UC Santa Barbara
GIS Core Curriculum for Technical Programs (1997-1999)

Title
Unit 46: Address Matching

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Publication Date
1998

Peer reviewed

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Unit 46: Address Matching

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Context:

Address matching allows the user to convert postal addresses and/or zip codes to geographic coordinates, create a new data layer containing these points, and display the information on a map. Three components are necessary to complete the address matching process: a geographic base file (GBF), a table containing address information, and a computer software package that performs the conversion. Address geocoding functionality is available in most geographic information system (GIS) software packages. The resultant new point data layer can subsequently be used to analyze spatial patterns.

The following examples are typical problems where address geocoding can be applied. Often, just visualizing the information on a map is enough to answer the questions. However, the geocoding process is frequently a preliminary step used in preparing the information for further spatial analysis.

Example Applications

1. **Medical**

You work in the MIS division of a health maintenance organization (HMO) which has recently received several complaints from participants. Waiting time to get an doctor's appointment is excessive and patients must travel too far when they need to see a specialist. Several participating companies are considering switching to another health care service. In order to retain these organizations, your senior management has asked you to evaluate where to increase physician coverage and how to improve service.

You maintain several databases, including information on participating companies, individuals, physicians, and local hospital and diagnostic facilities. It is hard to visualize where patients live, or where doctors and facilities are located by sorting and studying these databases. Fortunately, all the databases include a field containing address information.

The first task is to convert those addresses to points on a map using address geocoding. You will need to obtain a geographic base file, probably from a commercial vendor. Using the GBF and your databases, you now create new point data layers which show the distribution of patients, physicians, hospitals and diagnostic centers. You will then need to know where other doctors not currently in your HMO are located. You can purchase this information from several vendors using the standard industrial classification (SIC) for the type of doctors you need, and add the layer to your analysis. Finally you will use other GIS capabilities to determine where to recruit additional physicians.

2. **Local Government**

Each day, citizens and builders come into your department to obtain building permits. Your supervisor wants a monthly report describing the number, type and distribution of permits throughout the county. Until now, you have provided some charts that show the volume of permits according to type (room additions, driveway repair, swimming pool, deck, etc.) and by requester. You have located the permits using a push pin on a paper map. Your county has experienced a rapid increase in the number of permits requested and it is taking you a full day each month to create your map. There must be an easier way! Address geocoding will allow you to locate each permit by using the work site address in your permits database and the street centerline file (the GBF) that your county's mapping division has just completed. You can now make several maps. For example, you can provide a map showing all permits for the month, reclassify the information by permit type or requester, and show change from one month to the next using historical information.

3. **Distribution**

You work for a specialty attire company. Your product is very popular in large metropolitan areas throughout the United States, particularly in the west and south. You currently have two distribution centers, one in the east and one in the west. The stores that carry your attire in the west are complaining that your product is not arriving on time. Your western distribution center is overwhelmed and is not capable of completing all the delivery orders. Clearly, you need an additional distribution center. Your task is to choose the correct location. Location analysis is a complicated process and involves many GIS operations. Geographic information you must consider includes, but is not limited to: local zoning, supplier location, means of delivery (both how you receive and how you send out your goods), and customer location. To map your customer locations you will use address geocoding using your customer database and an available geographic base file. This base file can be a zip code, zip+4, TIGER or TIGER derivative file that you purchase. The points representing your customers will then be considered in the geographic analysis when locating your new distribution center.

4. **Marketing**

You work for a national computer chain in the direct mail department. You send out a mass mailing once a month advertising sales. Rather than sending out just one generic mailing, you want to develop advertisements that will appeal to the postal patron. For several months your company has been asking customers for their zip code when they make a purchase as part of a "market survey to determine where to place new stores". The company now has a large

database that includes everything that was purchased. You can map this information using address geocoding and then reclassify and sort the data to show spatial patterns. For this problem, you need your database and a zip code geographic base file. Once you see the map, it will help you know what products are selling in a specific area. You can then advertise complementary products and increase your sales.

Learning Outcomes

The following list describes the expected skills that students should master for each level of training i.e., Awareness/Competency/Mastery.

Awareness:

The learning goals are to identify sources and to develop a working knowledge of the three components necessary to complete the geocoding process: the geographic base file, the address file and the software. (Suggested time: one 50 minute unit)

Competency:

The learning goals are to define and evaluate appropriate base files, understand the importance of standardized address files, bring the necessary files into a software package, perform the geocoding process, and visualize the results. (Suggested time: one 50 minute unit and one 50 minute lab)

Mastery:

The learning goals are to effectively evaluate the accuracy of both base files and address files, standardize address files, evaluate non-matches, understand the rematch process, and perform a basic reclassification analysis using attribute information provided in the address file. (Suggested time: one 50 minute unit)

Preparatory Units:

Recommended Units:

Unit 1 Data acquisition

Unit 2 Demographic data

Unit 19 Planning a tabular database

Unit 21 Using spreadsheets

Unit 30 Validating databases

Unit 31 Managing database files

Highly recommended background for instructor

Unit 016 NCGIA Core Curriculum in GIScience: Discrete Georeferencing

Complementary Units:

Unit 7 Metadata

Unit 47 Visualization

Awareness

Learning Objectives:

- Identify sources of geographic base (reference) files.
- Identify sources of address files.
- Determine address geocoding applications.
- Evaluate desktop mapping software.
- Understand the components of address geocoding.

Topics:

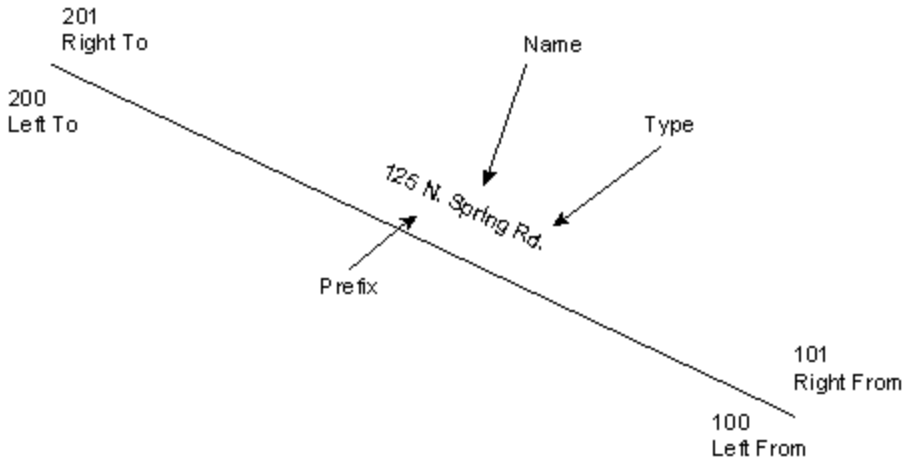
1. Identify sources of geographic base (reference) files

- Government sources
    - TIGER: U.S. Bureau of the Census
        - Available on CD, from libraries, on-line (Census Tiger Files)
        - Must be converted to appropriate software format
        - Line files that are organized by county and contain:
            Roads, railroads, rivers
            Census statistical boundaries
            Political boundaries
            Metropolitan address ranges and zip codes for streets
    - Local government: County mapping organizations
        - Normally only available in the format supported by the county
        - Requires conversion to appropriate software format

- Data vendors
  - Can be purchased from a variety of vendors
  - Enhanced TIGER files
  - May be more accurate and up-to-date (location and attribute)
  - Converted to specific software format

(full image)

Example of enhanced tiger format (Note: the address is separated into several fields)



Graphic 1: Example of a GBF road: inset

2. Identify sources of Address files

- Any organizational data base that contains a field with address information

  i.e., customer records, permit sites, crime locations, school children, store locations, disease outbreaks

(full image)

Example of an address file (Note: The address is in one file)

- Can be purchased address files, usually collected through yellow pages entries

i.e., fast food restaurants, hospitals, child care centers, competitor's locations

- Available on-line, on CDROM (Unit 016 NCGIA Core Curriculum in GeoScience, section 5.1.1)

3. Determine address geocoding applications

- Identifying location
  i.e., customers, competitors, permits, crimes, fires, available real estate
- Siting facilities
  i.e., existing distribution centers, health care providers, service facilities
- Determining patterns:
  i.e., fires near schools, potential customers not served by a store
- Delivery:
  i.e., mail, mass mailing, goods, services
- Market analysis
  i.e., location of competitors
- Anytime the location cannot be directly georeferenced

4. Evaluating desktop software

- Most desktop packages have address matching capabilities
- Some packages come with geographic base files
- Software must incorporate the capability to:
  - Be tolerant of errors in address files
  - Allow for consideration and review of "almost" matches
  - Provide for changing the

    Matching rules

    Data tables

    Cut-off thresholds

- Operate in both sequential batch and single event modes

5. Understand the components of address geocoding

- Reference Files (Geographic Base Files (GBF))

  i.e., street network, zip codes

- Table of addresses and other attribute information

  i.e., crime data, customers, store locations

- Software

Competency

Learning Objectives:

- Evaluate appropriate reference files.
- Evaluate address files for completeness and standardization.
- Perform address matching operations.
- Perform visual analysis of resulting point data layers.
- Practical Exercise: geocoding.

Topics:

1. Evaluate appropriate reference files

- Detail and accuracy of the address file
  - Contains full address or just zip code information?
  - Contains direction information (i.e., N. Main St. or Main St.)?
- Range of detail in reference files
  - Single field

    i.e., zip code, address all in one field, zip+4

- Single house with range

  i.e., house number, range along a street, no information on what is on the left or right side of the street

- U.S. streets with zones

  i.e., house, range along a street, information on what is on the left or right side of the street

(full image)

Example of zip code base file

(full image)

Example of US Streets base file

- Determine geographic extent of the application
  - Local, regional or national
  - More detailed reference files cost more to acquire

    Ask: Does application support increased resolution of the reference file?
    (i.e. rural routes should not use street style addresses)
- Successful implementation requires
  - Careful data preparation
  - Selecting the appropriate geocoding preferences in the geographic base file used to match to the address file

2. Evaluate address file for completeness and standardization
   - Addresses provide information about the location of an event or an incident
   - Usually collected without regard to standard format: no standard method for

identifying features

i.e., Ave., Avenue, Av all stand for the same feature type
Direction sometimes a suffix, sometimes a prefix

- Often contain errors and omissions

i.e., Spelling errors, duplicate records, data base not up to date
i.e., Phonetic errors, transpositions, random letter insertion, character deletion or replacement

- Files can be commercially standardized using U.S. Postal Service format

- The more complete and standardized the address file, the more successful the address matching process

3. Perform address matching operations

- Prepare the data

  - Identify the base and address files

  - Define the address style

(full image)

Example of US Streets address style (Note: Some fields are required, others are optional but may provide a higher match success rate if used to index the base file)

(full image)

Example of address file

- Define matching strategies for reference and address files

What fields need to be indexed?

What fields will be matched?

What is a match?

What about errors?

- Standardize the base and address files
- Prepare the base file: Separate data into individual fields and standardize abbreviations (this is usually done by the data provider)
- Index

(full image)

Example of defining the index process

- Prepare the Address Table by separating the data into individual fields and sorting (this is done by the software)

- Match the address file to the GBF

  - Set up the match process by identifying how the address file will link to the base reference file by defining the comparison methods (this is done by the software based on the parameters you have set)

    - Compares the address file to the base reference file field by field

      i.e., prefix direction, prefix type, street type, suffix direction

    - Compares the address character-by-character

      i.e., Main compared to Maine

    - Specify probabilities to compute matching score

(full image)

Example of setting the matching parameters (Note: In this ArcView example you 1) identify the GBF; 2) identify the address file and address field; and, 3) set the comparison preferences.)

- Perform the match

  - Software scores how close a match is found
  - Interpolates along the street network to determine the address location

(full image)

Example of how the software compare the address file to the base reference file (Note: The software determines possible matches to the address file in the GBF and picks the best match based on the parameters set.)

- Create the new geographic data layer containing one point for each address found

4. Perform visual analysis of resulting point data layers

- Display the resulting geographic point data layer

- Relate new information to other pieces of information

5. Practical Exercise: Geocoding

Address geocoding capabilities are available in most desktop packages. This exercise uses ArcView Version 3.0a. The data sets and an ArcView project for the exercise can be downloaded *[link removed]*. They are in ArcView shapefile.

You work for the Office of Economic Development in San Antonio, Texas, and are doing a market survey to determine how many aircraft manufacturing facilities are in San Antonio, and where they are located. You want to use address geocoding to create a map of the facilities. The three steps you will take are to:

1) prepare the data;
2) match the addresses; and,
3) display the results.

Prepare the data: You obtain the addresses of manufacturing plants through the electronic yellow pages *[outdated link removed]*. You create a database containing this information and obtain a geographic base reference file from a local data provider. Your third piece of information is the location of airfields within the San Antonio area. You open your GIS desktop software package and add your database (the aircraft manufacturers) plus the two geographic data layers (airports and streets).
(Example of how this view may look.)

You are now ready to index the geographic base file so the software can compare the information in the aircraft manufacturers address table to your geographic base file (streets). Let's take the case of Zee Systems, Inc., which

has an office at 406 West Rhapsody Drive. The software will take the address from the database. It will then look for all the Rhapsody Drive street segments in the geographic base file (see example). Using the match rules you set up, it will exclude any streets that are on East Rhapsody, identify the segment going from 306 to 598 West Rhapsody, and interpolate that the office is about 2/3 of the way down the street the right side. (see example) Once the match is identified, a new record is added to your point data layer of aircraft manufacturing facilities and the results are displayed on your map.

In order for the software to make this comparison between a geographic data layer and address table, you must complete several steps. The first step is to determine the type of base file you have. In this example, you are using a US Streets formatted file. When using US street format, your database must contain fields holding the left address from, left address to, right address from, right address to, and street name. Optional fields can contain the street type, prefix or suffix and direction. (see example). Notice that the necessary fields are available. This database is complicated by having two direction fields (prefix and suffix). You can specify both when setting up the index parameters. In ArcView, you need to set the Theme Preferences to recognize that the data layer contains US Street information. Once you set the preferences, the software asks you to build the index. The indexing process allows the software to make the comparison between the geographic base layer and the address file.

Match the addresses: You are now ready to geocode your manufacturers table. You set up the link between the geographic base file and the address field in the manufacturers table. In ArcView, you will choose View, Geocode Addresses (see example) and set up the relationship (see example). Your reference theme is the geographic base file (streets). You have already set the type of base file you are using to US Streets. Aircraft Manufacturer is the address table; you must tell the software you will use Address as the address field. You must also create a new file that will contain the point where each manufacturer is located. When you choose to match the two databases, the software takes the first record in the address table and tries to find the appropriate street (see example). It moves through each record and identifies which records are matched and which do not (see example). Notice that 73% of the address records were matched. In this example, do not worry about non-matches.

Display the results: The software now creates the new point data layer containing the aircraft manufacturing companies (see results). You can see that the manufacturing facilities are clustered around San Antonio International Airport and Kelly Air Force Base.

Mastery

Learning Objectives:

- Determine potential problems with address and reference files.
- Complete the matching process including
    - Evaluating non-matched records
    - Editing a reference file
    - Standardizing an address table
- Practical exercise: the rematch process.
- Practical exercise: creating a map using attribute information.

Topics:

1. Determine potential problems with address and reference files

- Overall problems
    - Geocoding is based on assumptions
    - addresses are in a range and equally spaced along the range
    - odd numbers are on one side of the street and evens on the other
    - places have addresses

        i.e., The White House is 1600 Pennsylvania Ave

- Base file
    - Not current: i.e., streets not in file
    - Inaccurate locations
    - Incorrect or unidentified streets
    - Incorrect or unidentified address ranges
    - Inconsistent attribution i.e., I10 is also McArthur Freeway
- Address file
    - Incomplete
    - Inaccurate
    - Not standardized
- Preferences
    - Spelling sensitivity set too high or low
    - Score to be considered is too high or low

2. Complete the matching process

- Evaluate non-matched to determine the problem
- GBF file
  - Increase geographic area covered
  - Add new developments
- Address file
  - Standardize
- Preferences
  - Adjust index search (blocking rules)
  - Adjust matching weights (how close a match is necessary)
  - Adjust minimum score to be considered a match

3. Practical exercise: the rematch process

In the previous example, 73% of the address file was matched to a geographic location in the GBF. Based on the initial parameters, there was one partial match and three addresses that did not match. The rematch process allows you to evaluate why the record did not match, fix any problems, and find more matches. Non-matched records are caused by:

incorrect or incomplete address file records,
errors or omissions in the geographic base file, or
by setting the preferences incorrectly for the data being matched.

Incorrect or incomplete address file records: In the previous example, the address "10823 Northeast Entrance R" scored as a 62% match. When you look at the record compared to the GBF file, it looks like you have found a match. (see example) The software does not recognize "R" as "Road", and when the record is parsed it identifies the street name as "Entrance R" and does not identify a street type. You need to fix the incorrect address record to be "Rd" or "Road" and a match will be found. In this ArcView example, you can click on the match button to interactively match the record to the GBF.

Let's look at the unmatched records. (see example) The Alcor Aviation record is an example of an incomplete address. Colwick Street has no street number. Once a street number is entered into the database, you can rematch the record and find a match. Alternatively, you can locate Colwick interactively, see that it is a small street near the airport, and interpolate the point location. (see example)

Errors or omissions in the geographic base file: The other two unmatched records appear to have adequate addresses. (see example) The next step is to evaluate the GBF file. You can sort the street database to show all the streets named "410". (see example) Several problems become evident. Notice that the name is inconsistent and there are no address ranges. What other problems do

you see?

Finally find all the Presa Street records. (see example) The software is looking for 9594 South Presa Street in the GBF. The highest range in the GBF file is 699 and all the Presa Streets in the database have a "N" prefix. Either the GBF file is incomplete or the address file in incorrect. You will need to do more research.

4. Practical exercise: creating a map using attribute information

An aircraft manufacturing company is trying to locate interior design and manufacturing companies and propeller manufacturers in Texas. A list of these three types of companies containing addresses is obtained. (see example) You have a zip code geographic data base containing city names and zip codes. You can address geocode the file containing company addresses to this file using the zip field. (see example) Follow the three steps in the geocoding process:

1) prepare the data;
2) match the addresses; and,
3) display the results.

First index the zipcode file so that the software knows you are sorting by zip code. (see example) Second, identify the files to match (see example) and perform the batch match. All 47 records match. Third, display your results. (see example)

You can display the propeller companies separately. In this ArcView example, make the aircraft company the active theme, and choose Edit, Copy Theme. Then choose Edit, Paste. You now have a duplicate theme. Under Theme, Properties, rename this theme "Propeller Manufacturers" and define the theme as ([Specialty] = "P"). (see example) The companies are in the Dallas/Fort Worth and San Antonio area. To see just the interior companies, make the Aircraft Companies theme active. Under Theme, Properties, define the subset as ([Specialty] = "ID") or ([Specialty] = "IP"). Then Under Theme, Edit Legend, set the Legend Type to Unique Value and the Values Field to Specialty. When you look at the interiors companies, they cluster around Dallas/Fort Worth and Houston. (see example)

Follow-up Units

Unit 40 Using reclassification operators

Unit 45 Location allocation

Unit 47 Boolean search

Resource

Definition of terms:

- Address geocoding: Conversion of postal addresses to geographic coordinates.

- DIME: Dual Independent Map Encoding. Predecessor to the TIGER files. Developed for the 1970 census.

- GBF: Geographic Base File. A digital geographic data base containing street networks (lines) or zip code files (point or polygon).

- Indirect georeferencing: Location of a feature based on some information (usually addresses) other than geographic coordinates (such as latitude/longitude or UTM meters). The process interpolates where the feature will be placed based on a reference file and a matching strategy.

- Reference files: A GBF used in the address geocoding process to indirectly reference a table of addresses to geographic coordinates.

- SIC Standard Industrial Classification A grouping of industries, classified by a government, usually with major grouping and sub-codes.

- Table of addresses: A database containing an address field and, usually, other attribute information.

- TIGER: Topologically Integrated Geographic Encoding and Referencing. A digital geographic data layer of streets and other census boundaries, created by the U.S. Bureau of the Census to support U.S. Census operations.

Reference Material:

- An excellent list of reference print and web references is found in (Unit 016 NCGIA Core Curriculum in GIScience: Discrete GeoReferencing, section 7)

Review and study guide

1. What are the three components necessary for address geocoding?

- Geographic base file
- Address file
- Software

1. What should your consider when beginning a geocoding application?

- Level of detail in address file (i.e. just zip code, full address, accuracy of the database
- Accuracy of the geographic database and whether you need to use more than one (i.e. streets for full street addresses, zip codes for rural routes)
- Purpose of the application

1. Describe the basic process used by the software to find locate a US street address.

- Finds the address in the address file
- Parses the address out based on the rules selected by the operator
- Locates the street based on the blocking strategy selected
- Determines the side of the street
- Interpolates where the address is located on the street
- Places the point

1. Create an attribute table for a geographic base file that contains the correct fields for the US Streets address style.

2. What field is necessary in the address reference file? Describe its characteristics?

- Any field containing an address
- Entire address is in one field (i.e. 125 Spring Valley Loop)
- Name some problems you can encounter with address files?
- Standardization not considered when designing and populating the database
- Inconsistencies
- Incomplete information (i.e. 125 Valley Rd. should be 125 N. Valley Rd.)
- Multiple spellings of same place
- Rural routes and P.O. boxes

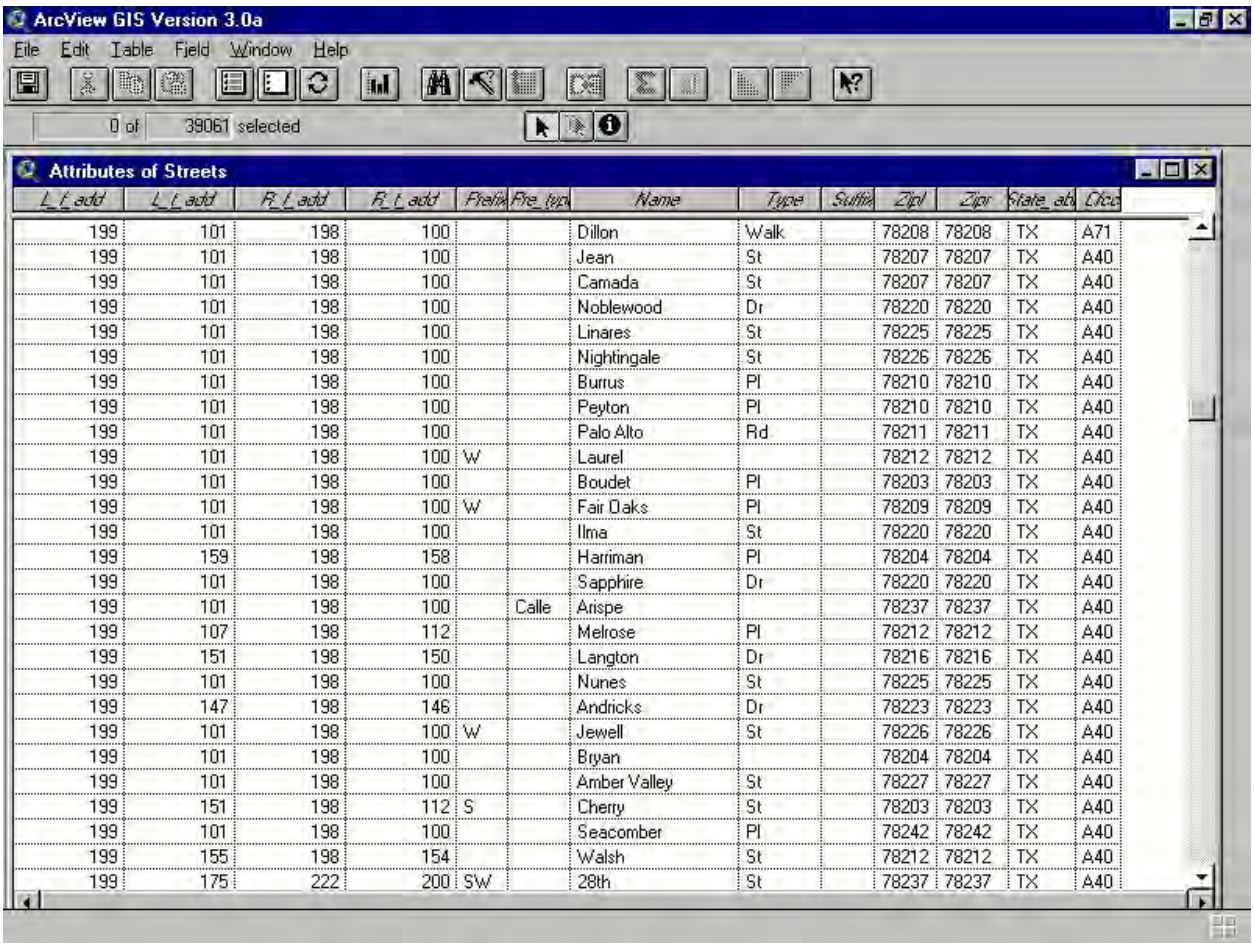
1. How do you correct the problems?

Standardize database prior to address matching
- US Postal Service standardization

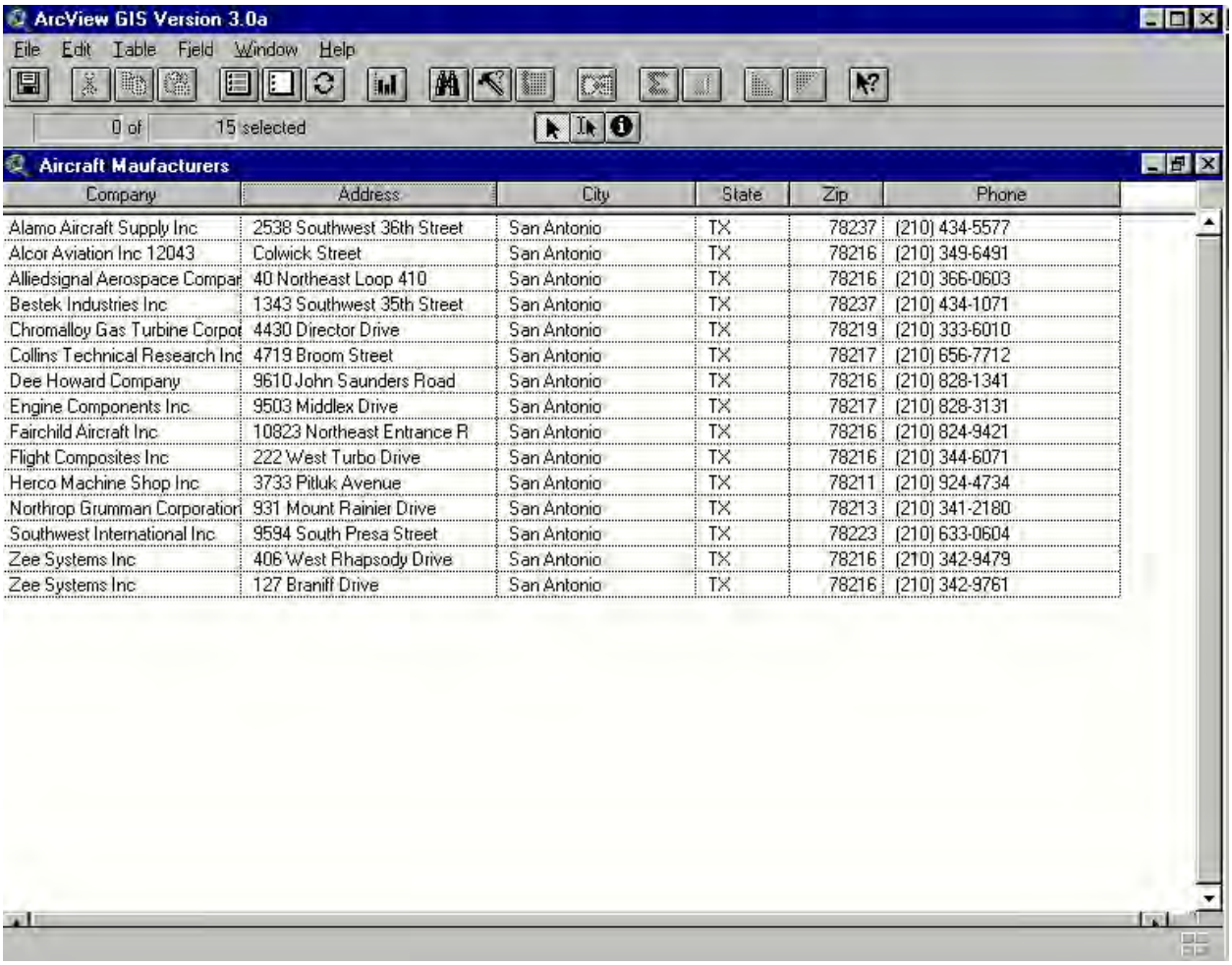
1. What problems might you find in the geographic base file?

- Location inaccurate
- New subdivisions not included: database not current
- Inaccurate attributes (i.e. wrong street names)

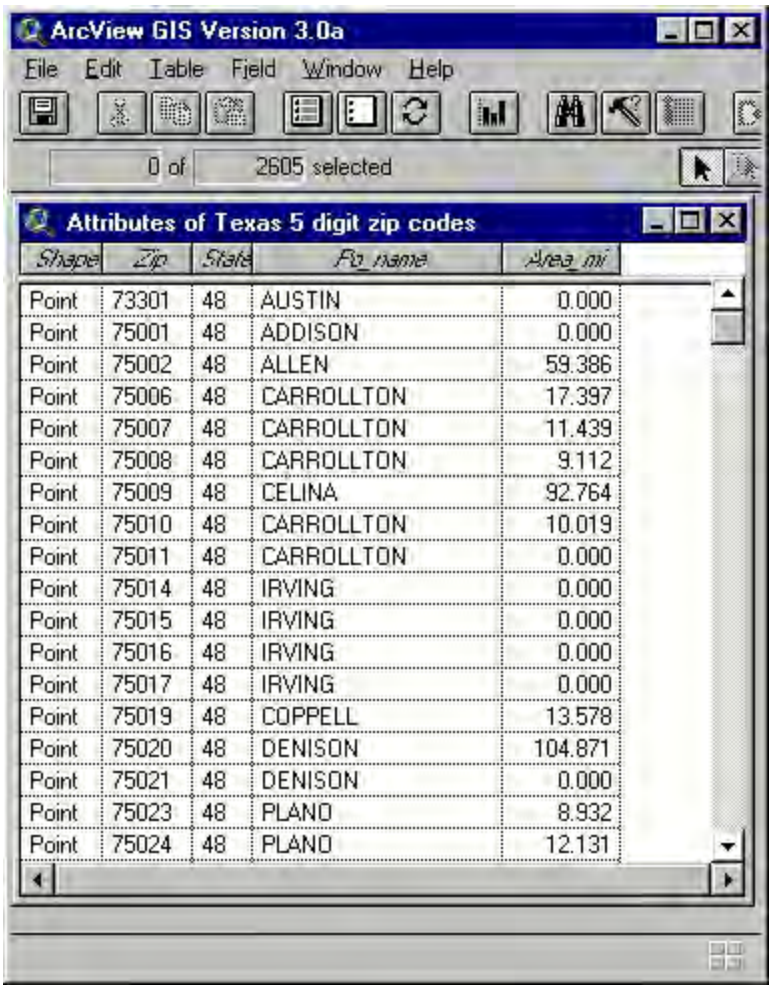
Created: May 14, 1997. Last updated: January 5, 1999.



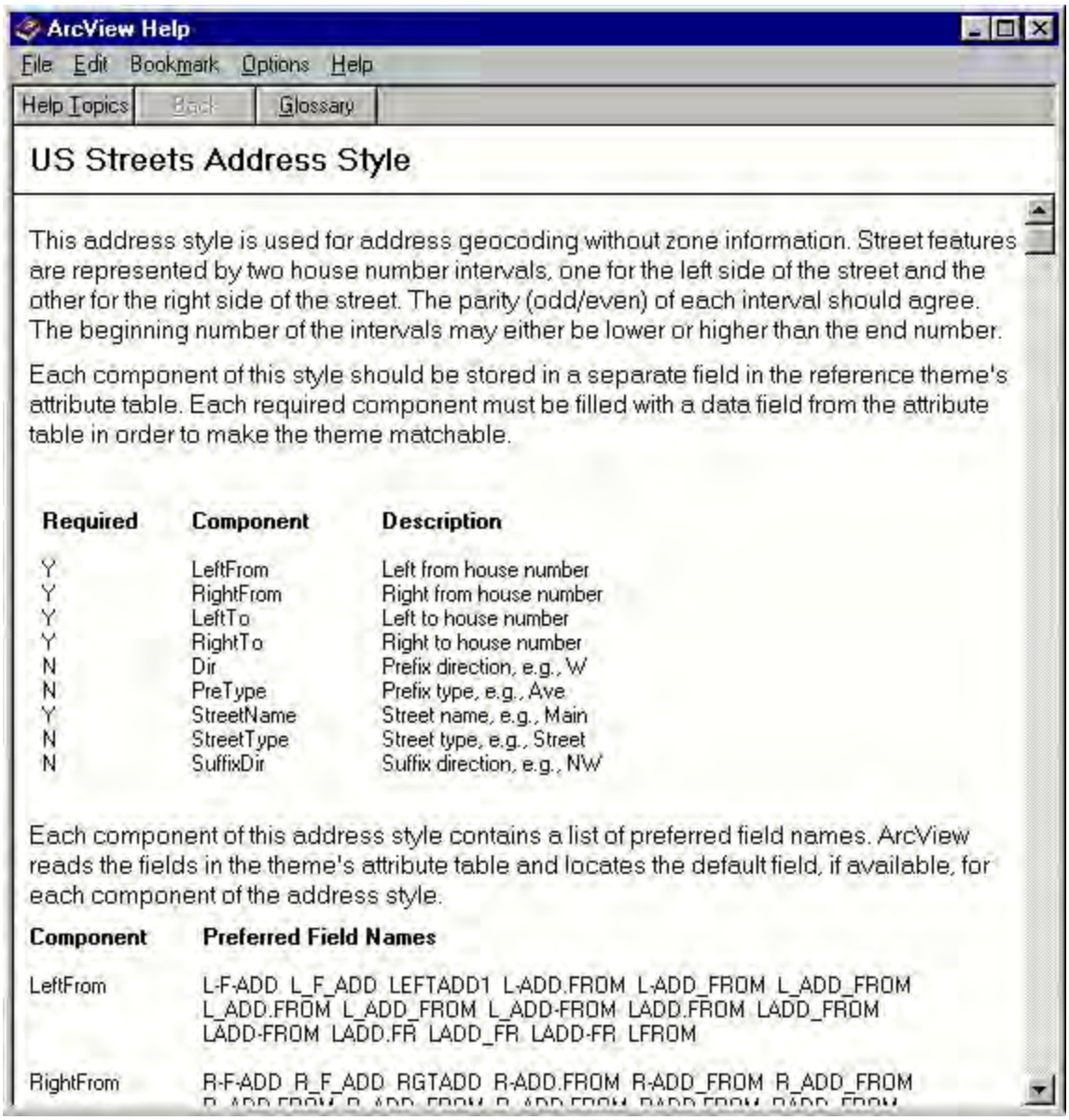
L_f_add	L_t_add	R_f_add	R_t_add	Prefix	Pre_typ	Name	Type	Suffix	Zipl	Zipr	State_ab	Ofca
199	101	198	100			Dillon	Walk		78208	78208	TX	A71
199	101	198	100			Jean	St		78207	78207	TX	A40
199	101	198	100			Camada	St		78207	78207	TX	A40
199	101	198	100			Noblewood	Dr		78220	78220	TX	A40
199	101	198	100			Linares	St		78225	78225	TX	A40
199	101	198	100			Nightingale	St		78226	78226	TX	A40
199	101	198	100			Burrus	Pl		78210	78210	TX	A40
199	101	198	100			Peyton	Pl		78210	78210	TX	A40
199	101	198	100			Palo Alto	Rd		78211	78211	TX	A40
199	101	198	100	W		Laurel			78212	78212	TX	A40
199	101	198	100			Boudet	Pl		78203	78203	TX	A40
199	101	198	100	W		Fair Oaks	Pl		78209	78209	TX	A40
199	101	198	100			Ilma	St		78220	78220	TX	A40
199	159	198	158			Harriman	Pl		78204	78204	TX	A40
199	101	198	100			Sapphire	Dr		78220	78220	TX	A40
199	101	198	100		Calle	Arispe			78237	78237	TX	A40
199	107	198	112			Melrose	Pl		78212	78212	TX	A40
199	151	198	150			Langton	Dr		78216	78216	TX	A40
199	101	198	100			Nunes	St		78225	78225	TX	A40
199	147	198	146			Andricks	Dr		78223	78223	TX	A40
199	101	198	100	W		Jewell	St		78226	78226	TX	A40
199	101	198	100			Bryan			78204	78204	TX	A40
199	101	198	100			Amber Valley	St		78227	78227	TX	A40
199	151	198	112	S		Cherry	St		78203	78203	TX	A40
199	101	198	100			Seacomber	Pl		78242	78242	TX	A40
199	155	198	154			Walsh	St		78212	78212	TX	A40
199	175	222	200	SW		28th	St		78237	78237	TX	A40



Company	Address	City	State	Zip	Phone
Alamo Aircraft Supply Inc	2538 Southwest 36th Street	San Antonio	TX	78237	(210) 434-5577
Alcor Aviation Inc 12043	Colwick Street	San Antonio	TX	78216	(210) 349-6491
Alliedsignal Aerospace Compar	40 Northeast Loop 410	San Antonio	TX	78216	(210) 366-0603
Bestek Industries Inc	1343 Southwest 35th Street	San Antonio	TX	78237	(210) 434-1071
Chromalloy Gas Turbine Corpor	4430 Director Drive	San Antonio	TX	78219	(210) 333-6010
Collins Technical Research Inc	4719 Broom Street	San Antonio	TX	78217	(210) 656-7712
Dee Howard Company	9610 John Saunders Road	San Antonio	TX	78216	(210) 828-1341
Engine Components Inc	9503 Middlex Drive	San Antonio	TX	78217	(210) 828-3131
Fairchild Aircraft Inc	10823 Northeast Entrance R	San Antonio	TX	78216	(210) 824-9421
Flight Composites Inc	222 West Turbo Drive	San Antonio	TX	78216	(210) 344-6071
Herco Machine Shop Inc	3733 Pitluk Avenue	San Antonio	TX	78211	(210) 924-4734
Northrop Grumman Corporation	931 Mount Rainier Drive	San Antonio	TX	78213	(210) 341-2180
Southwest International Inc	9594 South Presa Street	San Antonio	TX	78223	(210) 633-0604
Zee Systems Inc	406 West Rhapsody Drive	San Antonio	TX	78216	(210) 342-9479
Zee Systems Inc	127 Braniff Drive	San Antonio	TX	78216	(210) 342-9761



Shape	Zip	State	Fb_name	Area_mi
Point	73301	48	AUSTIN	0.000
Point	75001	48	ADDISON	0.000
Point	75002	48	ALLEN	59.386
Point	75006	48	CARROLLTON	17.397
Point	75007	48	CARROLLTON	11.439
Point	75008	48	CARROLLTON	9.112
Point	75009	48	CELINA	92.764
Point	75010	48	CARROLLTON	10.019
Point	75011	48	CARROLLTON	0.000
Point	75014	48	IRVING	0.000
Point	75015	48	IRVING	0.000
Point	75016	48	IRVING	0.000
Point	75017	48	IRVING	0.000
Point	75019	48	COPPELL	13.578
Point	75020	48	DENISON	104.871
Point	75021	48	DENISON	0.000
Point	75023	48	PLANO	8.932
Point	75024	48	PLANO	12.131



ArcView Help

File Edit Bookmark Options Help

Help Topics | Back | Glossary

US Streets Address Style

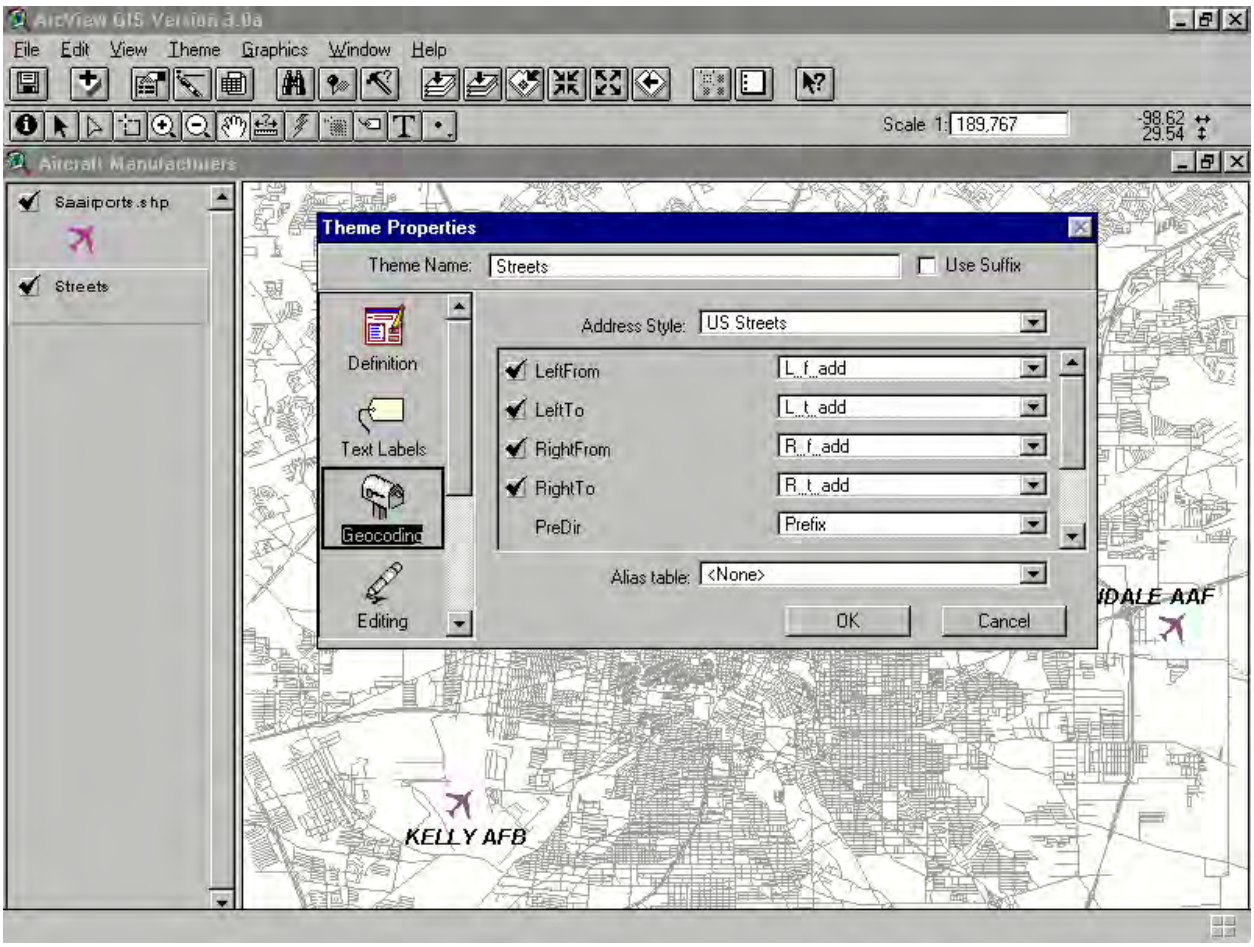
This address style is used for address geocoding without zone information. Street features are represented by two house number intervals, one for the left side of the street and the other for the right side of the street. The parity (odd/even) of each interval should agree. The beginning number of the intervals may either be lower or higher than the end number.

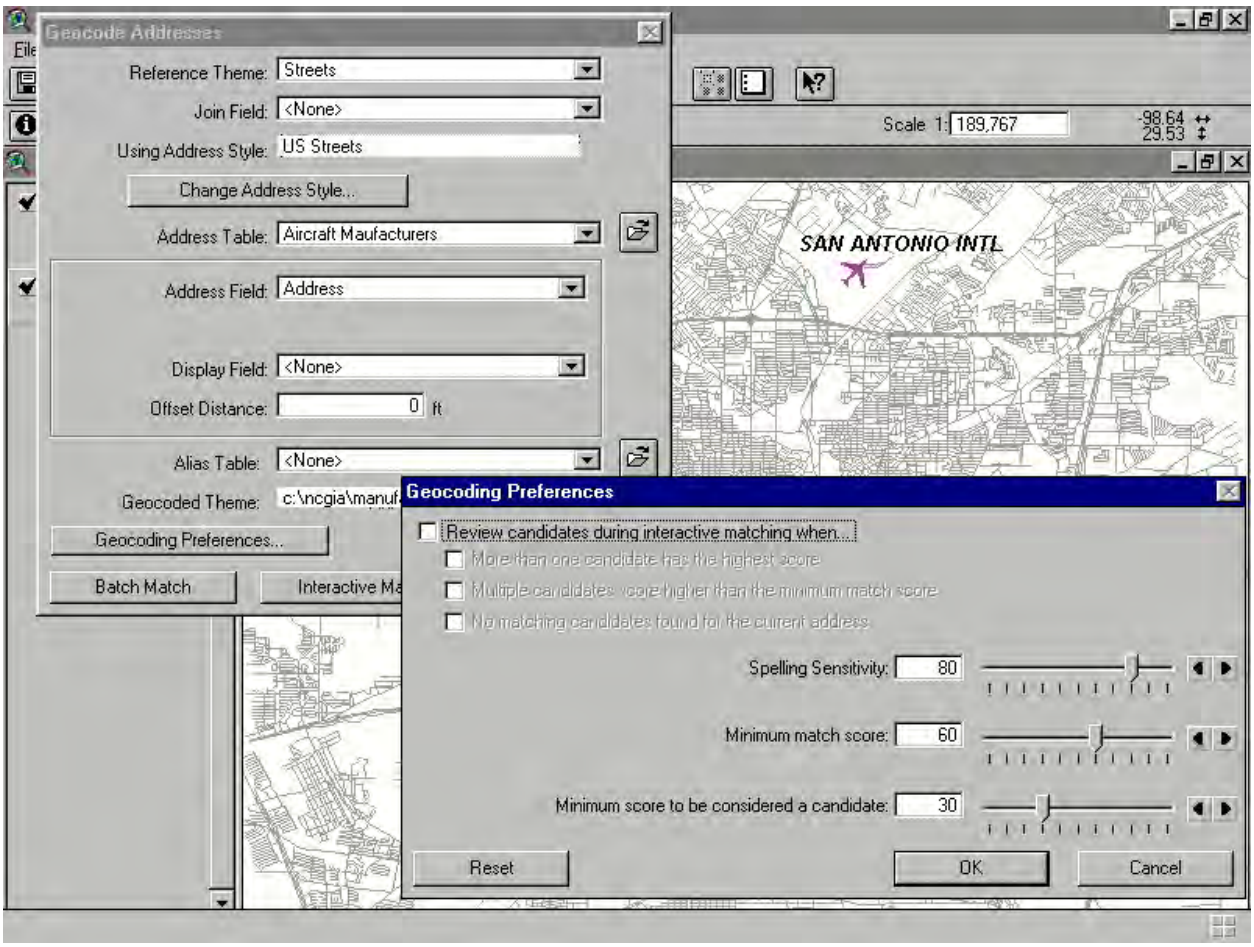
Each component of this style should be stored in a separate field in the reference theme's attribute table. Each required component must be filled with a data field from the attribute table in order to make the theme matchable.

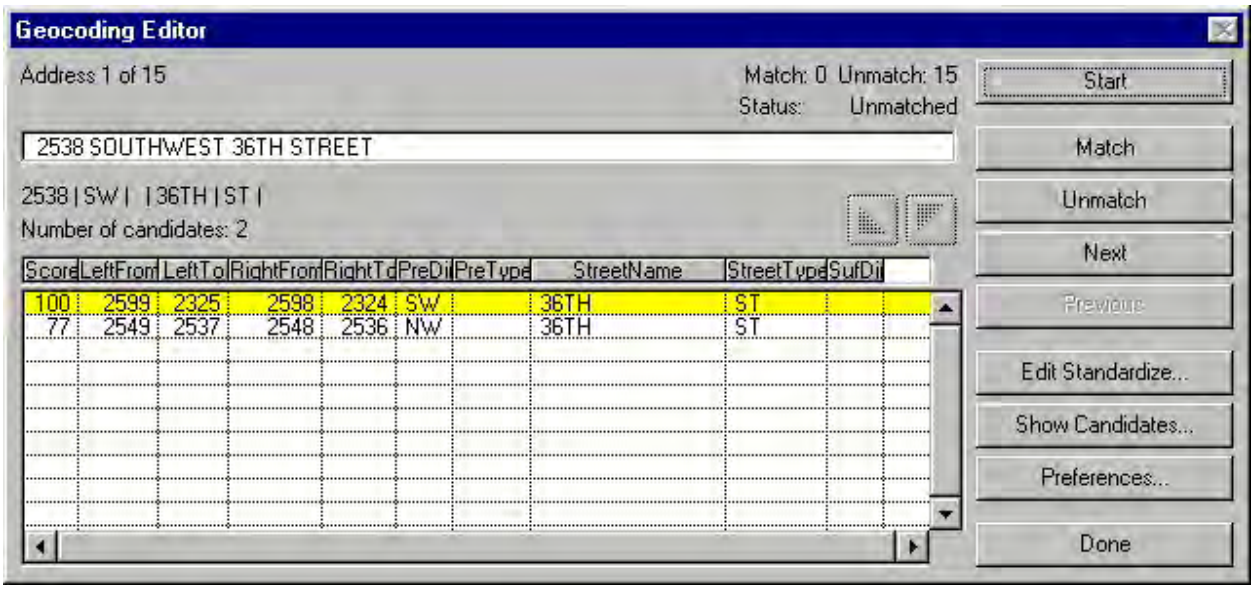
Required	Component	Description
Y	LeftFrom	Left from house number
Y	RightFrom	Right from house number
Y	LeftTo	Left to house number
Y	RightTo	Right to house number
N	Dir	Prefix direction, e.g., W
N	PreType	Prefix type, e.g., Ave
Y	StreetName	Street name, e.g., Main
N	StreetType	Street type, e.g., Street
N	SuffixDir	Suffix direction, e.g., NW

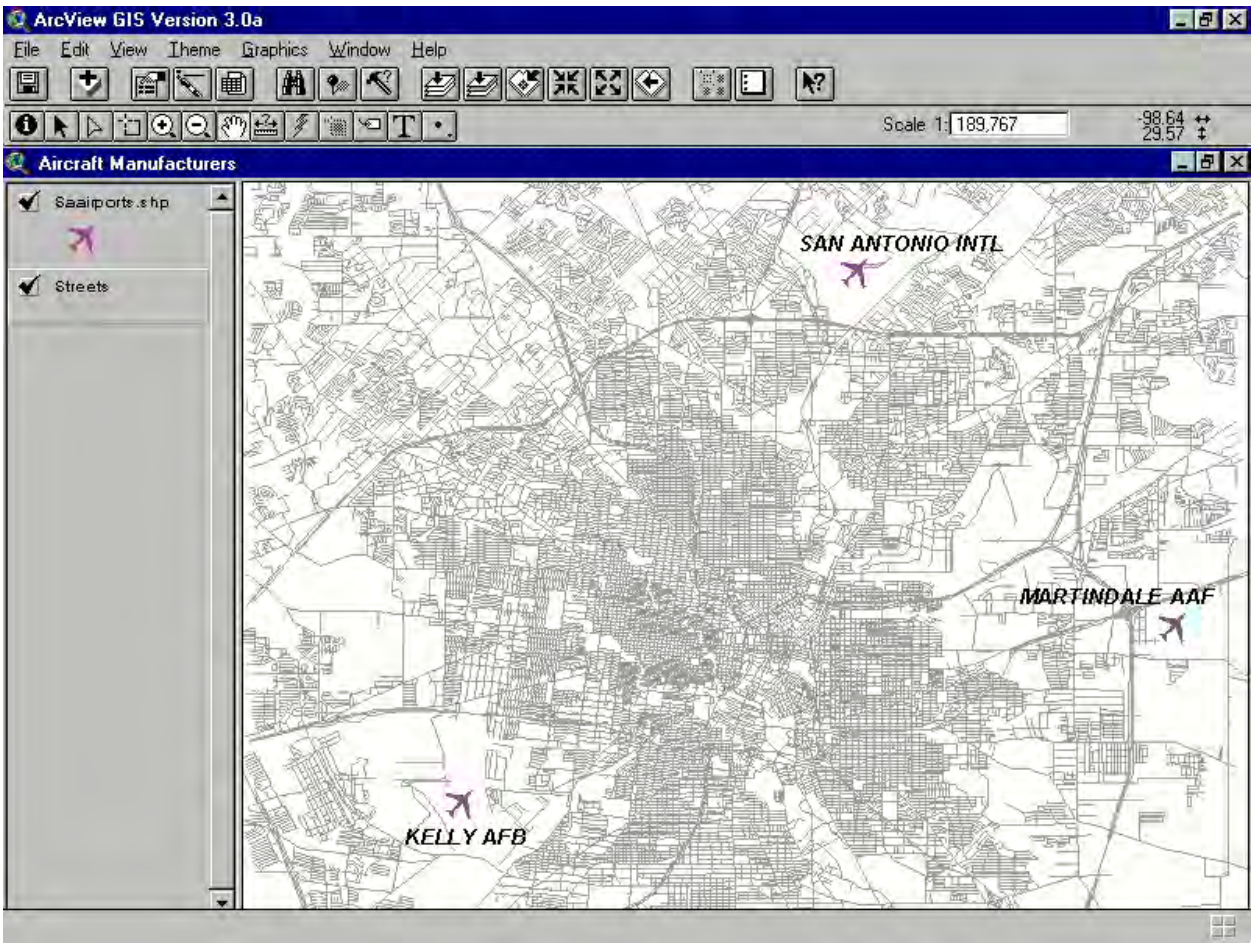
Each component of this address style contains a list of preferred field names. ArcView reads the fields in the theme's attribute table and locates the default field, if available, for each component of the address style.

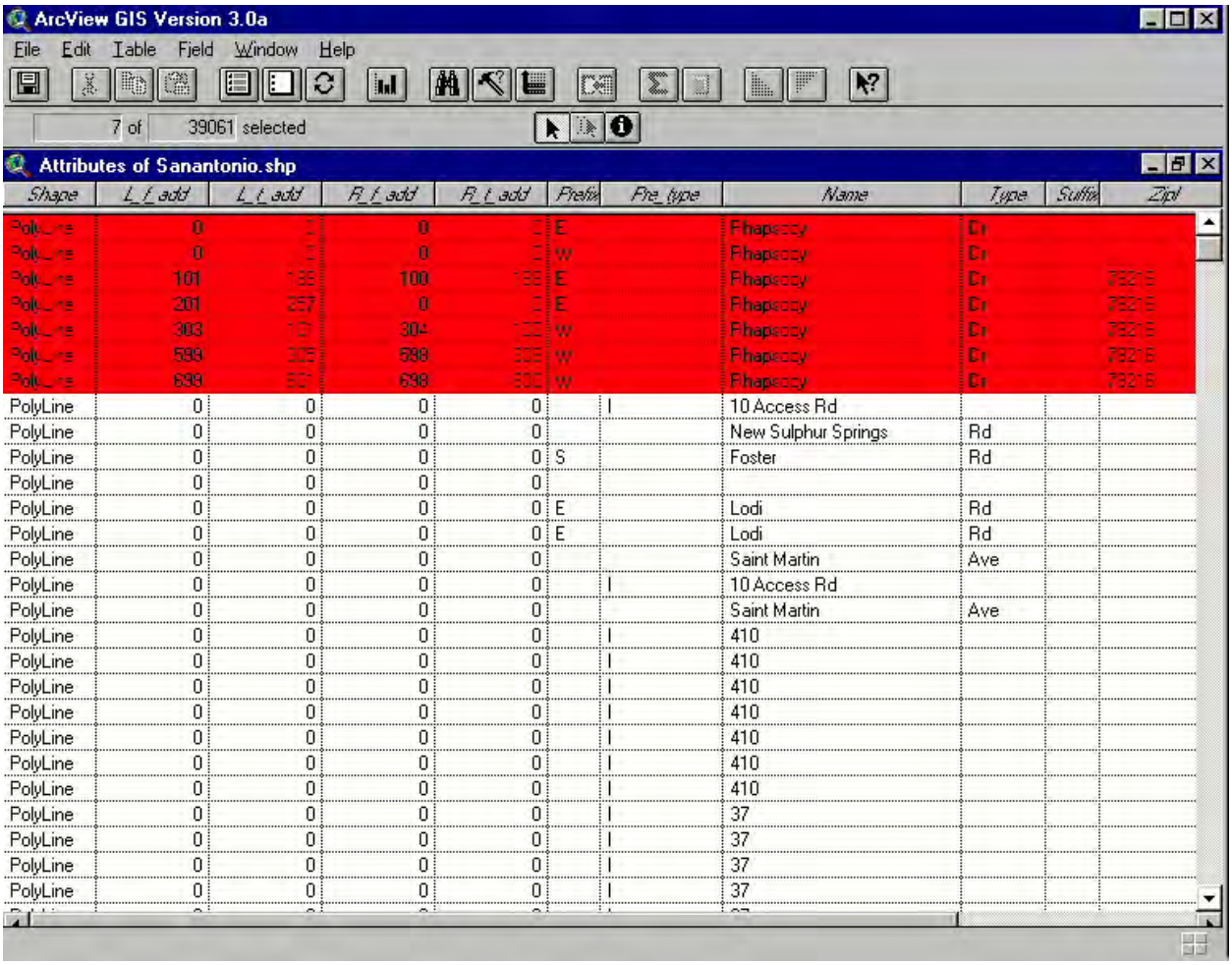
Component	Preferred Field Names
LeftFrom	L-F-ADD L_F_ADD LEFTADD1 L-ADD.FROM L-ADD_FROM L_ADD_FROM L_ADD.FROM L_ADD_FROM L_ADD-FROM LADD.FROM LADD_FROM LADD-FROM LADD.FR LADD_FR LADD-FR LFROM
RightFrom	R-F-ADD R_F_ADD RGTADD R-ADD.FROM R-ADD_FROM R_ADD_FROM


ArcView GIS Version 3.0a
File Edit View Theme Graphics Window Help
Scale 1: 189,767
Aircraft Manufacturers
Saairports.shp
Streets
Theme Properties
Theme Name: Streets
Use Suffix
Definition
Text Labels
Geocoding
Editing
Address Style: US Streets
LeftFrom L_f_add
LeftTo L_t_add
RightFrom R_f_add
RightTo R_t_add
PreDir Prefix
Alias table: <None>
OK
Cancel
KELLY AFB

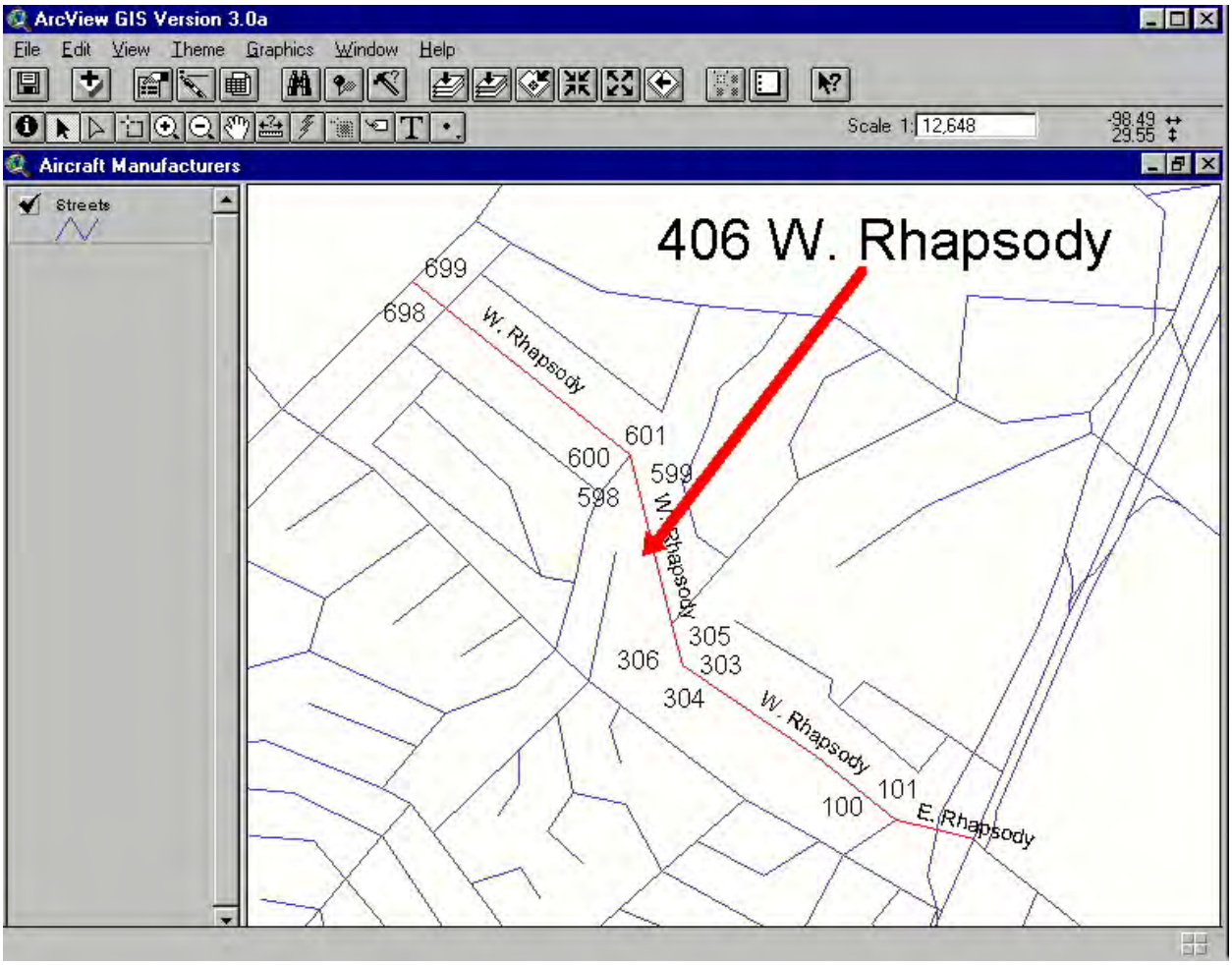

Geocode Addresses
Reference Theme: Streets
Join Field: <None>
Using Address Style: US Streets
Change Address Style...
Address Table: Aircraft Maufacturers
Address Field: Address
Display Field: <None>
Offset Distance: 0 ft
Alias Table: <None>
Geocoded Theme: c:\ncgia\manuf
Geocoding Preferences...
Batch Match
Interactive Ma
Scale 1: 189,767
-98.64
29.53
SAN ANTONIO INTL
Geocoding Preferences
Review candidates during interactive matching when...
More than one candidate has the highest score
Multiple candidates score higher than the minimum match score
No matching candidates found for the current address
Spelling Sensitivity: 80
Minimum match score: 60
Minimum score to be considered a candidate: 30
Reset
OK
Cancel

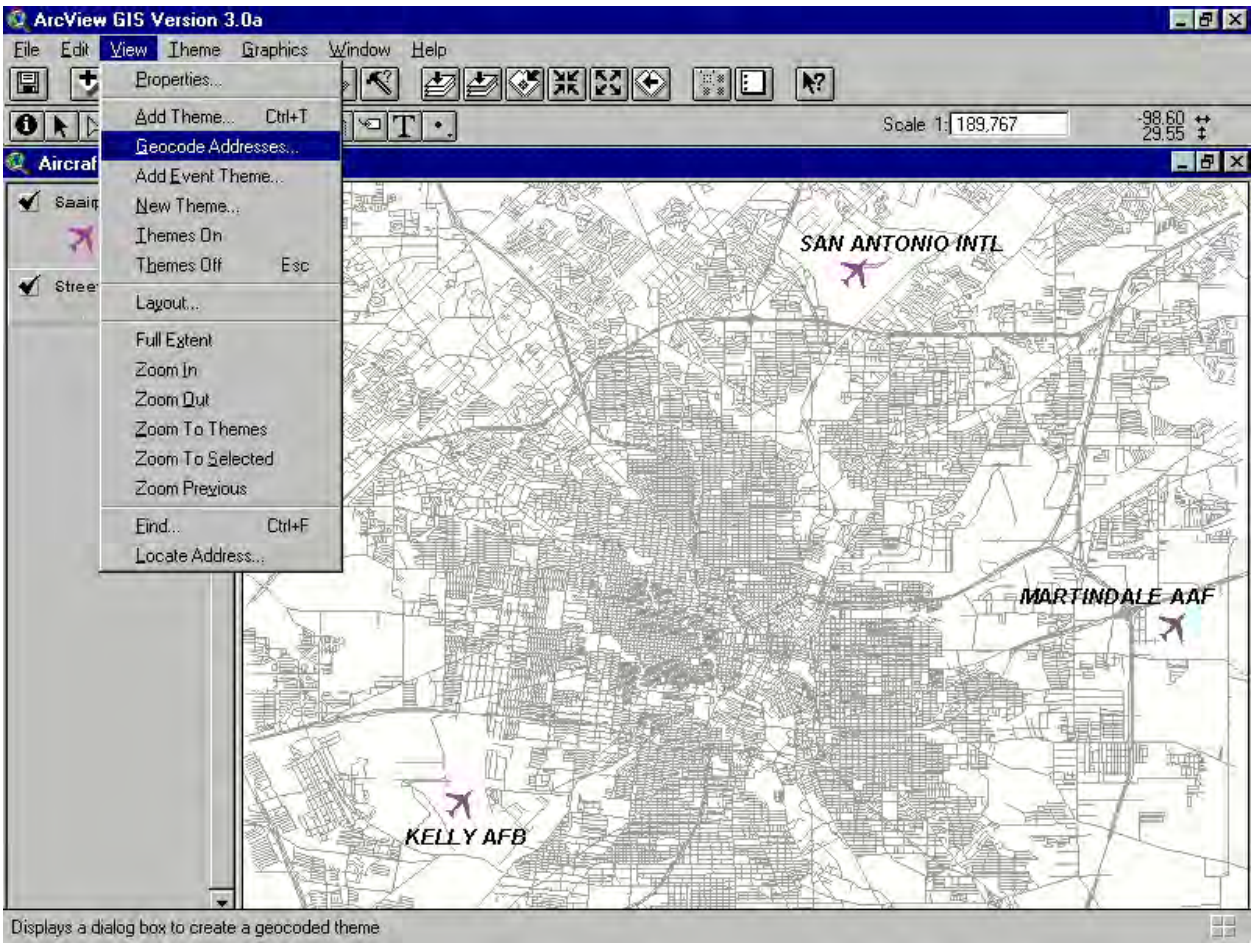

Geocoding Editor
Address 1 of 15
Match: 0 Unmatch: 15
Status: Unmatched
Start
2538 SOUTHWEST 36TH STREET
Match
2538 | SW | | 36TH | ST |
Unmatch
Number of candidates: 2
Next
Score LeftFrom LeftTo RightFrom RightTo PreDir PreType StreetName StreetType SufDir
100 2599 2325 2598 2324 SW 36TH ST
77 2549 2537 2548 2536 NW 36TH ST
Previous
Edit Standardize...
Show Candidates...
Preferences...
Done

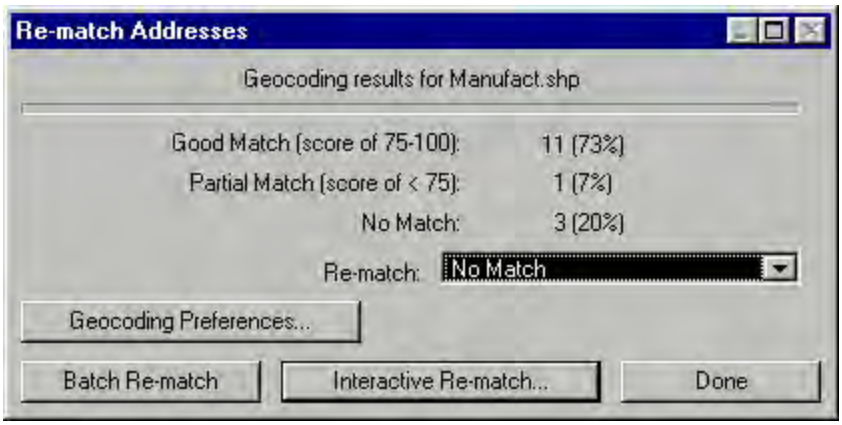

ArcView GIS Version 3.0a
File Edit View Theme Graphics Window Help
Scale 1: 189,767
-98.64
29.57
Aircraft Manufacturers
Saairports.shp
Streets
SAN ANTONIO INTL
MARTINDALE AAF
KELLY AFB

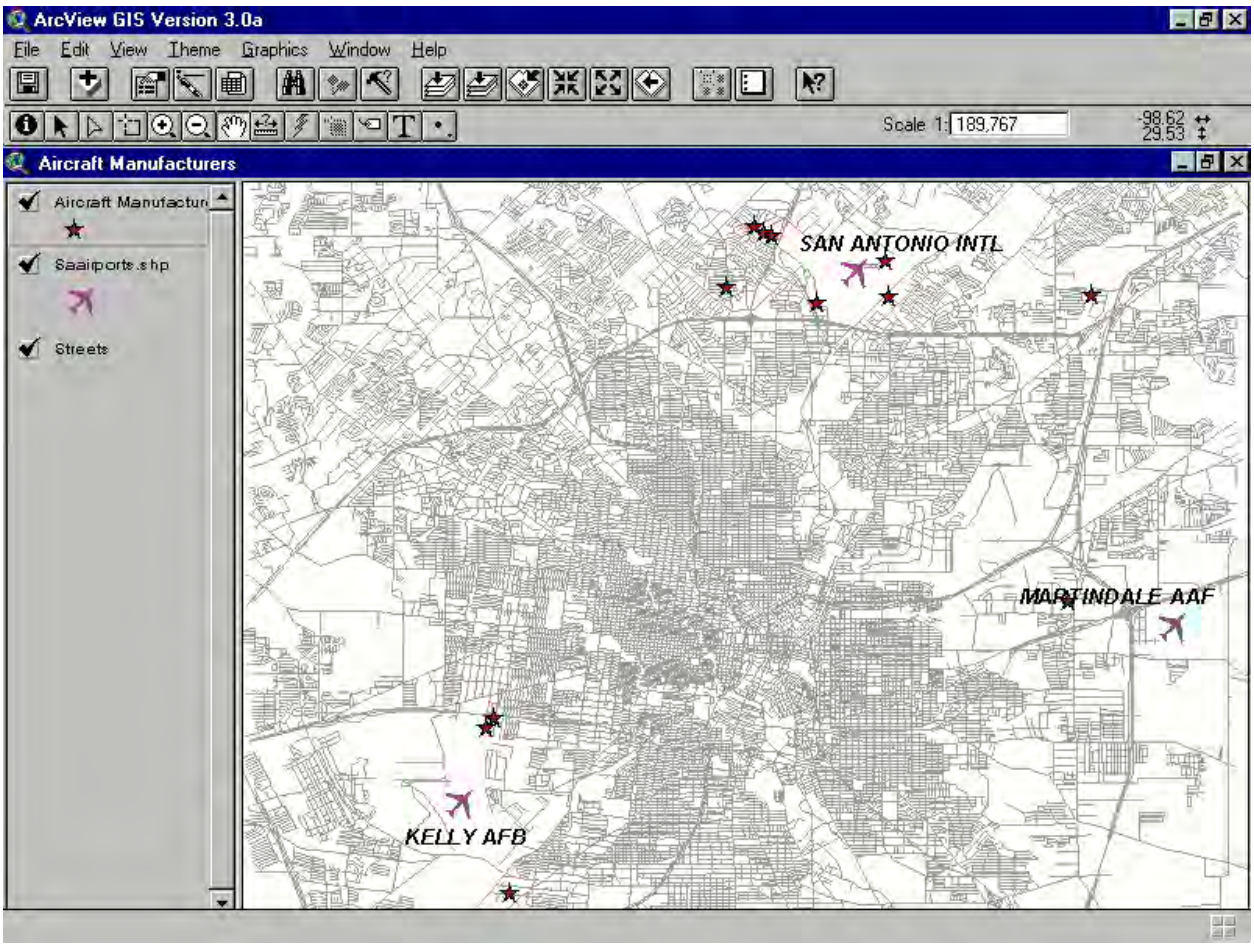


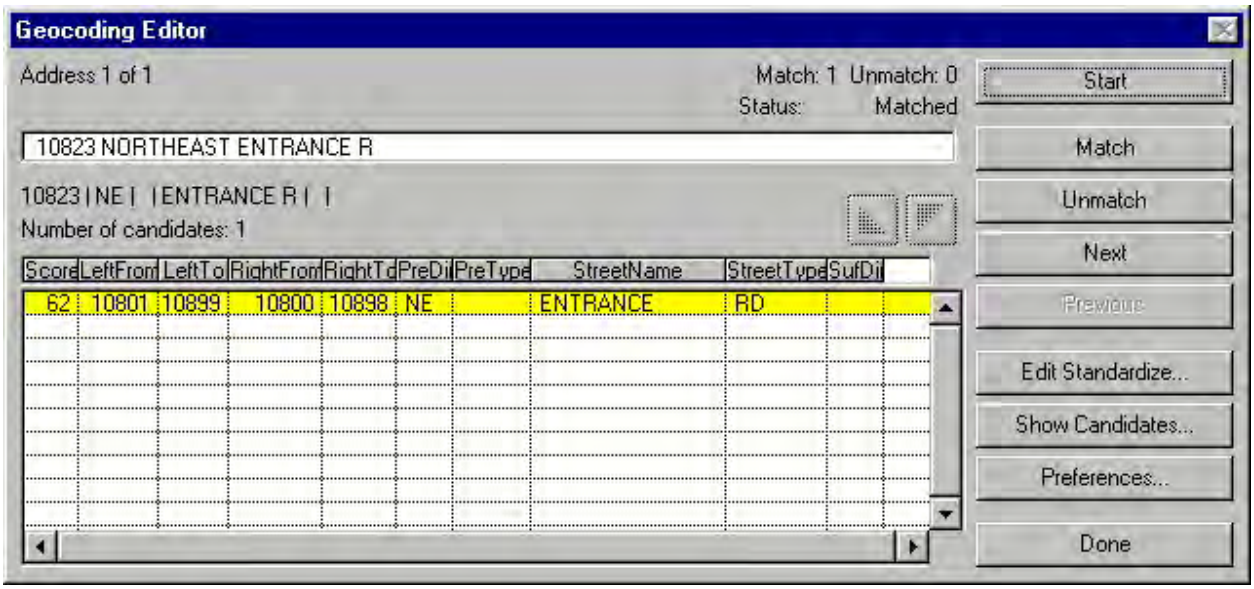
Shape	L_f_add	L_t_add	R_f_add	R_t_add	Prefix	Pre_type	Name	Type	Suffix	Zipl
PolyLine	0	0	0	0	E		Rhapsody	Dr		
PolyLine	0	0	0	0	W		Rhapsody	Dr		
PolyLine	101	199	100	198	E		Rhapsody	Dr		78218
PolyLine	201	257	0	0	E		Rhapsody	Dr		78218
PolyLine	303	401	304	400	W		Rhapsody	Dr		78218
PolyLine	599	505	598	506	W		Rhapsody	Dr		78218
PolyLine	699	601	698	600	W		Rhapsody	Dr		78218
PolyLine	0	0	0	0		I	10 Access Rd			
PolyLine	0	0	0	0			New Sulphur Springs	Rd		
PolyLine	0	0	0	0	S		Foster	Rd		
PolyLine	0	0	0	0						
PolyLine	0	0	0	0	E		Lodi	Rd		
PolyLine	0	0	0	0	E		Lodi	Rd		
PolyLine	0	0	0	0			Saint Martin	Ave		
PolyLine	0	0	0	0		I	10 Access Rd			
PolyLine	0	0	0	0			Saint Martin	Ave		
PolyLine	0	0	0	0		I	410			
PolyLine	0	0	0	0		I	410			
PolyLine	0	0	0	0		I	410			
PolyLine	0	0	0	0		I	410			
PolyLine	0	0	0	0		I	410			
PolyLine	0	0	0	0		I	410			
PolyLine	0	0	0	0		I	410			
PolyLine	0	0	0	0		I	37			
PolyLine	0	0	0	0		I	37			
PolyLine	0	0	0	0		I	37			
PolyLine	0	0	0	0		I	37			

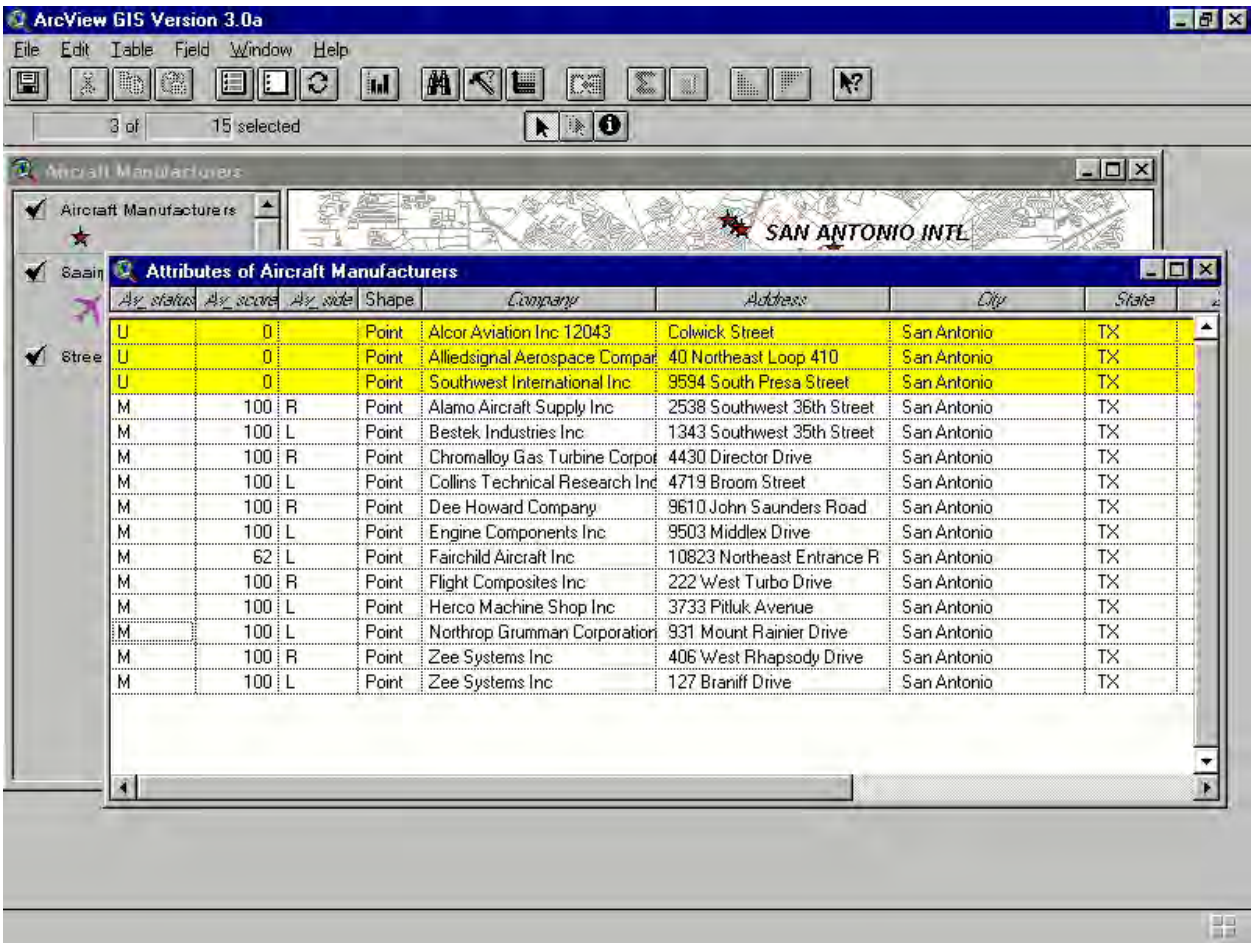

ArcView GIS Version 3.0a
File Edit View Theme Graphics Window Help
Scale 1: 12,648
-98.49
29.55
Aircraft Manufacturers
Streets
406 W. Rhapsody
699
698
W. Rhapsody
601
600
599
598
W. Rhapsody
305
306
303
304
W. Rhapsody
101
100
E. Rhapsody

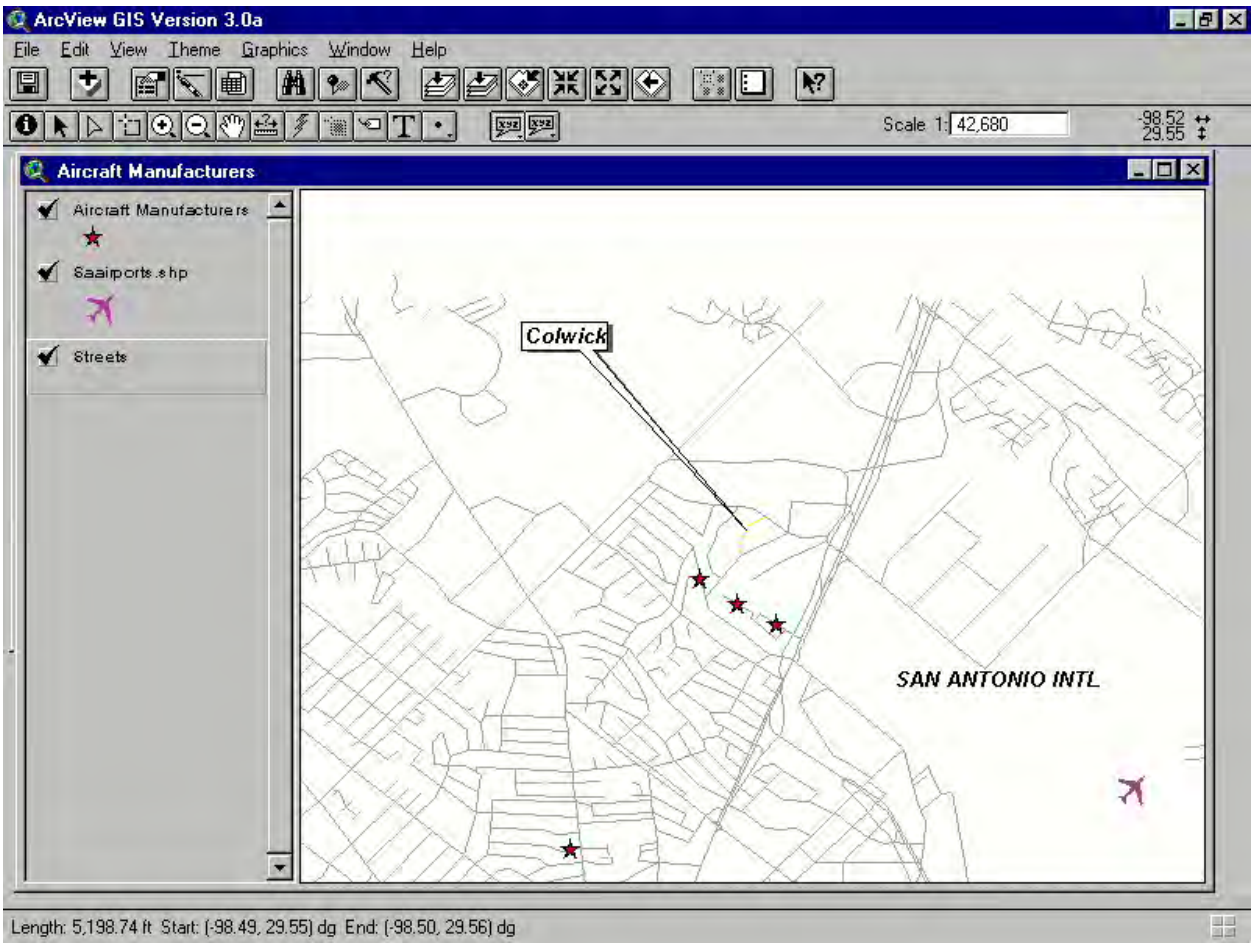

ArcView GIS Version 3.0a
File Edit View Theme Graphics Window Help
Properties...
Add Theme... Ctrl+T
Geocode Addresses...
Add Event Theme...
New Theme...
Themes On
Themes Off Esc
Layout...
Full Extent
Zoom In
Zoom Out
Zoom To Themes
Zoom To Selected
Zoom Previous
Find... Ctrl+F
Locate Address...
Scale 1: 189,767
-98.60
29.55
SAN ANTONIO INTL
MARTINDALE AAF
KELLY AFB
Displays a dialog box to create a geocoded theme

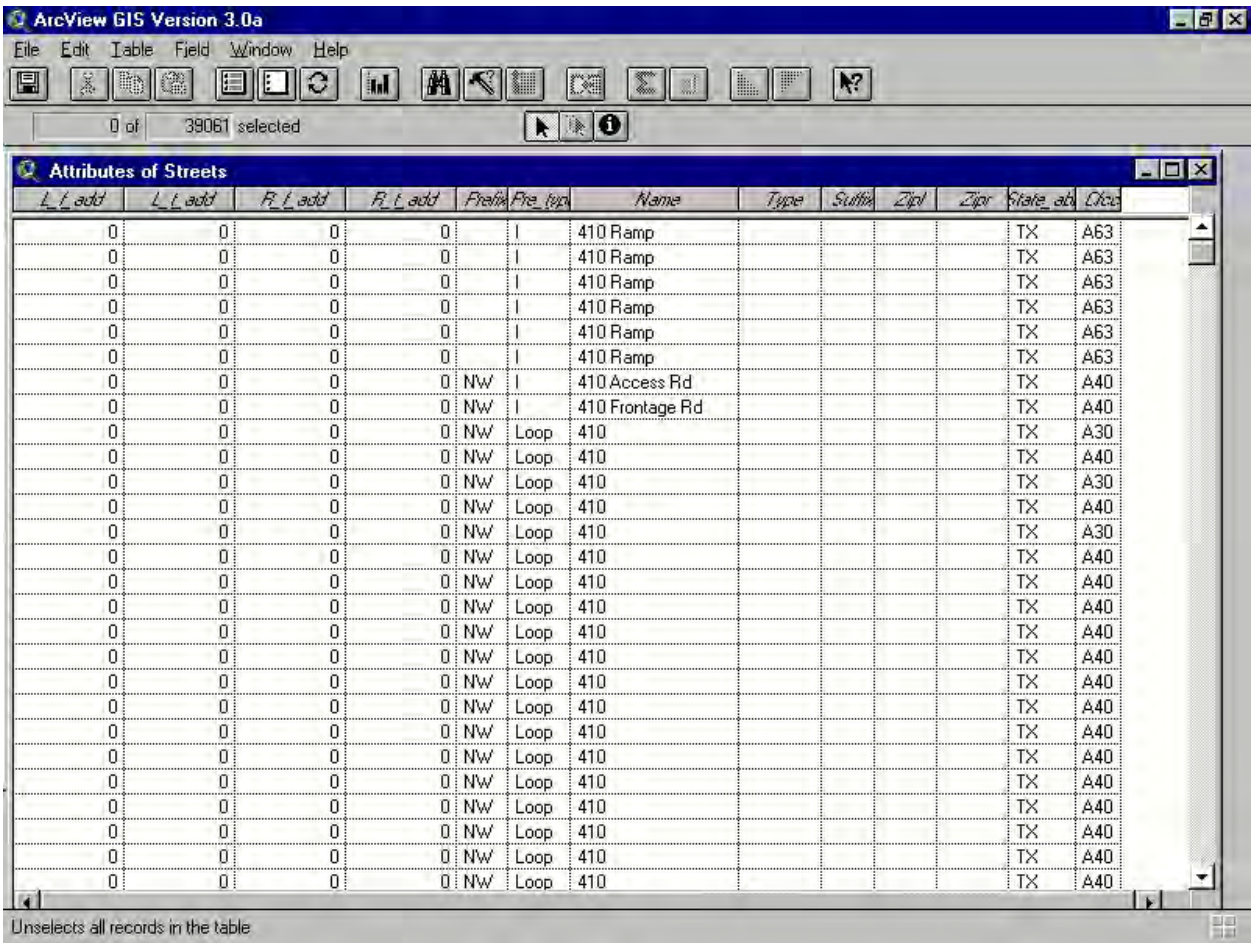

Re-match Addresses
Geocoding results for Manufact.shp
Good Match (score of 75-100):
11 (73%)
Partial Match (score of < 75):
1 (7%)
No Match:
3 (20%)
Re-match:
No Match
Geocoding Preferences...
Batch Re-match
Interactive Re-match...
Done

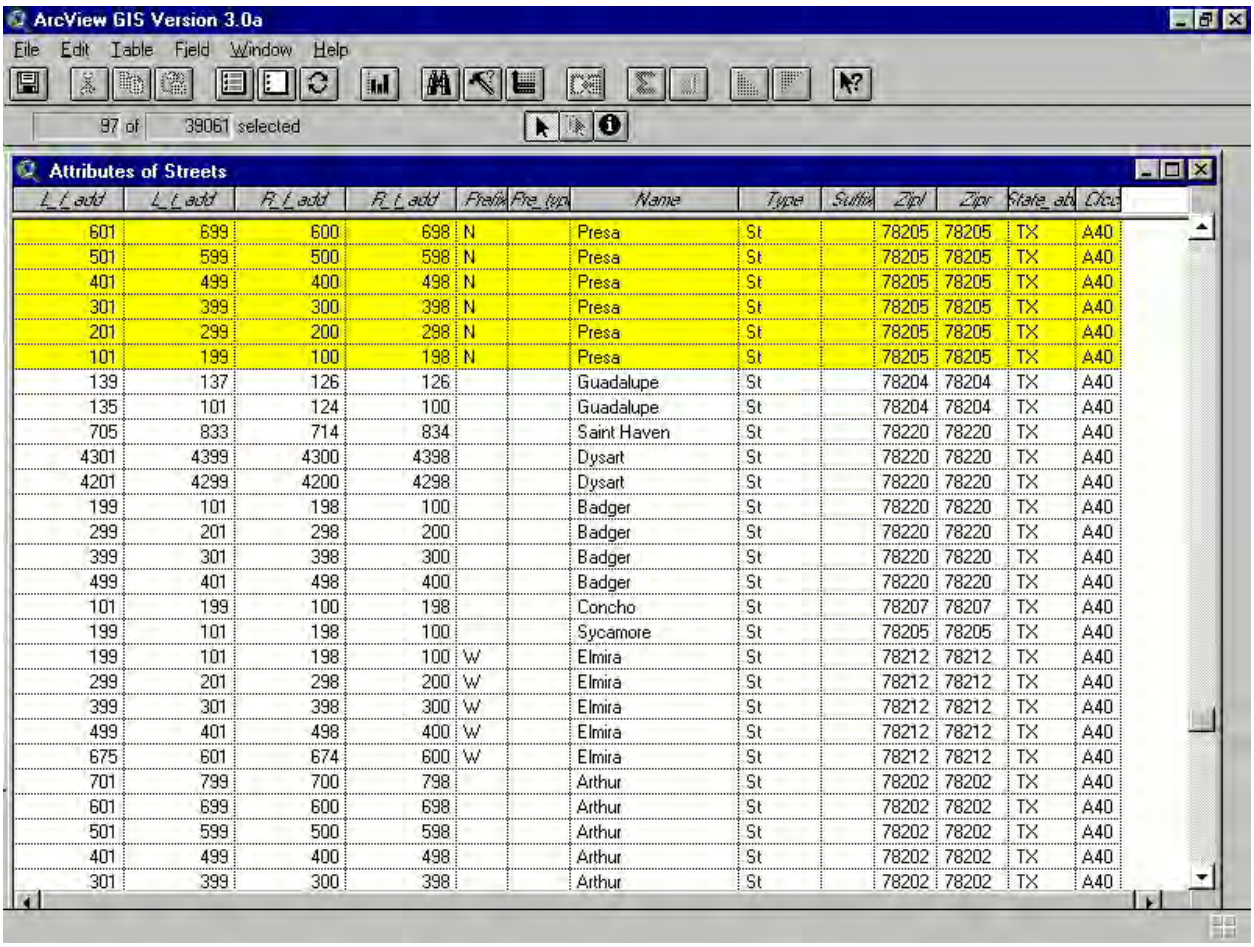

ArcView GIS Version 3.0a
File Edit View Theme Graphics Window Help
Scale 1: 189,767
-98.62
29.53
Aircraft Manufacturers
Aircraft Manufactur
Saaiports.shp
Streets
SAN ANTONIO INTL
MARTINDALE AAF
KELLY AFB


Geocoding Editor
Address 1 of 1
Match: 1 Unmatch: 0
Status: Matched
10823 NORTHEAST ENTRANCE R
10823 | NE | | ENTRANCE R | |
Number of candidates: 1
Score LeftFrom LeftTo RightFrom RightTo PreDir PreType StreetName StreetType SufDir
62 10801 10899 10800 10898 NE ENTRANCE RD
Start
Match
Unmatch
Next
Previous
Edit Standardize...
Show Candidates...
Preferences...
Done

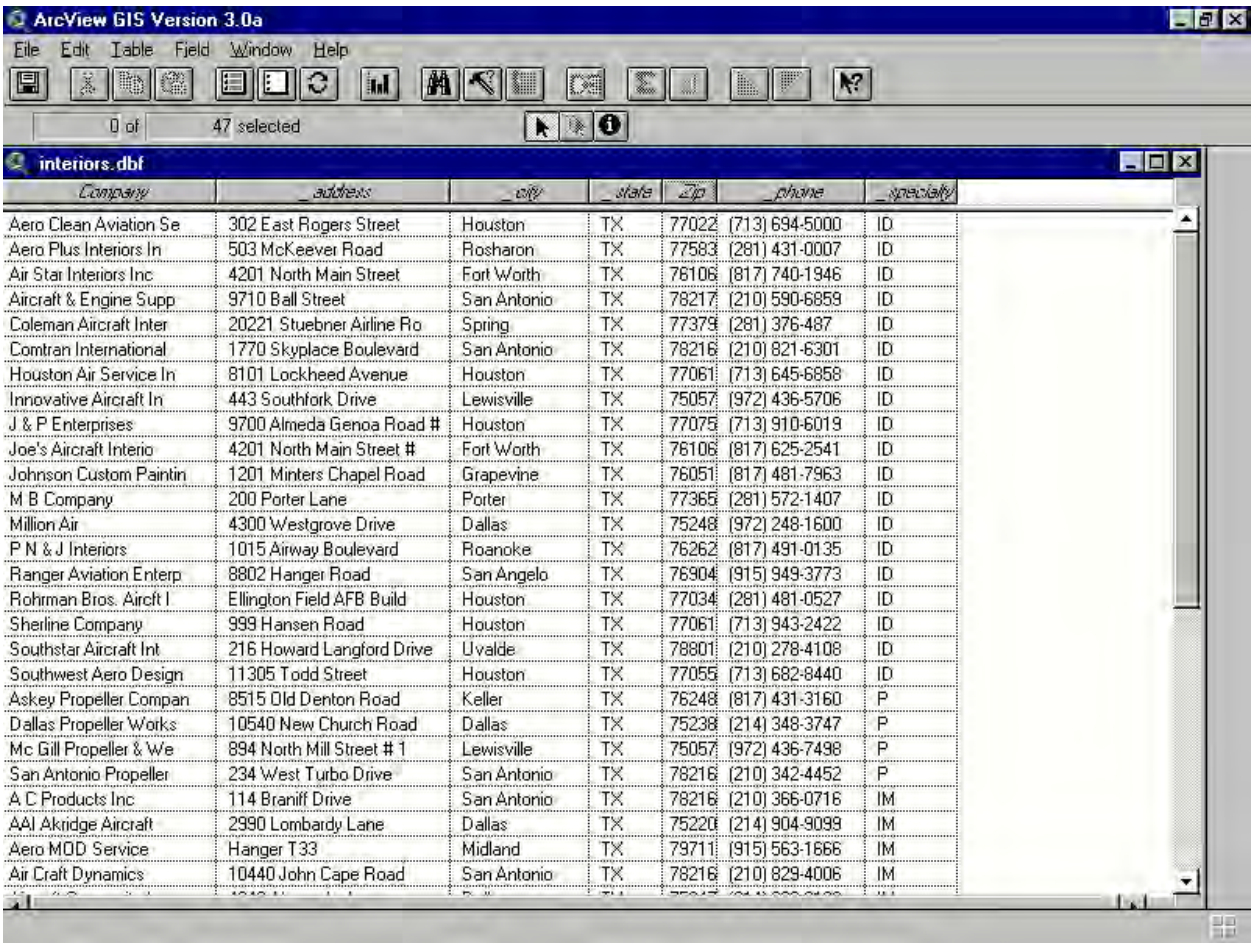

ArcView GIS Version 3.0a
File Edit Table Field Window Help
3 of 15 selected
Aircraft Manufacturers
SAN ANTONIO INTL
Attributes of Aircraft Manufacturers
Ay_status Ay_score Ay_side Shape Company Address City State
U 0 Point Alcor Aviation Inc 12043 Colwick Street San Antonio TX
U 0 Point Alliedsignal Aerospace Compar 40 Northeast Loop 410 San Antonio TX
U 0 Point Southwest International Inc 9594 South Presa Street San Antonio TX
M 100 R Point Alamo Aircraft Supply Inc 2538 Southwest 36th Street San Antonio TX
M 100 L Point Bestek Industries Inc 1343 Southwest 35th Street San Antonio TX
M 100 R Point Chromalloy Gas Turbine Corpor 4430 Director Drive San Antonio TX
M 100 L Point Collins Technical Research Inc 4719 Broom Street San Antonio TX
M 100 R Point Dee Howard Company 9610 John Saunders Road San Antonio TX
M 100 L Point Engine Components Inc 9503 Middlex Drive San Antonio TX
M 62 L Point Fairchild Aircraft Inc 10823 Northeast Entrance R San Antonio TX
M 100 R Point Flight Composites Inc 222 West Turbo Drive San Antonio TX
M 100 L Point Herco Machine Shop Inc 3733 Pitluk Avenue San Antonio TX
M 100 L Point Northrop Grumman Corporation 931 Mount Rainier Drive San Antonio TX
M 100 R Point Zee Systems Inc 406 West Rhapsody Drive San Antonio TX
M 100 L Point Zee Systems Inc 127 Braniff Drive San Antonio TX


ArcView GIS Version 3.0a
File Edit View Theme Graphics Window Help
Scale 1: 42,680
-98.52
29.55
Aircraft Manufacturers
Aircraft Manufacturers
Saaiports.shp
Streets
Colwick
SAN ANTONIO INTL
Length: 5,198.74 ft Start: (-98.49, 29.55) dg End: (-98.50, 29.56) dg

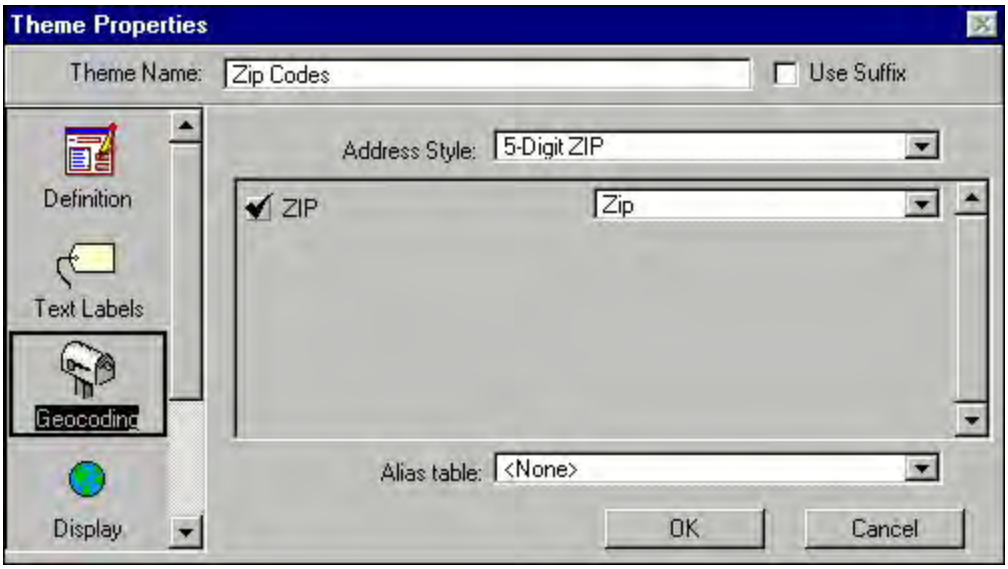

ArcView GIS Version 3.0a
File Edit Table Field Window Help
0 of 39061 selected
Attributes of Streets
L_f_add L_t_add R_f_add R_t_add Prefix Pre_typ Name Type Suffix Zipl Zipr State_ab Ofcs
0 0 0 0 I 410 Ramp TX A63
0 0 0 0 I 410 Ramp TX A63
0 0 0 0 I 410 Ramp TX A63
0 0 0 0 I 410 Ramp TX A63
0 0 0 0 I 410 Ramp TX A63
0 0 0 0 I 410 Ramp TX A63
0 0 0 0 NW I 410 Access Rd TX A40
0 0 0 0 NW I 410 Frontage Rd TX A40
0 0 0 0 NW Loop 410 TX A30
0 0 0 0 NW Loop 410 TX A40
0 0 0 0 NW Loop 410 TX A30
0 0 0 0 NW Loop 410 TX A40
0 0 0 0 NW Loop 410 TX A30
0 0 0 0 NW Loop 410 TX A40
0 0 0 0 NW Loop 410 TX A40
0 0 0 0 NW Loop 410 TX A40
0 0 0 0 NW Loop 410 TX A40
0 0 0 0 NW Loop 410 TX A40
0 0 0 0 NW Loop 410 TX A40
0 0 0 0 NW Loop 410 TX A40
0 0 0 0 NW Loop 410 TX A40
0 0 0 0 NW Loop 410 TX A40
0 0 0 0 NW Loop 410 TX A40
0 0 0 0 NW Loop 410 TX A40
0 0 0 0 NW Loop 410 TX A40
0 0 0 0 NW Loop 410 TX A40
Unselects all records in the table

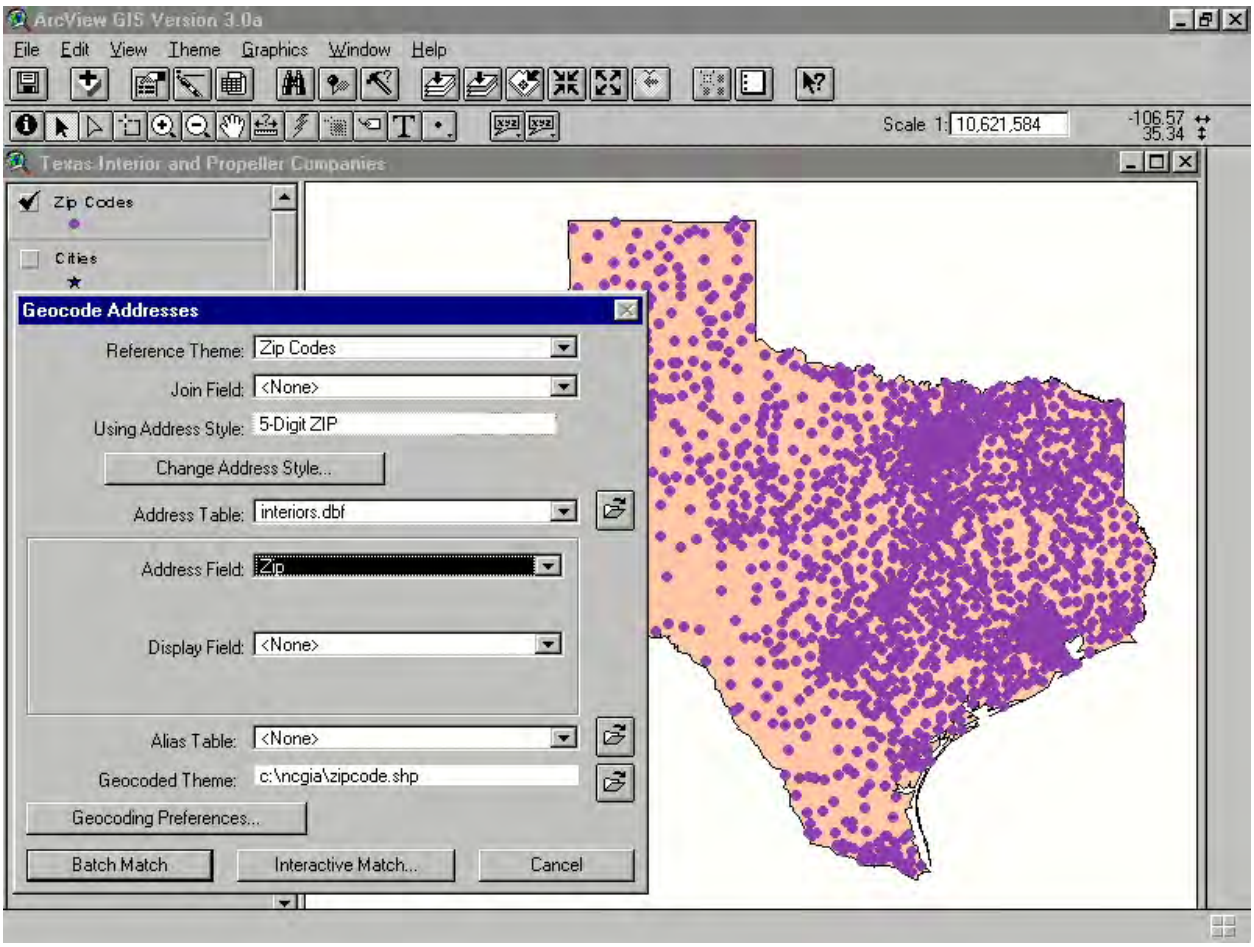


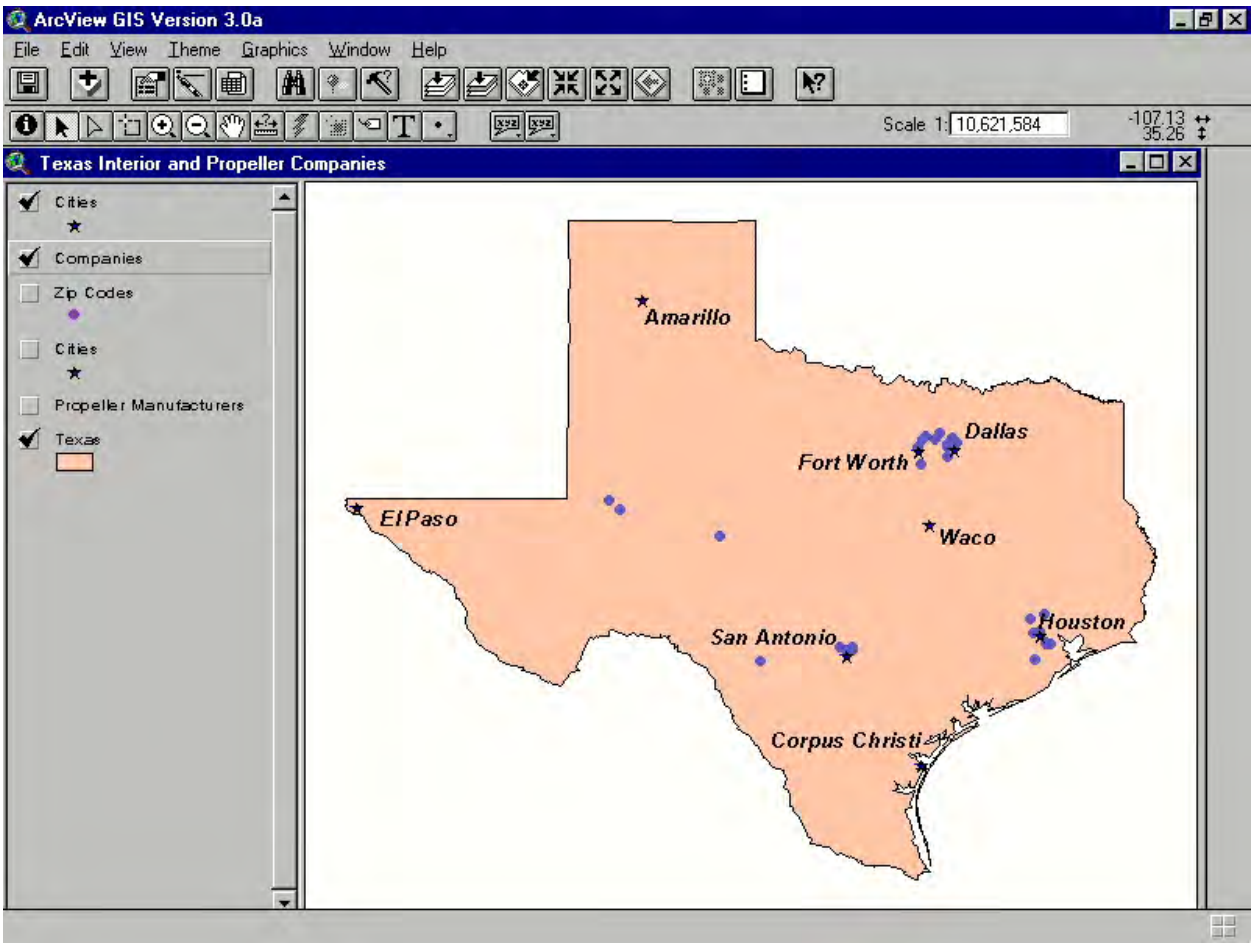
L_f_add	L_t_add	R_f_add	R_t_add	Prefix	Pre_typ	Name	Type	Suffix	Zipl	Zipr	State_ab	Cfcc
601	699	600	698	N		Presa	St		78205	78205	TX	A40
501	599	500	598	N		Presa	St		78205	78205	TX	A40
401	499	400	498	N		Presa	St		78205	78205	TX	A40
301	399	300	398	N		Presa	St		78205	78205	TX	A40
201	299	200	298	N		Presa	St		78205	78205	TX	A40
101	199	100	198	N		Presa	St		78205	78205	TX	A40
139	137	126	126			Guadalupe	St		78204	78204	TX	A40
135	101	124	100			Guadalupe	St		78204	78204	TX	A40
705	833	714	834			Saint Haven	St		78220	78220	TX	A40
4301	4399	4300	4398			Dysart	St		78220	78220	TX	A40
4201	4299	4200	4298			Dysart	St		78220	78220	TX	A40
199	101	198	100			Badger	St		78220	78220	TX	A40
299	201	298	200			Badger	St		78220	78220	TX	A40
399	301	398	300			Badger	St		78220	78220	TX	A40
499	401	498	400			Badger	St		78220	78220	TX	A40
101	199	100	198			Concho	St		78207	78207	TX	A40
199	101	198	100			Sycamore	St		78205	78205	TX	A40
199	101	198	100	W		Elmira	St		78212	78212	TX	A40
299	201	298	200	W		Elmira	St		78212	78212	TX	A40
399	301	398	300	W		Elmira	St		78212	78212	TX	A40
499	401	498	400	W		Elmira	St		78212	78212	TX	A40
675	601	674	600	W		Elmira	St		78212	78212	TX	A40
701	799	700	798			Arthur	St		78202	78202	TX	A40
601	699	600	698			Arthur	St		78202	78202	TX	A40
501	599	500	598			Arthur	St		78202	78202	TX	A40
401	499	400	498			Arthur	St		78202	78202	TX	A40
301	399	300	398			Arthur	St		78202	78202	TX	A40

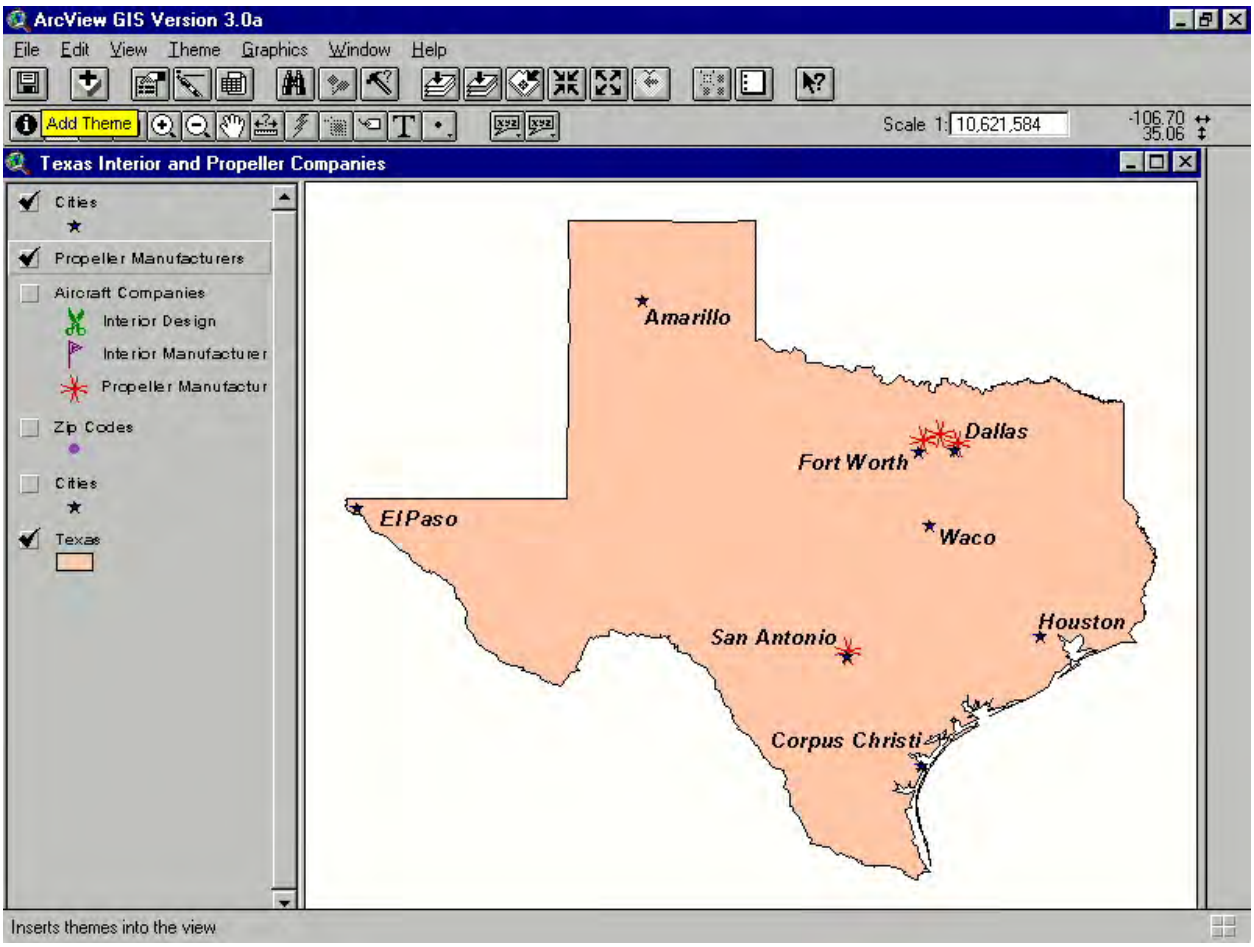


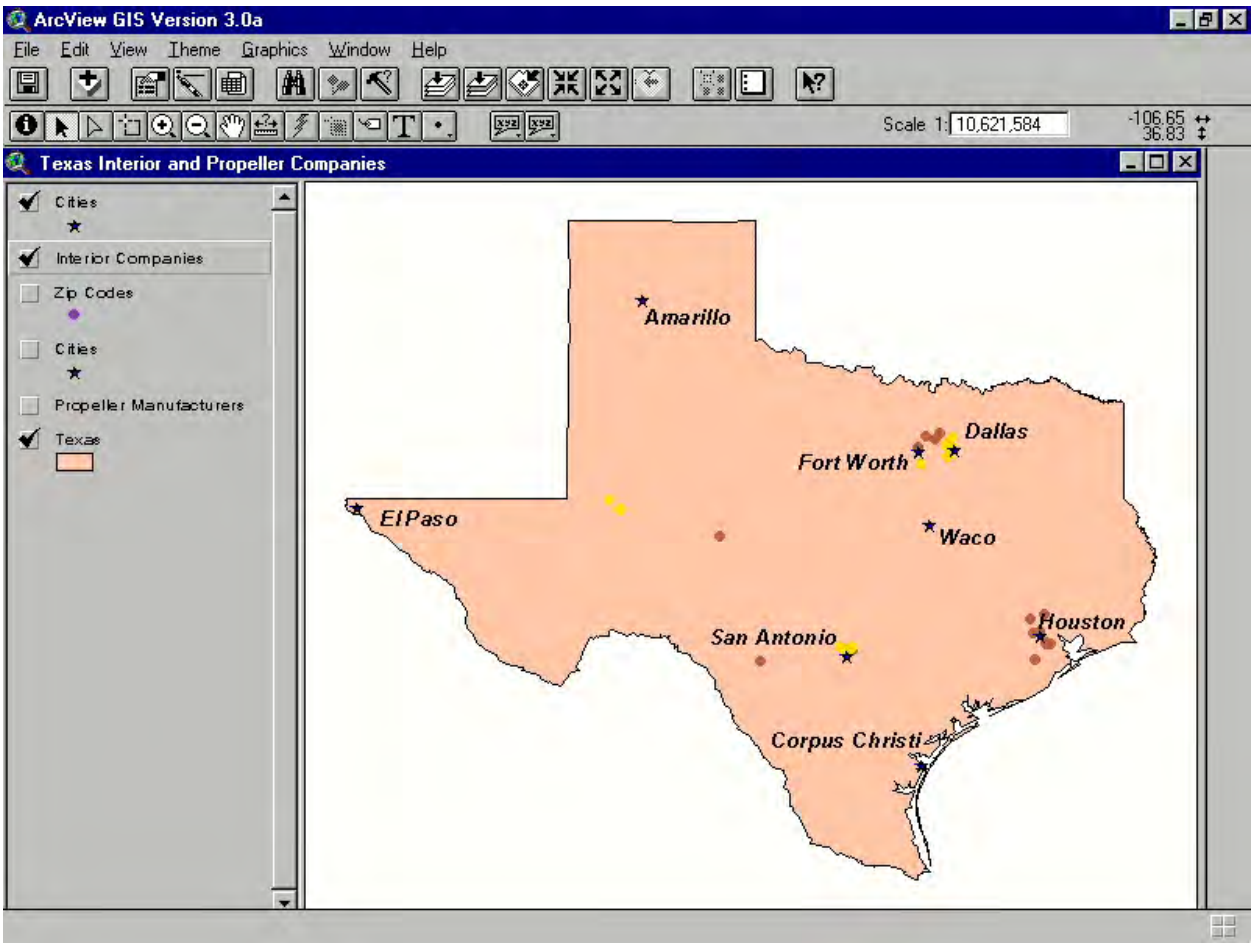
Company	_address	_city	_state	Zip	_phone	_specialty
Aero Clean Aviation Se	302 East Rogers Street	Houston	TX	77022	(713) 694-5000	ID
Aero Plus Interiors In	503 McKeever Road	Rosharon	TX	77583	(281) 431-0007	ID
Air Star Interiors Inc	4201 North Main Street	Fort Worth	TX	76106	(817) 740-1946	ID
Aircraft & Engine Supp	9710 Ball Street	San Antonio	TX	78217	(210) 590-6859	ID
Coleman Aircraft Inter	20221 Stuebner Airline Ro	Spring	TX	77379	(281) 376-487	ID
Comtran International	1770 Skyplace Boulevard	San Antonio	TX	78216	(210) 821-6301	ID
Houston Air Service In	8101 Lockheed Avenue	Houston	TX	77061	(713) 645-6858	ID
Innovative Aircraft In	443 Southfork Drive	Lewisville	TX	75057	(972) 436-5706	ID
J & P Enterprises	9700 Almeda Genoa Road #	Houston	TX	77075	(713) 910-6019	ID
Joe's Aircraft Interio	4201 North Main Street #	Fort Worth	TX	76106	(817) 625-2541	ID
Johnson Custom Paintin	1201 Minters Chapel Road	Grapevine	TX	76051	(817) 481-7963	ID
M B Company	200 Porter Lane	Porter	TX	77365	(281) 572-1407	ID
Million Air	4300 Westgrove Drive	Dallas	TX	75248	(972) 248-1600	ID
P N & J Interiors	1015 Airway Boulevard	Roanoke	TX	76262	(817) 491-0135	ID
Ranger Aviation Enterp	8802 Hanger Road	San Angelo	TX	76904	(915) 949-3773	ID
Rohrman Bros. Aircft I	Ellington Field AFB Build	Houston	TX	77034	(281) 481-0527	ID
Sherline Company	999 Hansen Road	Houston	TX	77061	(713) 943-2422	ID
Southstar Aircraft Int	216 Howard Langford Drive	Uvalde	TX	78801	(210) 278-4108	ID
Southwest Aero Design	11305 Todd Street	Houston	TX	77055	(713) 682-8440	ID
Askey Propeller Compan	8515 Old Denton Road	Keller	TX	76248	(817) 431-3160	P
Dallas Propeller Works	10540 New Church Road	Dallas	TX	75238	(214) 348-3747	P
Mc Gill Propeller & We	894 North Mill Street # 1	Lewisville	TX	75057	(972) 436-7498	P
San Antonio Propeller	234 West Turbo Drive	San Antonio	TX	78216	(210) 342-4452	P
A C Products Inc	114 Braniff Drive	San Antonio	TX	78216	(210) 366-0716	IM
AAI Akridge Aircraft	2990 Lombardy Lane	Dallas	TX	75220	(214) 904-9099	IM
Aero MOD Service	Hanger T33	Midland	TX	79711	(915) 563-1666	IM
Air Craft Dynamics	10440 John Cape Road	San Antonio	TX	78216	(210) 829-4006	IM


Theme Properties
Theme Name:
Zip Codes
Use Suffix
Definition
Text Labels
Geocoding
Display
Address Style:
5-Digit ZIP
ZIP
Zip
Alias table:
<None>
OK
Cancel


ArcView GIS Version 3.0a
File Edit View Theme Graphics Window Help
Scale 1: 10,621,584
-106.57
35.34
Texas Interior and Propeller Companies
Zip Codes
Cities
Geocode Addresses
Reference Theme: Zip Codes
Join Field: <None>
Using Address Style: 5-Digit ZIP
Change Address Style...
Address Table: interiors.dbf
Address Field: Zip
Display Field: <None>
Alias Table: <None>
Geocoded Theme: c:\ncgia\zipcode.shp
Geocoding Preferences...
Batch Match
Interactive Match...
Cancel


ArcView GIS Version 3.0a
File Edit View Theme Graphics Window Help
Scale 1: 10,621,584
-107.13
35.26
Texas Interior and Propeller Companies
Cities
Companies
Zip Codes
Cities
Propeller Manufacturers
Texas
Amarillo
Dallas
Fort Worth
ElPaso
Waco
Houston
San Antonio
Corpus Christi


ArcView GIS Version 3.0a
File Edit View Theme Graphics Window Help
Add Theme
Scale 1: 10,621,584
-106.70
35.06
Texas Interior and Propeller Companies
Cities
Propeller Manufacturers
Aircraft Companies
Interior Design
Interior Manufacturer
Propeller Manufactur
Zip Codes
Cities
Texas
Amarillo
Dallas
Fort Worth
ElPaso
Waco
Houston
San Antonio
Corpus Christi
Inserts themes into the view


ArcView GIS Version 3.0a
File Edit View Theme Graphics Window Help
Scale 1: 10,621,584
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36.83
Texas Interior and Propeller Companies
Cities
Interior Companies
Zip Codes
Cities
Propeller Manufacturers
Texas
Amarillo
Dallas
Fort Worth
ElPaso
Waco
Houston
San Antonio
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