with a value greater than zero, or

ii. if the attribute table contains a field called ENTITY with a value or ARC or CIRCLE.

Under case ii, if the attribute table contains the RAD or RADIUS field with a value of zero, the command will replace the value of zero with a computed radius value, which the command calculates based upon the shape of the polyline.

• The DISTANCE, AZIMUTH, BEARING and CARTESIAN are character fields, and their contents reflect the attribute implication of their label. For polylines which are treated as curves, these attributes pertain to the curve's chord.

• For polylines, if any coordinate attribute fields are introduced, they reflect the start and end points of a polyline, and not any of the vertices.

• If the SLN attribute field is introduced in a table associated with a mixture of two-point lines and polylines, the DISTANCE, AZIMUTH, BEARING and CARTESIAN attributes will reflect the imaginary line between the start and end points of the polylines. For two-point lines the attributes will reflect the attributes of the actual line.

• The ANG attribute field is introduced in a table automatically by the command only if the CUV field is present in the layer being processed. The CUV field denotes a CEDRA curve layer. The ANG field contains the curve's central angle in degrees, minutes and seconds.

• If it is determined that the polyline represents a curve, the value stored under the LEN or LENGTH field will be the arc length of the curve.

Summary

The [Update Geometry] command is a useful tool for ensuring that the attribute table contains geometric information reflection of the graphic representation of a feature, as well as, removing any features with invalid geometries.

As always, should the reader have any comments or suggestions they should feel free to forward them to us.