

Matching Locations to the Map

When you have data in a table that you want to display as points on a map, Atlas GIS can assign them longitude-latitude coordinates. This process is called *geocoding*. Atlas GIS provides three methods of geocoding:

- *Geocoding by ZIP* assigns a longitude-latitude coordinate that corresponds to the centroid (center) of a ZIP code region. (These centroids are assigned from a centroid database provided with the Atlas GIS software.) This can be very useful for maps covering a large area, such as an entire state or country.
- *Geocoding by address* assigns a longitude-latitude coordinate that matches the location of a street address. Additionally, this method includes a standardization function that verifies and updates the addresses in your table. Geocoding by address is best suited for maps covering smaller areas, such as cities or ZIP code boundaries.
- *Geocoding by map layer* assigns longitude-latitude coordinates that correspond to the centroids of features in a map layer or rows in another point table. The features may be either points, lines, or regions, allowing you greater flexibility in geocoding.

In this lesson, you'll practice using the first two methods.

In the first exercise, you'll use the `TABLE | GEOCODE BY ZIP` command to geocode a customer prospect list that's been opened as a table, in order to display the prospect locations on a map. The coordinates that will be added to the table will correspond to the centroids of ZIP codes.

In the second exercise, you'll use the `TABLE | GEOCODE BY ADDRESS` command to geocode a table containing addresses for several restaurants in Mountain View, California. The coordinates that will be added to the table will correspond to the actual street addresses of the restaurants, allowing you to display their exact locations on a map. (For more information on how Atlas GIS performs geocoding, see the on-line help, or refer to `TABLE | GEOCODE BY ADDRESS`, `TABLE | GEOCODE BY ZIP`, and `TABLE | GEOCODE BY MAP LAYER` in the *Reference Manual*.)

Note: Make sure that the drive and directory where the geocoding files are located are specified in `FILE | PREFERENCES` in the Geocode Data Path. For more information about the geocode data path, see `FILE | PREFERENCES` in the *Reference Manual*.

Geocoding by ZIP

In this exercise, you'll use the `TABLE | GEOCODE BY ZIP` command to geocode a customer prospect list that's been opened as a table, in order to match the prospect locations to the map. You'll need to open the table and add columns for the longitude and latitude coordinates before you can geocode the table.

To open the file as a table:

1. Open the `CA_SALES.PRJ` project file in the `C:\AGISWTUTORIAL` directory.
2. Open the `CA_PROSP.DBF` table in the `C:\AGISWTUTORIAL` directory.

The Table Link dialog box pops up. Since the table doesn't have longitude and latitude columns, you could open the table as unlinked and create the columns using `TABLE | DEFINE COLUMNS`; however, in this exercise you'll specify that the table contains points and let Atlas GIS create the longitude and latitude columns automatically.

3. Click on the Contains Points option button.

The subpanel displays the options for opening a point table.

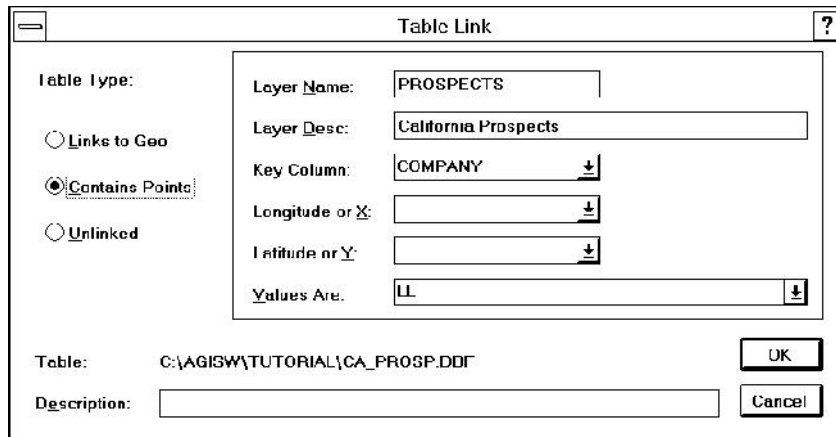


Figure 16.1 **Table Link dialog box**

4. In the *Layer Name* text box, type 'PROSPECTS'.

This assigns a name to the layer. (Point tables are treated as separate layers.)

5. In the *Layer Desc* text box, type 'California Prospects'.
6. In the *Key Column* list box, choose 'COMPANY'.

This specifies the key column for the table so that each row can be uniquely identified.

7. Leave the *Longitude or X* and *Latitude or Y* columns unspecified.

There are no longitude and latitude columns in the table yet; by not specifying any columns in these list boxes, Atlas GIS will create them automatically.

8. Click OK.

A message pops up informing you that the table does not contain longitude and latitude columns, and asks whether you want to add them.

9. Click on the Yes button to add the columns.

The coordinate columns LON and LAT are inserted as the far right columns of the table. You may view the columns in a Table window.

10. Choose WINDOW | NEW TABLE WINDOW and display the CA_PROSP:PROSPECTS layer in the window.

Notice that the new LON and LAT columns are empty; they don't yet contain the longitude and latitude coordinates. Next, you'll geocode the rows in the table so that you may display the prospect locations as points on the map.

To geocode the table:

1. Choose TABLE | GEOCODE BY ZIP to pop up the Geocode By ZIP dialog box.

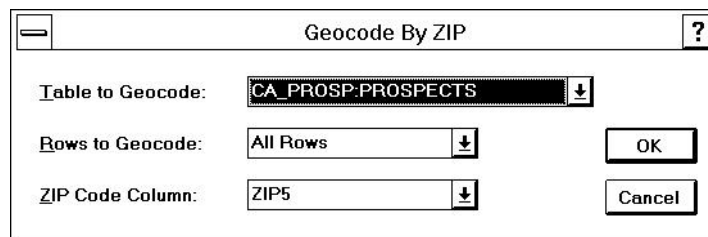


Figure 16.2 Geocode By ZIP dialog box

2. In the *Table to Geocode* list box, choose 'CA_PROSP:PROSPECTS'.
3. In the *Rows to Geocode* options, choose 'All Rows'.

You want to match all rows, since this table has never been geocoded.

4. In the *ZIP Code Column* list box, choose 'ZIP5'.

Atlas GIS will use the entries in the ZIP5 column to match the rows in the point table to the rows in the centroid database. The centroid database, provided with the Atlas GIS software, contains the longitude and latitude coordinates of all U.S. 5-digit ZIP code centroids (geographic centers). Atlas GIS automatically matches the specified column in the point table (i.e., ZIP5) to the ZIP column in the centroid database, then assigns the coordinates from the centroid database to the matching rows in the point table. The longitude coordinates will be assigned to the LON column, and the latitude coordinates will be assigned to the LAT column.

5. Click OK to begin the geocoding process.

Atlas GIS assigns the ZIP code centroids to the specified table rows.
(This can take a while.)

When the process is complete, you can scroll through the table to see the new coordinates.

6. Click on the Redraw button or choose VIEW | REDRAW to display all the matched points on the map.

If the Table window obscures the map, you can close the Table window or just move it out of the way. If you want to change the symbol style and size, right-click on the map (to pop up the Layers & Themes dialog box) and choose the style options for the layer.

Before going on to the next exercise, you should close the project file.

To close the project file:

1. Choose FILE | CLOSE to pop up the Close dialog box.
2. In the *Files to Close* list box, choose CA_SALES.PRJ and click OK.
3. When prompted, click on No to lose changes to the file.

Now that you know how to geocode by ZIP, you are ready to learn how to geocode by address.

Geocoding by Address

Like geocoding by ZIP, geocoding by address assigns longitude and latitude coordinates to the rows in a table. Because this process uses street addresses (rather than ZIP code centroids) to determine the coordinates, it is very useful when you need to display the exact location of a feature on a map. For example, a police department can geocode a database of addresses where recent crimes have occurred, then display the exact crime locations on a map. Similarly, a company can create points from an existing list of customers to monitor customer distribution in a given area.

In this lesson, you'll use the `TABLE | GEOCODE BY ADDRESS` command to perform a short but typical address-matching session. You'll geocode a table containing addresses for several restaurants in Mountain View, California. You'll first process the entire table all at once, then you'll process any unmatched rows one at a time.

Setup

Before you can geocode a table, you need to make sure that the table contains at least two columns for the information that will be added during geocoding. Specifically, there must be a longitude column and a latitude column, and additional columns for any other results you may want added during geocoding, such as match codes, census codes, or standardize codes. You can create these columns using the `TABLE | DEFINE COLUMNS` command prior to geocoding; however, for this exercise, we have created the following columns for you: `LON`, `LAT`, `MATCHCODE`, `TRACT`, and `STNDR`.

To open the table for geocoding:

1. Open the `MTNVIEW.PRJ` project file located in `CAAGISWTUTORIAL`.

Since you'll be making permanent changes to the `MVDINER.DBF` file when you geocode it, you need to save the file under another name to preserve the original data.

2. Choose `FILE | SAVE AS` to pop up the Save As dialog box.
3. Make sure the current directory is `CAAGISWTUTORIAL`.
4. In the *File to Save* list box, choose 'MVDINER.DBF'.
5. In the *File Name* text box, type 'DINERS.DBF'.
6. In the *Description* text box, type 'Mountain View Diners'.
7. Make sure the *Use New File* box is checked.
8. Click OK.

Atlas GIS creates a new table (called `DINERS.DBF`) with data for the restaurants in the Mountain View area, and closes the `MVDINERS.DBF` file.

9. Choose TABLE | GEOCODE BY ADDRESS.

The Geocode By Address dialog box pops up.

The Geocode By Address dialog box contains the following fields and options:

- Table to Geocode:** DINERS:Sites
- Rows to Geocode:** All Rows
- Standardize Addresses
- Match Method:**
 - Address
 - ZIP + 4
 - ZIP + 2
 - ZIP Code
- Relax Options:**
 - Directionals
 - Street Type
 - Street Name
 - House Number
 - ZIP Code
- Address Columns:**
 - Display Name: RESTAURANT
 - Address: ADDRESS
 - Address 2: (none)
 - City: CITY
 - State: STATE
 - ZIP / ZIP+4: ZIP
 - +4: (none)
- Save Standardized Data
- Result Columns:**
 - Standardize Code: (none)
 - Match Code: MA1CHCODE
 - Block Code: (none)
- Offset From Street:**
 - Distance: 50 feet
- Buttons:** Interactive..., Batch, Close

Figure 16.3 Geocode By Address dialog box

10. In the *Table to Geocode* list box, choose DINERS:SITES.
11. In the *Rows to Geocode* list box, choose 'All Rows'.

You want to match all rows, since this table has never been geocoded.

12. Leave *Standardize Addresses* unchecked.

When you place a check in the *Standardize Addresses* box to turn on this feature, Atlas GIS compares the addresses in your table with a postal database. If there were a partially incorrect address in your table, Atlas GIS would correct the address. For the tutorial, however, leave the box unchecked.

13. In the Address Columns group box, set the list box options according to the following table.

OPTION	SETTING
Display Name	RESTAURANT
Address	ADDRESS
Address 2	<None>
City	CITY
State	STATE
ZIP/ZIP+4	ZIP
+4	<None>

Note: You don't have to specify the names of the longitude and latitude columns; Atlas GIS automatically places the coordinates in the LON and LAT columns, respectively.

14. Notice that the *Save Standardized Data* check boxes are dimmed. If Standardize Addresses were turned on, these boxes would let you indicate which columns you want overwritten with the correct data.
15. In the Match Method group box, place a check in the *Address* box and make sure the other options in the group box are unchecked.

This tells Atlas GIS to assign coordinates based on the address only. If you were to check any of the other options, such as ZIP+4, in addition to Address, coordinates would be assigned for the next option you checked (ZIP+4) if the address could not be found.

16. In the Relax Options group box, make sure all of the options are unchecked.

With all of the Relax Options off, Atlas GIS will match exact addresses only. During the first attempt, you want to find an exact match for as many addresses as possible. In the second attempt, you will relax some of the options in order to help match the rows that weren't matched during the first pass.

17. In the Result Columns group box, choose 'MATCHCODE' in the *Match Code* list box.

A match code is a code that is automatically entered into a specified column every time Atlas GIS tries to match an address. This code indicates how a row was matched (exact match, street type incorrect but all else correct, etc.) or why it was not matched. You'll use these match codes later in the lesson to help troubleshoot matching problems.

For the tutorial, we will not choose columns for the standardize code or census code. (Standardize codes are generated only when you turn on Standardize Addresses.) For information on these codes, see the on-line help.

18. In the Offset From Street group box, type '50' in the *Distance* text box.

This number determines how far from the street each address location will be displayed. In this case, the points will display 50 feet back from the street.

Now you need to decide whether Atlas GIS should geocode the entire table in one pass, or process it interactively (i.e., stop at each unmatched address for you to match manually). Typically, a combination of these methods is useful for geocoding a table. For example, on your first pass, geocode the entire table to find as many exact matches as possible. Then on subsequent passes, use the relax options and the match codes that are returned for each row to match the addresses that weren't matched in the first pass.

To geocode the entire table:

1. Click on the Batch button to process the table all at once.

The Geocode By Address Progress dialog box appears and displays a progress bar to indicate what percentage of the rows have been processed. This dialog box also displays the match type, count, match rate, and the number of matched and unmatched records.

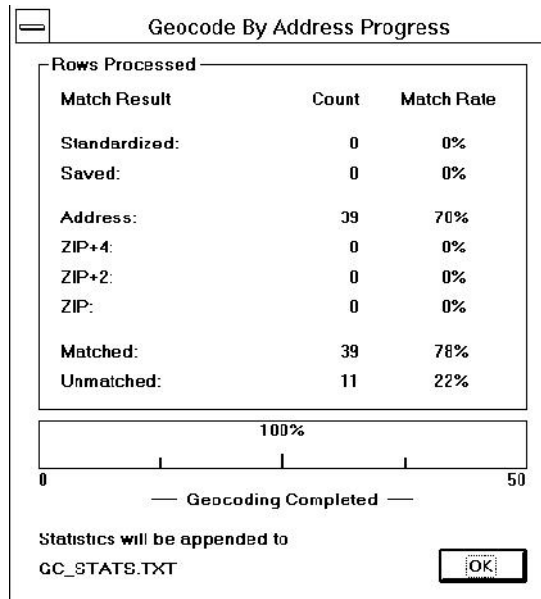


Figure 16.4 Geocode By Address Progress dialog box

2. When 'Geocoding Completed' displays at the bottom of the box, notice that 11 records were unmatched.
3. Click OK to close the Geocode By Address Progress dialog box.

Viewing the Results

After you've completed the first attempt at matching addresses, you can display the matched locations on the map. You can also look at the changes to the point table. In rows that were matched, the longitude and latitude coordinates of the address location are inserted in the LON and LAT columns, respectively. The TRACT and STNDR columns remain blank, because we did not assign the census or standardize codes to them in this exercise. A match code is assigned to the MATCHCODE column in every row; when a row was unmatched, the first character in the MATCHCODE column is '0'.

To view the results:

1. Click on the Close button in the Geocode By Address dialog box.

The map view is redrawn to display the successfully matched addresses.

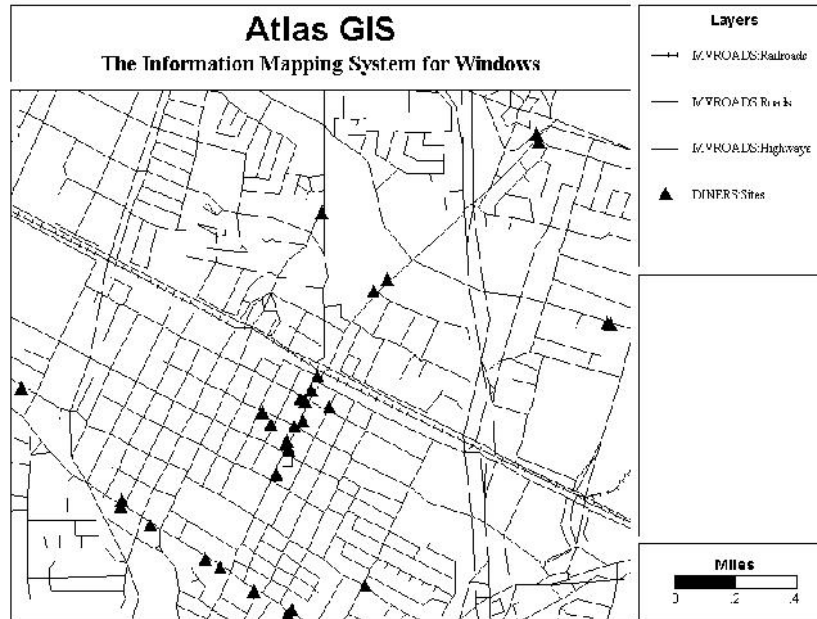


Figure 16.5 **DINERS map after initial pass**

2. Click on the Table button to pop up the Window Layer dialog box, or choose WINDOW | NEW TABLE WINDOW.
3. In the *Layer* list box, choose DINERS:SITES and click OK.

A Table window pops up with the DINERS:SITES point table displayed. Use the horizontal and vertical scroll bars to view the information entered during geocoding.

Select	LON	LAT	RESTAURANT	ADDRESS
	-122.051751	37.385394	Augie's Mug II	779 E. E
	-122.077042	37.395532	Bangkok Spoon	702 Villa
	-122.080506	37.392728	Blue Sky Cafe	336 Brye
	-122.111327	37.402910	Burger King	607 San
	-122.060238	37.397427	Carl's Junior	209 E Mi
	-1.000000	-1.000000	Central Station Bar & Grill	126 Cast
	-122.078437	37.395805	Chef Wang's	212 Cast
	-122.083536	37.385948	China City	855 Wee
	-122.087676	37.387948	Chinese Cookbook	1245 We
	-122.078562	37.392879	Cho's Mandarin Dim Sum	273 Cast
	-122.050662	37.405065	Clubhouse Restau	401 Fair

Figure 16.6 DINERS table after initial pass

As you scroll down through the table, notice that all matched rows have a match code '6' in the MATCHCODE column, and all unmatched rows have a '0'. The match codes that appear in this lesson have the following meanings:

MATCH CODE	DESCRIPTION
0	No match or unresolved multiple match
4	Relaxed street match or user-resolved multiple match
6	Exact match

For the match codes numbers above (0 only if it's an unresolved multiple match), the number is followed by the string 'NHTDS', where the letters have the following meanings:

MATCH CODE	DESCRIPTION
N	Street name
H	House number
T	Street type (avenue, street, drive, etc.)
D	Directional prefix or suffix
S	Street side

If one of letters is upper-case, that part of the address was found. If one of the letters is lower-case, that part of the address was not found. For example, 'NHtDS' would indicate that all parts of the address but the street type were found. The 't' that appears after these characters indicates that the address came from a custom geocoding database.

Finally, if the match code ends in an 'M', the address has more than one possible match (multiple matches). For a complete list of match codes, see "Match Codes" in the on-line help.

Relaxing Address Components

After running the first pass of geocoding with an exact match required for all address components, you may find it necessary to *relax* one or more of the components and try geocoding again. When you relax a component, Atlas GIS looks for alternatives when (and only when) an exact match cannot be found. For example, if Atlas GIS cannot find an exact match for the street name, and the street name component is relaxed, it looks for a close name with a correct number. A close name is a name that sounds similar, such as *Main* and *Maine*. For more information on how address components are affected when relaxed, see "Relax Options" in the on-line help.

To relax an address component:

1. Choose TABLE | GEOCODE BY ADDRESS to pop up the Geocode By Address dialog box.
2. In the *Rows to Geocode* list box, choose 'Unmatched Rows Only'.
3. In the Relax Options group box, place a check in the *Directionals*, *Street Type*, and *Street Name* boxes.

Normally, it's a good strategy to work with only one option at a time. For example, you could relax the directionals and do a batch run, then relax the street type and do a batch run, and so forth. To make the exercise shorter, however, you'll relax all three at once.

4. Click on the Batch button.

The Geocode By Address Progress dialog box pops up and displays the geocoding progress.

During this second pass, Atlas GIS tries again to match any row that is currently unmatched (that is, any row with LON and LAT columns that are blank or have 0 or -1). With the directional, street type, and street name components relaxed, Atlas GIS looks for a street segment where the street number is an exact match, and the rest are close matches. When there is more than one possible match for a row, you will view the possible matches and select the correct address when you use the Interactive feature in the next exercise.

5. When the Geocode By Address Progress dialog box displays 'Geocoding Completed', click OK.

Retrying Individual Matches

Although relaxing address components helps match some of the addresses, it may also lead to either multiple matches or incorrect matches. Therefore, you may find it necessary in some cases to edit the unmatched rows manually.

In the previous steps, you performed a batch matching with several address components relaxed. While many addresses were matched, you still have three that are unmatched. You will now use the Interactive feature to geocode these addresses.

To geocode one address at a time:

1. In the Geocode By Address dialog box, click on the Interactive button.

Atlas GIS processes for a few seconds, then pops up the Geocode Multiple Match dialog box.

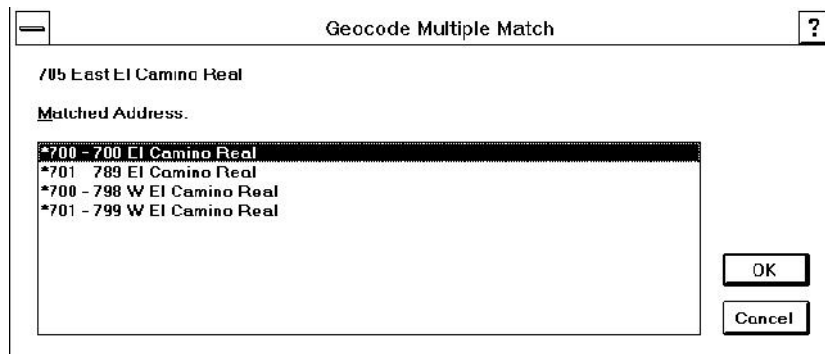


Figure 16.7 **Geocode Multiple Match dialog box**

This dialog box appears when there is more than one possible match. The unmatched address, '705 East El Camino Real', appears in the upper-left corner of the dialog box. The *Matched Address* list box below displays the possible matches.

Let's assume that the correct address is '705 El Camino Real'. Notice that there are two possible matches for El Camino Real: one beginning with 700, and one beginning with 701. The reason there are two within the same range is that one contains the even-numbered addresses, whereas the other contains the odd numbers. This is an important distinction, because the choice you make here will determine the side of the street on which the point appears.

2. In the *Matched Address* list box, choose '701-789 El Camino Real' and click OK.

The Geocode Multiple Match dialog box closes, and the Geocode By Address Interactive dialog box pops up, displaying the row you just matched.

☰
?
Geocode By Address Interactive

Current Address

RESTAURANT:

Address:

City: State:

ZIP / ZIP+4: +4:

Match Results

Standardize Code: NA (Standardization disabled)

Match Code: 4NHTrdS1M (Revised address match)

Address: 700 - 700 El Camino Real

ZIP Code: 94040

Block Code: 06/085/5091.05/207

Longitude or X: 122° 3'52.97"W Current Row: 1

Latitude or Y: 37°22'38.94"N Total Rows: 3

Figure 16.8 **Geocode By Address Interactive dialog box**

3. Click OK—Next Error.

Atlas GIS processes briefly, then takes you back to the Geocode By Address Interactive dialog box and displays the next unmatched address. The Geocode Multiple Match dialog box appears only if there is more than one possible match; in this case, it found no matches at all, so you went directly to the Geocode By Address Interactive dialog box.

Notice that the address is '100 City Hall'. City Hall is not a street but the name of a common building. The geocoding database does not recognize common buildings; it requires a street address. In this case, City Hall is on Castro Street. (To teach Atlas GIS to recognize certain addresses like City Hall, see "Translation Files" under TABLE | GEOCODE BY ADDRESS in the *Reference Manual*.)

4. In the Current Address group box, highlight 'City Hall' in the *Address* text box and type 'Castro Street'.

Notice that when you highlight text on the screen, the text you type overwrites it.

5. Click on the Retry button.

In the Match Results group box, notice that ‘Exact address match’ now displays in the parentheses next to the match code.

Note: Retry uses the same relax options you specified in the Geocode By Address dialog box, whereas Retry Relaxed would relax all of the address components.

6. Click OK—Next Error.

The Geocode By Address Progress dialog box displays, then the Geocode Multiple Match dialog box pops up, displaying the possible matches for the address ‘103 Dana’.

Let’s assume the correct street directional is *East* Dana. As before, you are given two options for a similar range of addresses; in this case, you want the one containing odd-numbered addresses.

7. Highlight ‘101-131 E Dana’ and click OK.

That was the last unmatched row. You are now back at the Geocode By Address Progress dialog box, where it displays ‘Geocoding Completed’.

8. Click OK.

Atlas GIS closes both the Geocode By Address Progress dialog box and the Geocode By Address Interactive dialog box, then takes you back to the Geocode By Address dialog box.

9. Click on the Close button.

Congratulations! You’ve finished your first geocoding session. The Table window is still open, and the map in the background redraws to display the points. Since the table is now a point table, you may use it to display, query, perform analytical operations, and create theme maps of the addresses just as you would with other map features. You can also manipulate the way in which the points are displayed, just as you can with any other layer in a map.