Address Matching ArcView 3.1
An Instructional Lesson

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Introduction

Successful integration of various information types is necessary for effective GIS (Geographic Information Systems) analysis. Take for example a company that needs to display potential customers and competitors for a relocation decision. There are two ways to digitally create such a map: (1) manually digitizing the locations onto a digital map of Charlottesville, or (2) address matching. **Address matching** is process of referencing a database of addresses with geographic coordinates through **geocoding**.

This step-by-step lesson will teach you how to successfully perform address matching using ArcView 3.1. First, you will learn the basic principles of address matching, identifying all the necessary components. In the next section, learn how to prepare, match and re-match addresses. Changes in data are covered in the last section, in addition to an example final output. Within all sections you will find examples and various ArcView windows that are commonly seen during address matching. If you need any further assistance, notify the information desk in the Geostat Center in Alderman Library.

What You Need To Get Started

To begin, you will need:

- Table of addresses
- Shapefile containing the street network for the study area

Table of Addresses

After identifying the addresses that need to be matched for your project, find an associated table of addresses. An address table related your particular project may already exist. Make sure that the table adheres to the format guidelines listed below. If there is no existing table, you can create your own table using Excel.

Format Guidelines

Inside an Excel spreadsheet, begin by creating a separate column label for each location* field (street address, city, state, and zip). Next, enter each address, with one address per line. The street address should contain the address number + street name, in addition to street type and any suffixes. For example, "1581 Main St. N.W." should all be within one cell. ArcView will recognize intersections of roads using an ampersand (&) to describe the intersection, such as "15th St. & Page St." Also include any other attributes needed to describe the project. For instance, information on gross sales, soil compositions, and population figures should all be placed in separate, labeled columns. When you are finished, the table of addresses must be one of the following two formats:

1) An ASCII text file with comma delimited field values and header row of field names
2) A dbase file (.dbf)

The dbase file format is most commonly used in ArcView and can be created through an existing Excel spreadsheet.

Converting Excel Tables (.xls) to dBase Format (.dbf)

To convert the address spreadsheet to a dbase file format:

- Open your Excel file (.xls) of addresses
- Highlight all cells to be converted
- Go to File > Save As, and choose the dbase IV format.

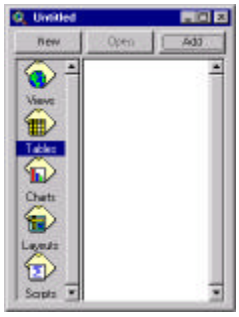
A window explaining that information may be lost in the conversion will appear, click OK.

* Depending on your project, you may not need (or not be able to find) the entire address, which is acceptable in ArcView 3.1.

Importing dBase Address Tables into ArcView

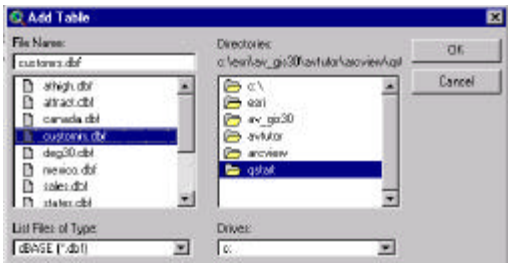
To **Import** a table into ArcView 3.1:

- Start ArcView 3.1



- In the Untitled window, click once on the Tables icon, then select Add

- In the Add Table window, select your file



You have now added your table to your ArcView project and are ready to proceed. Here is an example table of addresses (.dbf format) in ArcView 3.1.

food.dbf

Name	Address	Zip	Type	Sales
Ace Market	1171 PIEDMONT AVE NE	30309	Store	59811.70
Andrew's Gasoline	1670 W PEACHTREE ST NE	30309	Service Station	10843.39
AP Supermarket	455 BEVERLY RD NE	30309	Store	160910.57
Atlanta Market	241 18TH ST NW	30318	Store	55718.99
Beans and Stuff	1233 PEACHTREE ST NE	30309	Cafe	73425.10
Big Sky Groceries	360 FORTUNE ST NE	30312	Store	47896.30
Breakfast in Atlanta	151 ALABAMA ST SW	30303	Restaurant	33958.89
Bud's Gas Station	200 CORLEY ST NE	30312	Service Station	29888.17
Camp Service Station	169 HUNNICUTT ST NW	30313	Service Station	34219.39
Central Petroleum	1100 CENTER ST NW	30318	Service Station	55130.41
Charlie Cola Inc.	400 EIGHTH ST NW	30318	Restaurant	45468.80
City Food Market	501 ETHEL ST NW	30318	Store	55686.90
Clarenty's	421 SPRING ST NW	30308	Store	55305.93
Crossroads Theater	120 MEMORIAL DR SE	30312	Movie Theater	30117.70
Damar Sales	388 7TH ST NE	30308	Service Station	55518.01
Dan's Taco Emporium	1032 CENTER ST NW	30318	Restaurant	55243.43
Daryl's Market	1001 CENTER ST NW	30219	Store	55369.80
Dream Ice Cream	77 MILLS ST NW	30308	Restaurant	55260.50
Eastern Express	150 6TH ST NE	30308	Cafe	55574.15
Flashin the Pan	101 BAKER ST NW	30309	Restaurant	54649.80

An example table of addresses in dbase (.dbf) format imported into ArcView3.1

Street Network Theme

Theory of Geocoding

To geocode the addresses in your table, you need geographic data composed of indexed street segments. The area of interest must be contained within this theme. In other words, you cannot match Charlottesville addresses with a Chicago street network theme. A finite range of addresses found on a street plus its street name indexes each street in the interested area. In ArcView, a theme stores this indexed information. When matching addresses, ArcView first goes to the

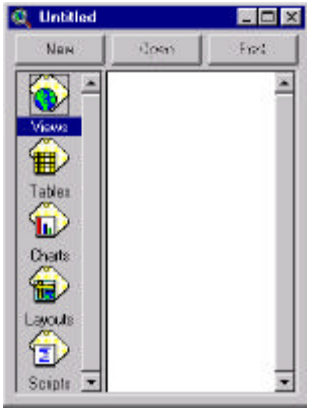
specified theme, then locates all the segments with the given street name. Next, ArcView locates the address range that contains the given address. Within this street segment, ArcView calculates the fractional location of the given address based on the address range and then places a marker on that position. Therefore, address matching is the approximation of where an address falls into a given numerical range.

Where to Find Themes

The Geostat Center has a wide variety of geographic data ready to use in address matching. The street network theme you choose will most likely be from TIGER census data. If not, please consult Geostat to make sure your file is acceptable for geocoding. There are ways to cover the entire U.S. within one street network theme. One way is to use the StreetMap* extension in ArcView 3.1.

Importing Themes

To **Import** a theme into ArcView 3.1:

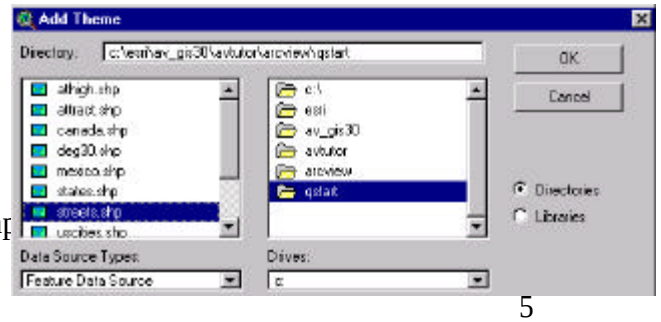


- In the Untitled window, click once on the Views icon, then select New

A new window named View1 will appear.

- Go to View>Add Theme in the top menu bar or select 

In the **Add Theme** window, select the .shp file containing the specific street network

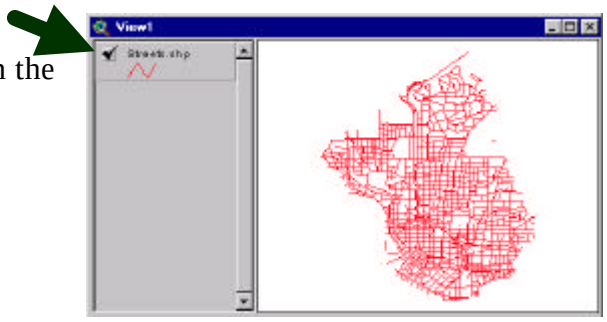


* Please see the guide "Address Matching Using StreetMap

Your street network theme has now been added to your project.

To **Display** this theme:

- Select the small box to the left your theme in the Legend of View1.



Your street network theme should now appear in the View1 window. Each theme has an associated attribute table. Below is an example attribute table of a street network theme (.shp) when opened in ArcView3.1**.**

To open your street network theme table (not necessary for address matching, but as a check of your data):

- Go to Theme>Table in the top menu bar or select 

Attributes of Streets.shp

Shape	Fnode_	Tnode_	Lpoly_	Rpoly_	Length	Streets_	Streets_id	L_f_add	L_t_add	R_f_add	R_t_add	Fgnd	Pre_fgnd	Fname	Ftype	Ftnode
PolyLine	10254	10220	2935	2916	0.001	1	5995576	0	0	0	0			85		
PolyLine	10364	10377	2957	2977	0.001	2	5995566	186	186	187	187			LITTLE JOHN	TRL	NE
PolyLine	10414	10254	2936	2929	0.007	3	5995571	0	0	0	0			85		
PolyLine	10445	10364	2957	2977	0.002	4	5995564	176	184	177	185			LITTLE JOHN	TRL	NE
PolyLine	10445	10463	3012	2957	0.001	5	5995568	1768	1808	1769	1809			FRIAR TUCK	RD	NE
PolyLine	10377	10498	2957	2977	0.002	6	5995565	189	200	189	201			LITTLE JOHN	TRL	NE
PolyLine	10498	10445	3012	2977	0.003	7	5995562	1724	1786	1723	1767			FRIAR TUCK	RD	NE
PolyLine	10510	10463	3024	3012	0.001	8	5995557	1725	1754	1725	1755			DONCASTER	DR	NE
PolyLine	10525	10463	2957	3024	0.002	9	5995556	1753	1799	1752	1798			BARNESDALE	WAY	NE

An example street network theme attribute table in ArcView 3.1

Here is an example of an UNACCEPTABLE street network theme. Although the theme consists of street line segments, there are no left and right address ranges. Also, there are indexes yet no street names. ArcView cannot perform address matching without street names and/or referenced address ranges.

Attributes of Hwym.shp

Shape	Hwy_	Hwy_id	Hwy	Arclength	Measure1m	Lowmeasure	Highmeasur	Firstarcid	Lastarcid	Numarcsin
PolyLineM	1	2	1	49144.246	3057.290	0.000	3057.290	1	99	89
PolyLineM	2	51	2	41084.219	2554.413	0.000	2554.413	90	162	73
PolyLineM	3	11	3	24549.643	1533.000	0.000	1533.000	163	189	27
PolyLineM	4	3	4	46612.293	2930.040	24.960	2955.000	190	279	90
PolyLineM	5	20	5	4587.898	205.362	0.000	205.362	280	287	8
PolyLineM	6	9	6	29660.648	1863.000	0.000	1863.000	288	331	44
PolyLineM	7	17	7	11589.801	726.000	0.000	726.000	332	353	22
PolyLineM	8	12	8	13183.041	824.000	0.000	824.000	354	379	26
PolyLineM	9	13	9	22707.748	1410.000	0.000	1410.000	380	404	25
PolyLineM	10	8	10	15695.810	972.000	0.000	972.000	405	455	51
PolyLineM	11	1	11	53390.820	3318.000	0.000	3318.000	456	574	119

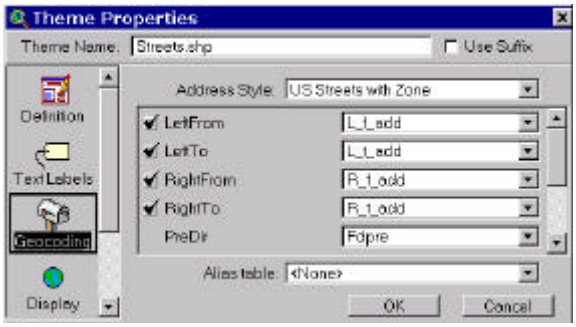
An example of an unacceptable street network theme attribute table in ArcView 3.1

Address Matching

Geocoding

Building the Geocoding Index

After adding the appropriate address table and street network theme to your project, you are now ready to geocode the addresses. Make sure that the street network theme is active. When active, the theme name should appear raised in the legend. To activate a theme, click once on the theme name in the legend of View1.



To **Geocode** a theme:

- Go to Theme>Properties at the top menu bar
- Select Geocoding from the left menu bar in the Theme Properties window

This window establishes the street network theme address format. Address Style controls the type of address match. The default, US Streets w/ Zone, will match addressing using the street address and zip code. Thus, **zip code must be included** in the address table.

To change the type of address match, select the format using the scroll down arrow. Make sure that your address table at least includes the fields necessary for the address style you have selected. Alias Table (not necessary) allows you to attach a table containing alternate names for streets and addresses. An example alias table would look like:

Route 66 = Main St.

Grant Park = 2702 State St.

The remaining entries in the window confirm the field names in the street network theme, and need not be changed except for corrections.

- Choose **OK**.

The Building Geocoding Index window appears, confirming the address style format.

- Select **YES**.

Linking the Address Table to the Street Network Theme

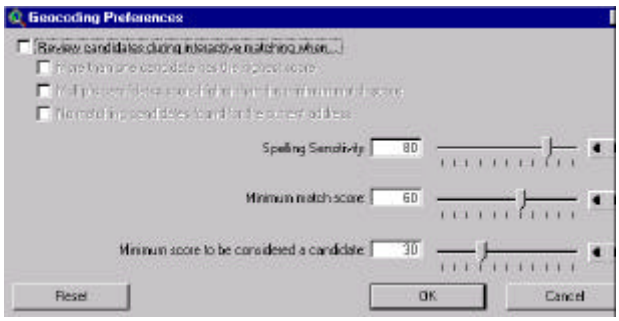
- Go back to View1. Make sure that the street network theme is still active.
- Select View>Geocode Address from the top menu bar.

The Geocode Addresses window appears. The Reference Theme entry is the name of the street network theme to which you are geocoding. Join Field should remain at <none>. If you would like to change the type of address match, select the Change Address Style button.

- To link your table of addresses to the street theme, select  at the right of Address Table, or type the path directly into the window. Make sure that the following windows (Address Field, Zone Field, etc.) are correct.

The Display Field window controls the field to be used for display purposes with the mouse. The default name for your address locations is c:\temp\geocd1.shp. Change the directory path and/or theme name in the Geocode Theme window.

The Geocoding Preferences button regulates the sensitivity to spelling for the matches. To increase the likelihood of the match, decrease one of the scales: spelling sensitivity, minimum match score, or minimum candidate score. Note that setting lower sensitivities can possibly introduce greater error in your analysis, even though the likelihood of matches would increase.



Matching

Using Batch Match

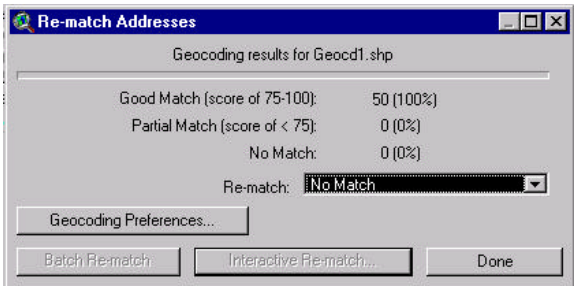
To match all addresses in your address table **at once**,

- Click on Batch Match (Geocoding Addresses window)

Ususally, a batch match is suggested in order to save time by matching the majority of matchable addresses at one time. Interactive Match is used for address tables that require special attention and accuracy, matching each address individually.

After selecting the batch match button, ArcView matches the addresses in the address table to the geocoded coordinates, placing a marker (a small dot by default) at the appropriate location.

Depending on the size of your table, this will take a few moments to complete. When finished, a Re-match Addresses window displaying the results of the geocoding will appear. This window displays the matching scores for addresses that were fully matched, partially matched, or not matched at all. The match score is a number (0-100) based on: (1) street name spelling (2) street address falling within the address range. Thus, a full match is an address that is spelled exactly like a street name in the street theme and has its street address number within the address range given in the street network theme. Good matches are scores from 75-100. If the street name is mispelled, the address could be a partial match (score less than 75) or remain umatched, depending on the degree of the misspelled street name. An addresses that is not similar in spelling to any street names, or an address that does not fall within the specified address ranges of the street is considered a no match (0 score).

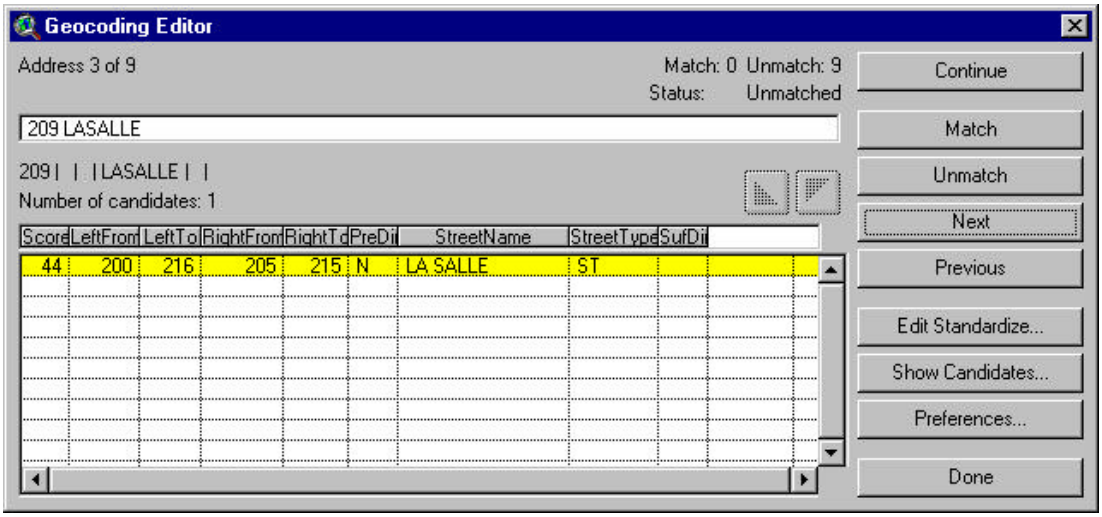


❖ If all addressess were fully matched, select done. **The Address Matching process is now complete.**

❖ If you have partial matches or no matches, you can either select done, then recheck your address table for errors or select Interactive Re-match.

Using Interactive Re-match

Use Interactive Re-match to re-match partial matches or addresses that did not get matched. After selecting the Interactive Re-Match button, the Geocoding Editor window appears. Each address is displayed on the main line, separately. Potential candidates are shown below the main line. At the left of each candidate is the matching score based upon similarity in address, street name, street type, etc.



The primary matching criterion is street address, so if you have 457 East Main St, but there isn t any 457 on East Main St., ArcView will miss the match altogether. Depending on the level of accuracy needed for your project, you can "force" a match. If you know the street name is right, you can adjust the block number until a match is found. In the case above, the problem seems to be that the address did not have a street type or suffix given. Furthermore LaSalle is written as La Salle (with a space) in the street database. If you think it reasonable that the possible match given is in fact the match for this address, click Match. If you're not confident of this, go on to the next one

by clicking Next or back by clicking Previous. If your address was matched to what you believe to be the wrong address click Unmatch. Select the Edit Standardize button to manually type in changes. Show Candidates will display the new potential matches after any changes. The Preferences button controls the spelling sensitivity of the match.

Finished Product

When satisfied with the matches, press the Done button. ArcView then creates a new shapefile theme for the matches. When you return to View1, the new theme of addresses will present in the legend (default name is geocd1.shp). To display, click on the small box next to the theme name in the Legend. If necessary, the view is now ready to be printed or exported.

Changes in Spatial Data

You have now successfully taken a file of locations and linked it to a spatial network of geocoded streets. This linked information is now fixed. If there are any geographically related changes (additional addresses, new streets, etc) that come up, the address matching process (start with Building the Geocoding Index) must be repeated.

Changing Non-spatial Data

To make alterations of non-spatial (sales figures, population estimates, etc) attributes:

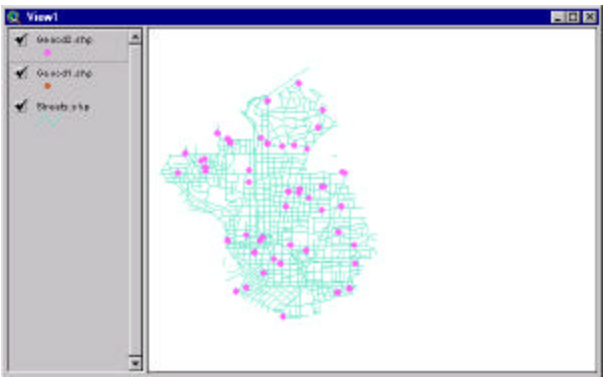
- Activate the new theme (double click on the theme name in the legend)
- Open the table by double clicking 
- Choose **Table> Start Editing**

Edit your table as necessary. When you are finished,

- Choose Table>Stop Editing

A window will ask you to save edits, select Yes.

Hopefully, your final view looks something like this:



An example of a final view of matched addresses.

Additional Resources

For further help, look to:

- Chapter 26 of *Getting to Know ArcView Gis* published by ESRI (1997)
- Chapter 2, of *Inside ArcView GIS* by Scott Hutchinson and Larry Daniel (1997)

Both books are available in the Geostat Reference section.

Good Luck!