

FROM NON-SPATIAL DATA TO SPATIAL DATA.

GEOCODING & GEOREFERENCING IN ARCGIS

OBJECTIVES

Upon completion of this tutorial, you should be able to perform the following tasks in ArcGIS:

- Preparation of address data for effective geocoding
- Creation of an Address Locator using Reference Streetline Files.
- Interactive geocoding of problematic addresses
- “Cleaning” of geocoding results for use in analysis
- Spatial join of geocoded addresses to extract values from other spatial data
- aggregation of geocoded address data to other geographic boundaries
- adding non-georeferenced spatial imagery to a map document
- application of georeferencing tools to add spatial referencing data to imagery

GETTING READY FOR THE TUTORIAL

SIGN UP FOR THE GIS-L LISTSERV

The Yale University GIS-L Listserv is an internal University message system, devoted to GIS use and issues at Yale. The list is the primary source for updates on software and license server issues, data acquisitions and workshop announcements. All GIS users are encouraged to sign up for the list. The GIS-L list is very lightly used, so that you will not be overwhelmed with messages that are not relevant to you.

1. In your Web Browser, **Go To the Map Collection Website**, at www.library.yale.edu/maps
2. Under the **Quick Links** section on the right,, **Click** on the “**Sign up for the Yale GIS-L Mailing List**” link to go to the **GIS-L Registration Page**.
3. **Enter** your **Email Address** and **Choose a Password**.

Note: We suggest that you not select the Daily Digest feature.

4. **Click** on the **Subscribe Button** to finish.


You should receive a confirmation email shortly afterward, with instruction on how to use the GIS-L list.

DOWNLOAD THE DATA

The datasets used in this tutorial are available for download on the Map Collection Website. Feel free to download and use these tutorial materials, as you wish, and to pass them along to interested colleagues.

1. **Return** to the **Map Collection Homepage**, in your **Web Browser**.
2. Under the **Quick Links Section** on the right, **Click** on the “**Download GIS Workshop Materials**” link.
3. **Find** the “**Data**” **Link** for the ArcGIS 9.2 “**From Non-Spatial Data to Spatial Data. Geocoding & Georeferencing in ArcGIS**” and **Right-Click** on the **Link**.
4. In **Firefox**, **Select** “**Save Link As,**” in **Internet Explorer**, **Select** “**Save Target As...**”
5. Depending on your browser and setup, you may be offered a **Browse Window**, to select the folder into which you want the downloaded file placed. If so, **Browse** to a **Folder** on your hard drive that you have write permission for. For this

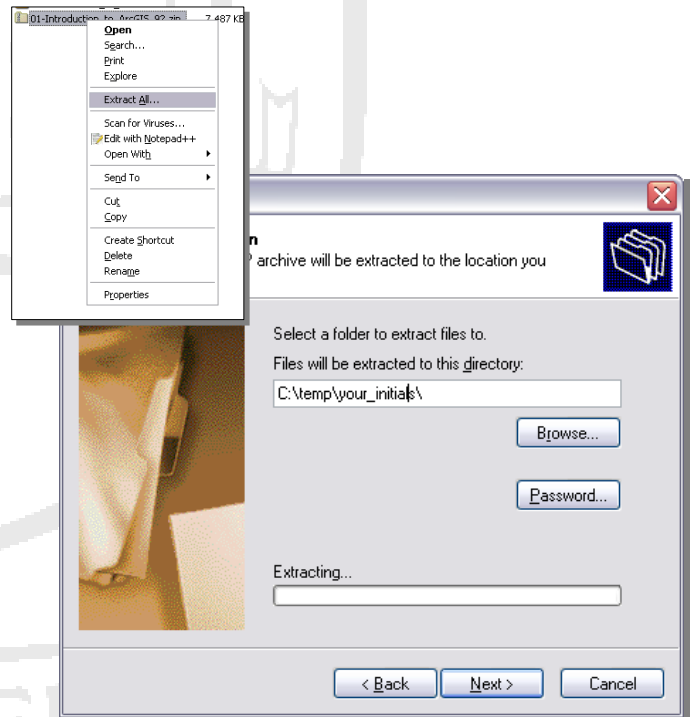
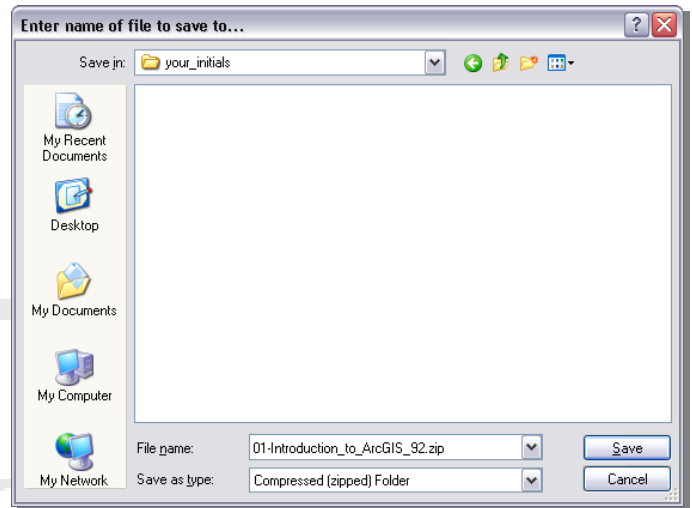
tutorial, we will assume that you are using the **C:\temp** folder of the machine you are working on.

6. **Clicking** on the **Create New Folder**  **Button, Create a New Folder**, using your initials as the name of the folder, so that you end up with a full path something like: **C:\temp\your_initials**
7. **Save** the **Downloaded File** to this **New Folder**.

UNZIP THE DATA

You should now have a file called “**03-Geocoding_and_Georeferencing.zip**” in your new folder. It is now necessary to decompress, or unzip, the tutorial data for use. Note that in Microsoft Windows XP and Vista, it is possible to “Explore” a compressed file, as if it were a folder. ArcMap does not support this type of browsing, so it is necessary to actually unzip the file for use. This part of the tutorial assumes that you are using Windows’ built in Compressed File support.

1. **Browse** into the **Folder** where you saved the **03-Geocoding_and_Georeferencing.zip** file.
2. **Right-Click** on the **File** and **Select “Extract All...”**
3. **Click Next** to arrive at the window shown at the right.
4. Under “**File Will Be Extracted To This Directory:**” **Remove** the **\03-Geocoding_and_Georeferencing** part of the **Path Name** (this is redundant, as the zip file contains a directory structure of its own).
5. **Click Next** to **Extract** the **File**.
6. Once the extraction has completed, you can **Uncheck “View Extracted Files”** and **Click Finish**.



GEOCODING OF TABULAR ADDRESS DATA

EXAMINING THE STREETS REFERENCE DATA

1. **Browse** into the C:\temp\your_initials\03-Geocoding_and_Georeferencing\Geocoding\ Folder and **Double-Click** on the **Geocoding.mxd** Map Document file to **Launch** the **ArcMap** Application.
2. **Right-Click** on the **tgr090091kA** Layer and **Open** its **Attribute Table**.

FID	Shape	TLID	FNODE	TNODE	LENGTH	FEDIRP	FENAME	FETYPE	FEDIRS	CFCC	FRADDL	TOADDL	FRADDR	TOADDR	ZIPL	ZIPR	CENSUS1	CENSUS2	CFCC1	CFCC2	SOURCE
0	Polyline	3696375	1014	993	0.18365		Palmer	Rd		A41	1	99	2	98	06478	06478	0	0	A	A4	A
1	Polyline	3696376	1053	1049	0.12232		Hillside	Ter		A41	1	15	0	0	06483		0	0	A	A4	A
2	Polyline	3696378	1253	1184	0.52826		Squantuck	Rd		A31	101	125	0	0	06483		0	0	A	A3	A
3	Polyline	3696379	1003	1011	0.0381		Roosevelt	Dr		A21	404	400	403	401	06478	06478	0	0	A	A2	A
4	Polyline	3696383	1003	1014	0.05414		Hawkstone	Ter		A41	1	5	2	10	06478	06478	0	0	A	A4	A
5	Polyline	3696385	1013	1011	0.0282		Roosevelt	Dr		A21	395	399	394	398	06483	06483	0	0	A	A2	A
6	Polyline	3696386	1014	1034	0.09483		Hawkstone	Ter		A41	7	13	12	16	06478	06478	0	0	A	A4	A
7	Polyline	3696387	1013	1023	0.06481		Riviera	Ter		A41	1	9	2	6	06483	06483	0	0	A	A4	A
8	Polyline	3696388	1039	1023	0.10568		Sunset	Ter		A41	1	15	2	16	06483	06483	0	0	A	A4	A
9	Polyline	3696389	1030	1013	0.10735		Roosevelt	Dr		A21	379	393	378	392	06483	06483	0	0	A	A2	A
10	Polyline	3696390	1023	1031	0.04068		Riviera	Ter		A41	11	25	8	16	06483	06483	0	0	A	A4	A
11	Polyline	3696391	1031	1043	0.10305		Edgehill	Ter		A41	26	8	19	7	06483	06483	0	0	A	A4	A
12	Polyline	3696392	1030	1094	0.30714		Roosevelt	Dr		A21	376	322	377	325	06483	06483	0	0	A	A2	A

Note the fields included in this reference data set. This streets reference data is ‘topologically integrated,’ meaning that there is information encoded into the dataset. Fields included for each street segment that are essential to the geocoding process include:

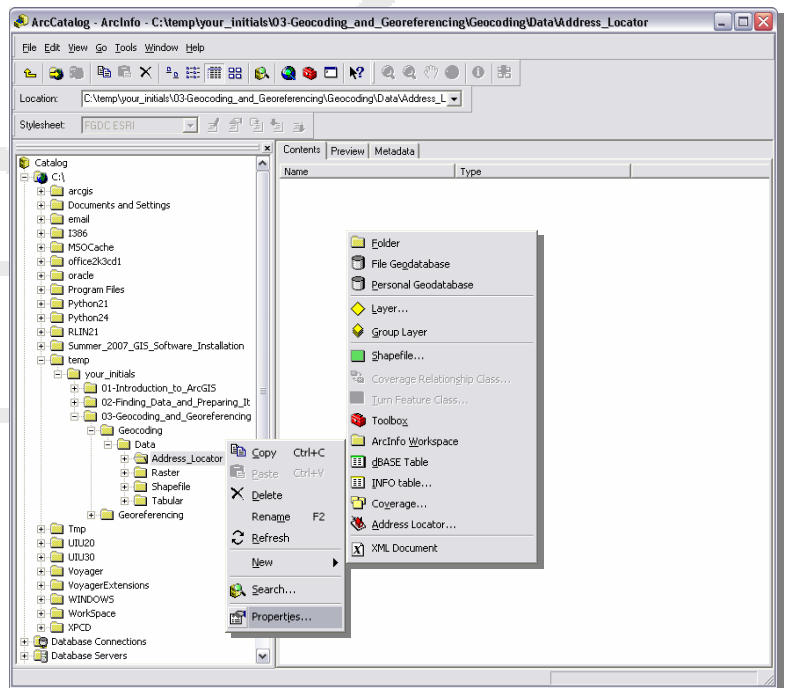
- **FNODE** – This is an identifying number for the point FROM WHICH the street segment begins.
- **TNODE** – This is an identifying number for the point TO WHICH the street segment extends.
- **FRADDL & FRADDR** – These are the values of the address range for the given street segment at the **FNODE** for the **LEFT & RIGHT** side of the street, respectively.
- **TOADDL & TOADDR** - These are the values of the address range for the given street segment at the **TNODE** for the **LEFT & RIGHT** side of the street, respectively.

Together, the FRADDL, FRADDR, TOADDL & TOADDR values provide the numeric range of addresses for both sides of a given street segment. This information is used to calculate the “percent along” the street segment that a given address lays.

3. **Close** the **Attribute Table**.

CREATING A NEW ADDRESS LOCATOR

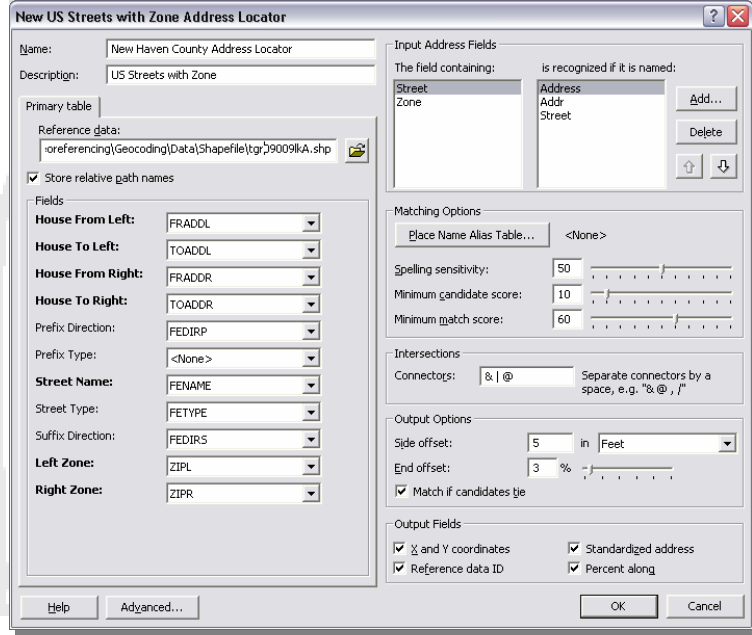
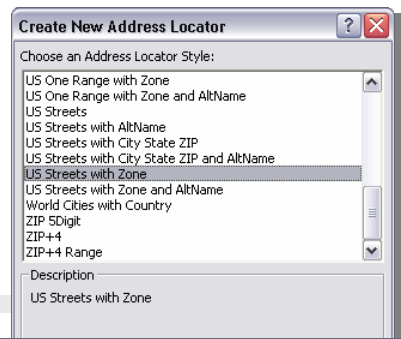
4. On the **Windows Start Menu**, **Go To Start>Programs>ArcGIS>ArcCatalog** to launch the **ArcCatalog** Application.
5. In the **Catalog Tree Panel**, **Browse** to the **C:\temp\your_initials\03-Geocoding_and_Georeferencing\Geocoding\ata\Address_Locator** Folder.
6. **Right-Click** on the **.\Address_Locator** Folder and **Go To New>Address Locator**.



7. In the first “Create New Address Locator” Dialog Window, Select ‘US Streets With Zone.’
8. Click Ok.
9. In the next dialog window, populate the properties of the Address Locator as shown in the image, and as noted below:

- Name: ‘New Haven County Address Locator’
- Check ‘Store Relative Pathnames’
- Reference Data: C:\temp\your_initials\03-Geocoding_and_Georeferencing\Geocoding\Data\shapfile\090091ka.shp
- Fields: [ensure the fields are mapped as shown in the image on the right]
- Matching Options:
 - Spelling Sensitivity: 50
- Output Options:
 - Side Offset: 5 Feet
- Output Fields: Check All

10. Click Ok to Create the Address Locator.
11. Make sure that the New Haven County Address Locator is added to the C:\temp\your_initials\03-Geocoding_and_Georeferencing\Geocoding\Data\Address_Locator Folder.



EXAMINING THE ADDRESS DATA

1. Return to ArcMap.
2. Click on the Source Tab at the bottom of the Table Of Contents Panel.
3. Find the NH_Nursing_Homes Table, Right-Click and Open it.

Note that the format of the addresses in the table differs from that in the reference street data. This format, where the full street address is concatenated into a single field is how ArcGIS “prefers” address data. Also note that there are two Zipcode fields. The first is the original field, which is recorded as a numeric value. In this case, the leading 0 of the CT Zipcodes has been dropped as a function of the format (integer). In the second Zipcode field (ZIPTXT), the zipcodes have been converted to text and the leading 0’s have been restored. This is actually how the reference data records Zipcodes (as text) and will improve our match % when geocoding.

4. Close the Attribute Table.

OID	NAME	ADDRESS	CITY	STATE	ZIP	PHONE	ZIPTXT
0	ST JOSEPH MANOR	6448 MAIN STREET	TRUMBULL	CT	6611	(203) 288-6204	06611
1	WINDSOR REHAB & HEALTHCARE CTR	581 POGUONOCK AVE	WINDSOR	CT	6095	(860) 688-7211	06095
2	CRESTFIELD REHAB CTR & FENWOOD	565 VERNON ST	MANCHESTER	CT	6040	(860) 643-5151	06040
3	MONTWHESE HEALTH & REHAB CTR,	163 QUINNIPIAC AVE	NORTH HAVEN	CT	6473	(203) 624-3303	06473
4	CHESTERFIELD'S HEALTH CARE CEN	132 MAIN ST	CHESTER	CT	6412	(860) 526-5363	06412
5	HARBORSIDE HEALTHCARE-GLEN HIL	1 GLEN HILL RD	DANBURY	CT	6810	(203) 744-2840	06810
6	CAROLTON CHRONIC & CONV HOSP,	400 MILL PLAIN RD	FAIRFIELD	CT	6430	(203) 255-3573	06430
7	PLAINVILLE HEALTH CARE CENTER	269 FARMINGTON AVE	PLAINVILLE	CT	6062	(860) 747-1637	06062
8	HEWITT HEALTH & REHABILITATION CENTER, INC	45 MALTBY STREET	SHELTON	CT	6484	(203) 924-4671	06484
9	BLAIR MANOR	612 HAZARD AVE	ENFIELD	CT	6082	(860) 749-8388	06082
10	SKYVIEW CENTER	35 MARC DR	WALLINGFORD	CT	6492	(203) 265-0981	06492
11	WETHERSFIELD HEALTH CARE CTR	341 JORDAN LANE	WETHERSFIELD	CT	6109	(860) 563-0101	06109
12	BIRMINGHAM HEALTH CENTER	210 CHATFIELD ST	DERBY	CT	6418	(203) 735-7401	06418
13	SALMON BROOK CENTER	72 SALMON BROOK DR	GLASTONBURY	CT	6033	(860) 633-5244	06033
14	COURTLAND GARDENS HEALTH CENTE	53 COURTLAND AVE	STAMFORD	CT	6902	(203) 351-8300	06902
15	HAVEN HEALTH CTR-SOUNDVIEW	ONE CARE LANE	WEST HAVEN	CT	6516	(203) 934-7955	06516
16	AVERY NURSING HOME	705 NEW BRITAIN AVE	HARTFORD	CT	6106	(860) 527-9126	06106

STARTING THE GEOCODING PROCESS

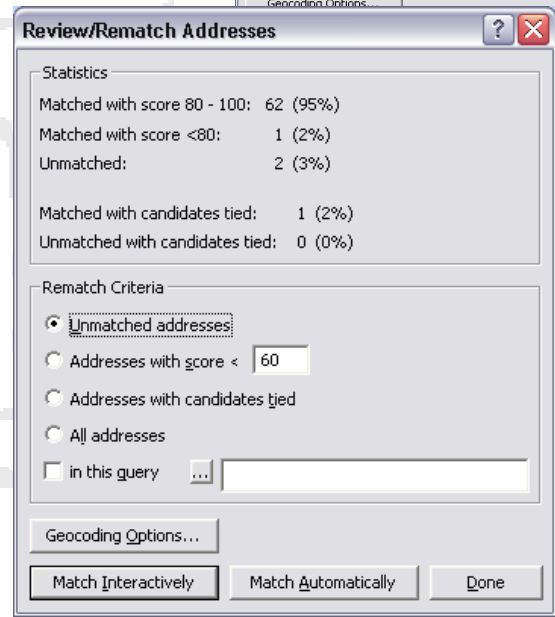
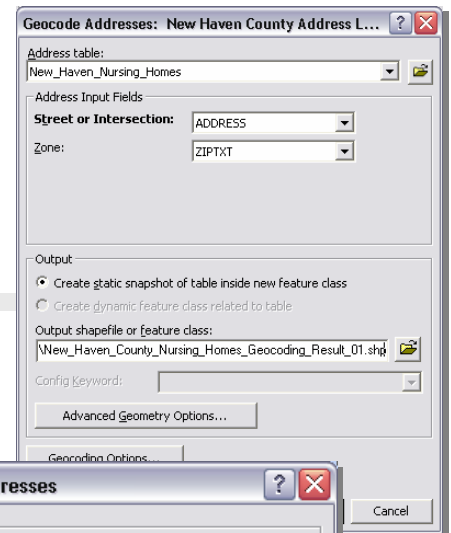
1. **Right-Click** on the **NH_Nursing_Homes Table** and **Select Geocode Addresses...**
2. In the resulting **Geocoding Dialog**, **Change the Zone:** to **'ZIPTXT'**.
3. **Browse** to the **C:\temp\your_initials\03-Geocoding_and_Georeferencing\Geocoding\Data\Shapefile\ Folder** and **Save the Output Shapefile as New_Haven_County_Nursing_Homes_Geocoding_01.shp.**
4. **Click Ok** to begin the **Geocoding Process.**

Once the Geocoding process has finished, you will be presented with the Review/Rematch Address dialog. This dialog will indicate the number of successful geocode matches, and allow you to examine the unsuccessfully matched addresses to determine what the problem might be. In this case, there are two unmatched addresses. In normal circumstances, you would investigate why these addresses could not be matched. Here, we will simply remove the unmatched addresses.

CLEANING UNMATCHED ADDRESSES FROM THE GEOCODING RESULTS

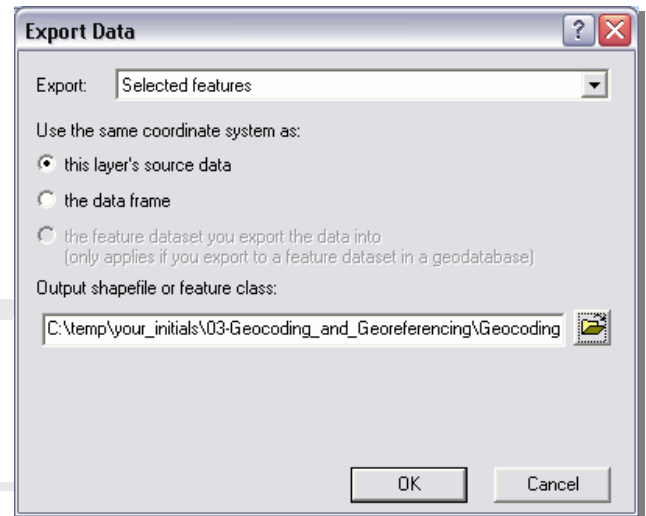
We now want to **"Select Out"** the successful geocodes and **Export** them to a shapefile. *Unsuccessfully geocoded items in our current file will cause problems with certain geoprocessing tasks in ArcGIS because they do not have geometry.*

1. **Right-Click** on the **Geocoding Result: New_Haven_County_Nursing_Homes_Geocoding_Result_01 Layer** and **Open the Attribute Table.** *Note that the attributes from the original address table have been carried over to this new shapefile.*
2. **Right-Click** on the **Score Fieldname** and **Select "Sort Ascending."** This should place the unmatched address at the top of your **Attribute Table** for examination and verification of the address accuracy through other means.
3. **Click and hold** on the **Small Grey Box** to the left of the first field in your **Attribute Table**, **Drag** down until all **Unmatched Records** are **Selected.**

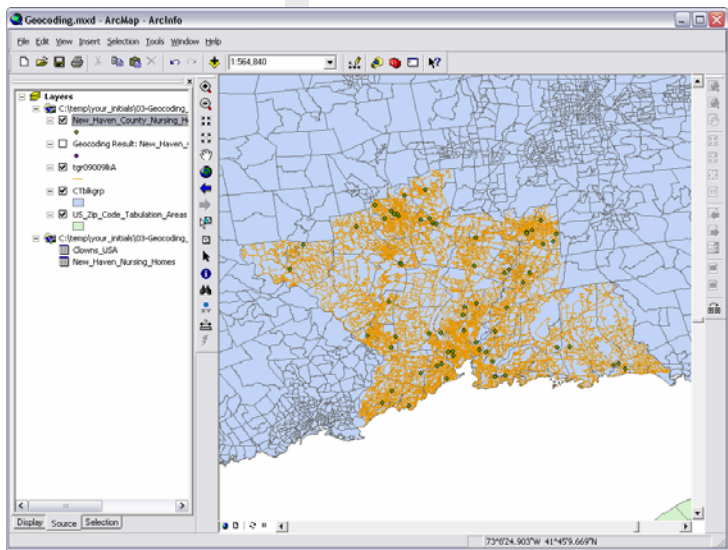


FID	Shape	Status	Score	Side	X	Y	Stan_addr	Ref_ID	Pct_along
3	Point	U	0		0	0	80 HERITAGE RD 06488	-1	0
39	Point	U	0		0	0	915 ELLA GRASSO BLVD 06519	-1	0
1	Point	T	63	L	-73.211427	41.503735	990 N MAIN ST 06488	71	86.2069
28	Point	M	81	R	-73.055802	41.400919	41 SKOKORAT ST 06483	16479	10
12	Point	M	87	L	-73.03213	41.469538	89 WED DR 06770	32390	8.6957
0	Point	M	100	L	-73.236097	41.459647	162 S BRITAIN RD 06488	21058	96.1039
2	Point	M	100	L	-73.026833	41.59391	2817 N MAIN ST 06704	22152	16.3265
4	Point	M	100	L	-73.063988	41.552627	1243 W MAIN ST 06708	22861	7.6923
5	Point	M	100	L	-73.081114	41.576693	177 WHITEWOOD RD 06708	21688	27.381
6	Point	M	100	L	-73.114943	41.537792	778 MIDDLEBURY RD 06762	21574	42.3077

4. **Click** on the **Options Button** at the bottom of the attribute table and select **“Switch Selection.”** Note that all of your points in the **Map View** window are now selected, as well as their corresponding records in the attribute table.
5. **Close** the **Attribute Table**.
6. **Right-Click** on the **Geocoding_Results_01** Layer in the **Table of Contents** and **Select Data>Export Data**.



Since you have an active selection **“Selected Features”** will be the default action for this dialog box.



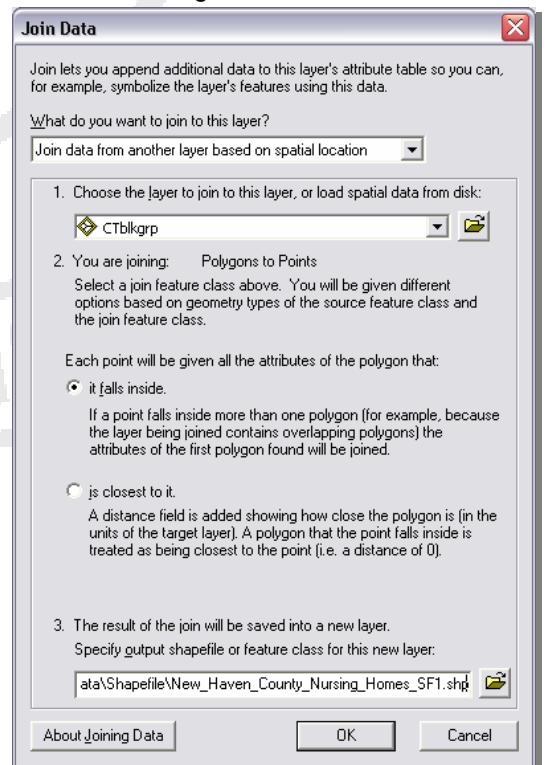
7. **Browse** to your **C:\temp\your_initials\03-Geocoding_and_Georeferencing\Geocoding\Data\Shapefile** Folder and **Save** the **New Shapefile** as **New_Haven_County_Nursing_Homes_Clean.shp**.
8. **Click OK** to **Export** the **Data**.
9. **Click Yes** when prompted to add the new layer to your map.

10. You can now **Turn Off** the **Visibility** of the original **Geocoding Result: New_Haven_County_Nursing_Homes_Geocoding_Result_01** Layer, or **Remove** it altogether.
11. **Save** your work.

USING “SPATIAL JOINS” TO EXTRACT DATA VALUES

Now suppose that we would like to overlay these addresses with demographic data in order to determine the socioeconomic characteristics of the area that each of these facilities serves.

1. **Right-click** on the **New_Haven_County_Nursing_Homes_Clean** Layer in the **Table of Contents** and **Select Joins and Relates>Join to open** the **Join Data Dialog Box**.
2. You want to:
 - **“Join data from another layer based on spatial location.”**
 - Join the layer to: **“CTblkgrp.shp.”**
 - Give each point the attribute of the polygon **“it falls inside.”**
 - **Browse** to your **C:\temp\your_initials\03-Geocoding_and_Georeferencing\Geocoding\Data\Shapefile** Folder and **Save** the **Output** as **New_Haven_County_Nursing_Homes_SF1.shp**.



3. **Click OK** to **Create** the new layer.
4. **Right-Click** on the **New_Haven_County_Nursing_Homes_SF1** Layer and **Open** the **Attribute Table**.

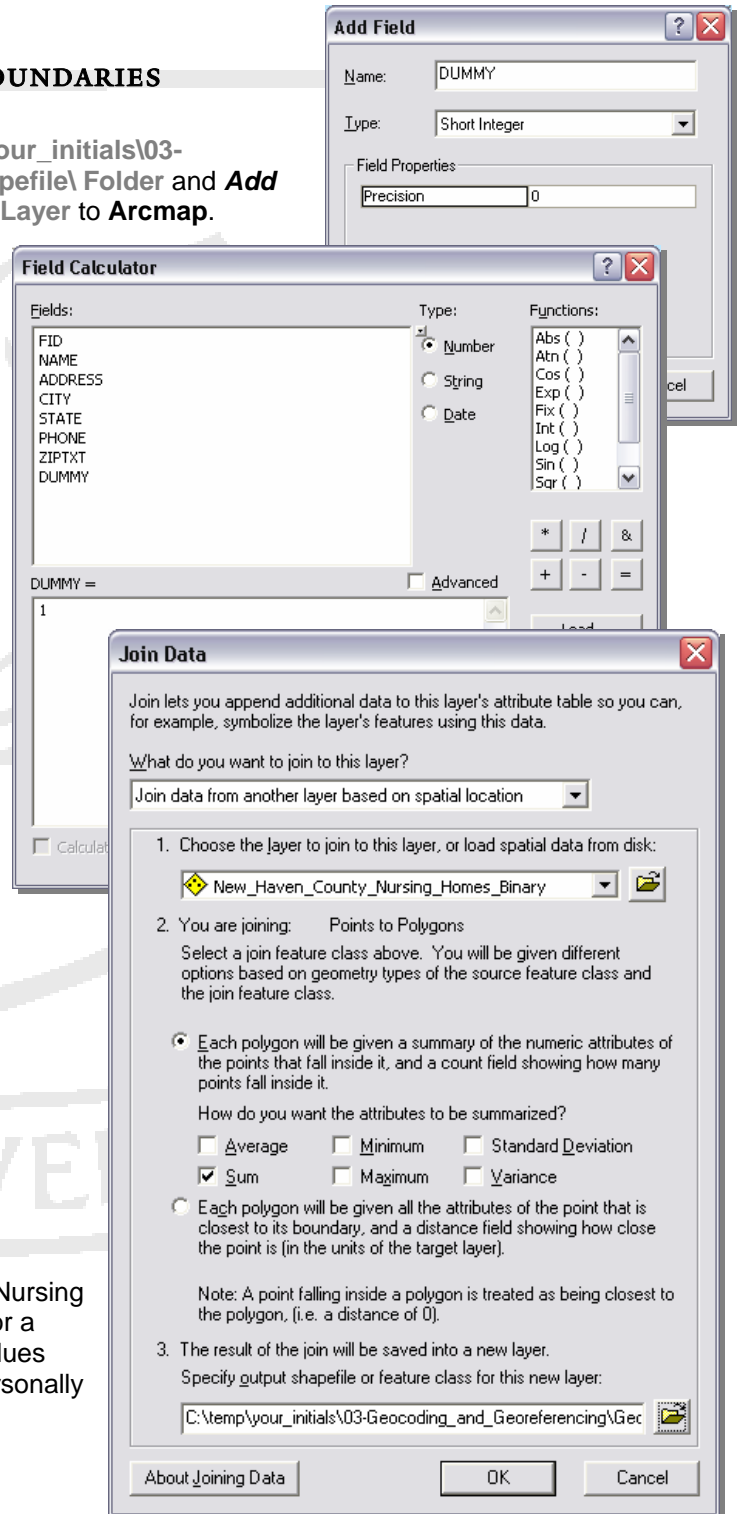
Note that each of your Nursing Home records now also contains the Census demographic attributes of its corresponding block group.

5. **Save** your work.

AGGREGATING ADDRESS DATA TO GEOGRAPHIC BOUNDARIES

1. **Click** on the **Add Data Button**, **Browse** to the **C:\temp\your_initials\03-Geocoding_and_Georeferencing\Geocoding\Data\Shapefile** Folder and **Add** the **New_Haven_County_Nursing_Homes_Binary.Shp** Layer to **Arcmap**.
2. **Right-Click** and **Open** the **Attribute Table** of this Layer.
3. **Click** on the **Options Button** and **Select Add Field**.
4. **Name** the Field **'DUMMY'**, **Type=Short Integer**.
5. **Click Ok**.
6. **Right-Click** on the **DUMMY Field Header** and **Select** the **Field Calculator**.
7. In the **Argument Window**, put the **Value '1'** and **Click Ok** to **Populate** the **Field** with **1's**.
8. **Close** the **Attribute Table**.
9. **Right-Click** on the **CTBlkgrp** Layer and **Go To Joins And Relates>Join...**
10. You want to:
 - **"Join Data From Another Layer Based On Spatial Location"**
 - **"...Layer to Join..." =**
New_Haven_County_Nursing_Homes_Binary
 - **"...attributes to be summarized..." By: Sum**
 - **Save the Output Shapefile as**
CTBlkgrp_with_Nursing_Home_Count.shp
11. **Click Ok** to **Apply** the **Join**.
12. **Open** the **Attribute Table** of the **CTBlkgrp_with_Nursing_Home_Count** Layer.

Note that the **SUM_DUMMY** variable provides the number of Nursing Homes within each Census Block Group (many have none, or a value of 0). The Spatial Join summarizes only the numeric values within the data set, so that (in the case of incident data) all personally identifying information has been removed.



GEOREFERENCING OF SCANNED MAPS & SPATIAL ADJUSTMENT OF VECTOR DATA

Georeferencing is the process of assigning spatial coordinates to data that is spatial in nature, but has no explicit geographic coordinate system. Here, we will take a scanned paper USGS topographic map and assign spatial coordinates to the image so that it can be overlaid with modern data. Then, we will use the georeferenced topo map to perform a spatial adjustment to a streets layer derived from the U.S. Census Bureau's TIGER Line Files, which are notoriously inaccurate.

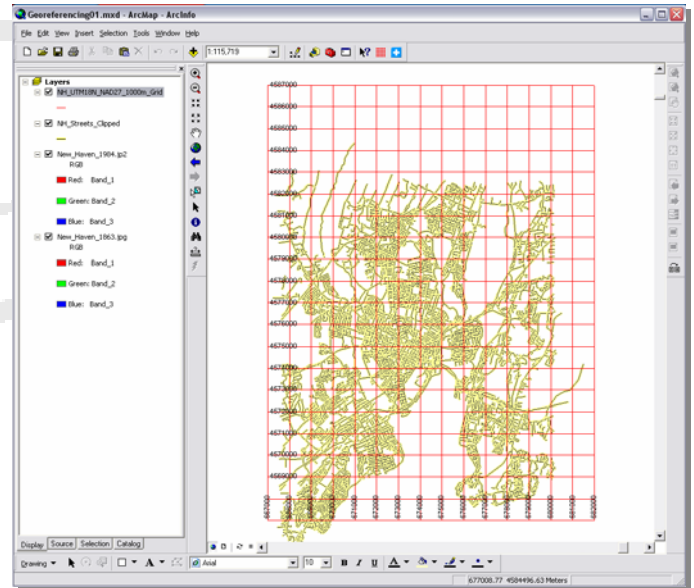
GEOREFERENCING OF SCANNED MAPS TO A SET OF KNOWN COORDINATE POINTS

This first part of the tutorial shows you the steps involved in georeferencing a scanned map that contains reference ticks or graticules in a known Coordinate System and Datum.

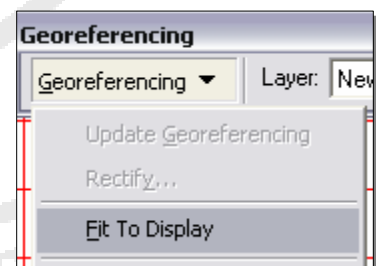
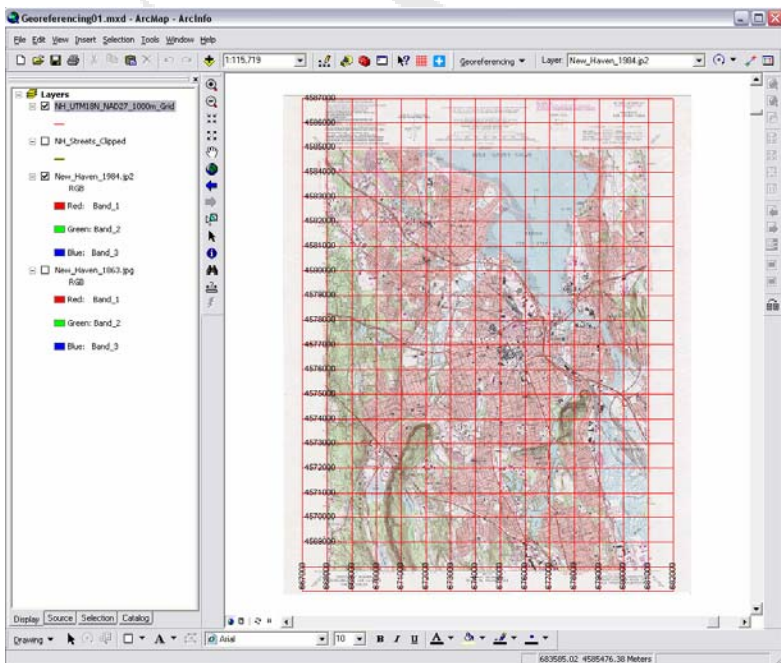
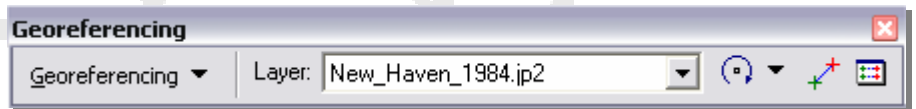
1. Open the **Georeferencing.mxd Map Document** included with this tutorial.


Note that you have three layers listed in the Table of Contents, but only two of the layers are visible. This is because the image layer listed does not yet have spatial reference.

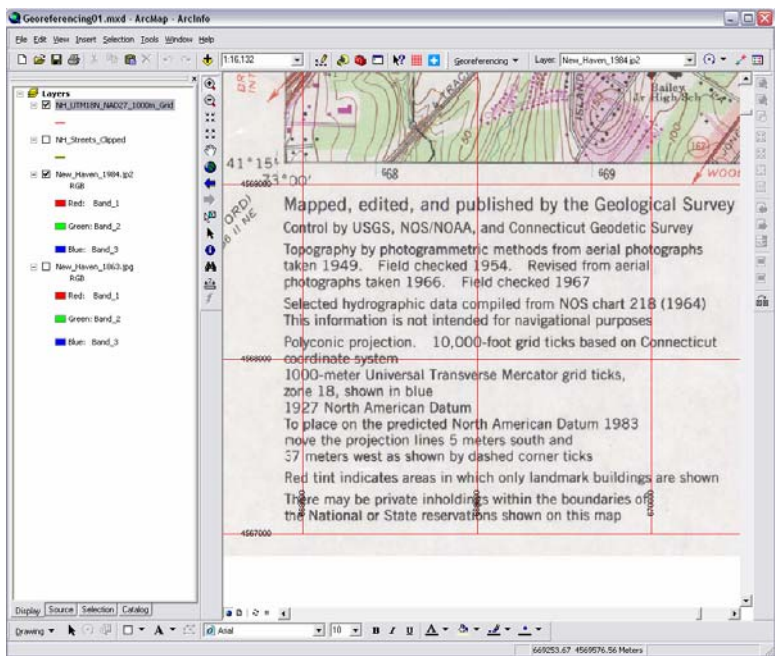
We will first use the **NH_Topo_1984_corner_points.csv** file to create a set of corner points as a reference to provide spatial coordinates to our scanned USGS Topo Map.



2. In the **Main Menu, Go To View>Toolbars>** and **Turn On the Georeferencing Toolbar**. If it is floating, you can dock it in the position of your choice.



3. Make sure that the **New_Haven_1984.jp2** layer is **Selected** in the **Layer: Drop-down** of the **Georeferencing Toolbar**.
4. **Click** on the **Georeferencing Button** and **Select Fit To Display** to bring your **New_Haven_1984.Jp2 Layer** into view.
5. **Use the Zoom Tool**  to **Zoom** into the bottom left corner of the **New_Haven_1984.Jp2 Layer**.



Note that in some cases, the image may be flipped so that you have a vertical mirror image of the map. You can resolve this by clicking on the **Georeferencing Button** and going to **Flip or Rotate>Flip Vertical**.

You should now be able to see that the scanned image of this 7.5 Topo map contains information about the Projection, Coordinate System, Datum and reference grid that the map contains. This type of information is available on most modern maps created by the USGS and its international equivalents. This information can be used to prepare the reference files to be used for georeferencing so that the most accurate result possible is attained. In this case, reference data (**NH_UTM18N_NAD27_1000m_Grid**) was created in the UTM Zone 18n Coordinate System, using the NAD 1927 Datum, since this is the geographic reference used in the paper map. Likewise, 1000 meter graticules were used, as in the scanned image, to provide a reference grid comparable to that in the USGS Topo map. Note that there is more than one reference grid on the USGS Topo map, but we have chosen the one in meters. Also note

that at each corner of the map image, there are Latitude Longitude Coordinates. These coordinates have been provided in the CSV file

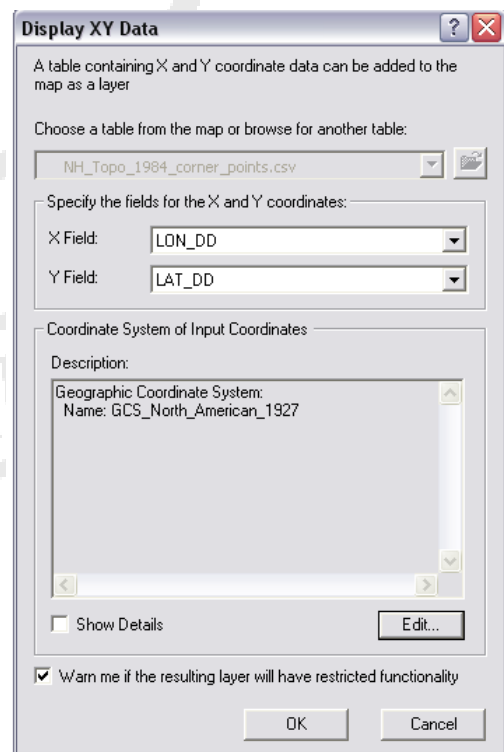
NH_Topo_1984_corner_points.csv.

6. **Click** on the **Source Tab** at the bottom of the **Table of Contents**. Find the **NH_Topo_1984_Corner_Points.Csv** Table, which should be at the bottom of the **Table of Contents**.
7. **Right-Click** on the **NH_Topo_1984_Corner_Points.Csv** and **Open** the **Table**.
8. Notice that the **Table** contains the **Lat/Lon Coordinates** of the corners of the topo map. **Close** the **Table**.
9. **Right-Click** on the **NH_Topo_1984_Corner_Points.Csv** Layer and **Select Display XY Data**.
10. In the **Display XY Data** dialog box, **Click** on the **Edit... Button**, under **Spatial Reference of Input Coordinates**.
11. **Click** on **Select...** and **Browse** to **Geographic Coordinate Systems>North America>North American Datum 1927.prj**.
12. **Click Add**.
13. **Click OK** twice.

You should now have a set of four points in your Map Document, to use as reference points for georeferencing.


14. If you have not already, **Zoom** into the lower left corner of the scanned map, so that you can see the corner of the map image and the XY


ID	LON_DD	LAT_DD
1	-73	41.375
2	-72.875	41.375
3	-72.875	41.25
4	-73	41.25



point you have added to the map layout.


15. **Click** on the **Georeferencing Button** and **Deactivate** the **Auto Adjust Feature** in the **Georeferencing Toolbar**. *This will prevent some fairly strange flip-flopping, that sometimes happens when adding control point (especially the second one).*

16. **Activate** the **Add Control Points Tool**  on the **Georeferencing Toolbar** and **Add a Control Point** by clicking on the scanned map corner first, then click on the corresponding reference point.



17. **Use** the **Pan Tool**  to pan to the lower right corner of the map, making sure that you can also see the reference point and corner at the same time. You can use the

Fixed Zoom Out Tool  to zoom out until you can see both.

18. Once again, **Activate** the **Add Control Points Tool**

 on the **Georeferencing Toolbar** and **Add** a control point by clicking on the scanned map corner first, then **Click** on the corresponding reference point.

19. **Repeat** the preceding steps for the remaining two reference points. Alternating between using the **Pan**

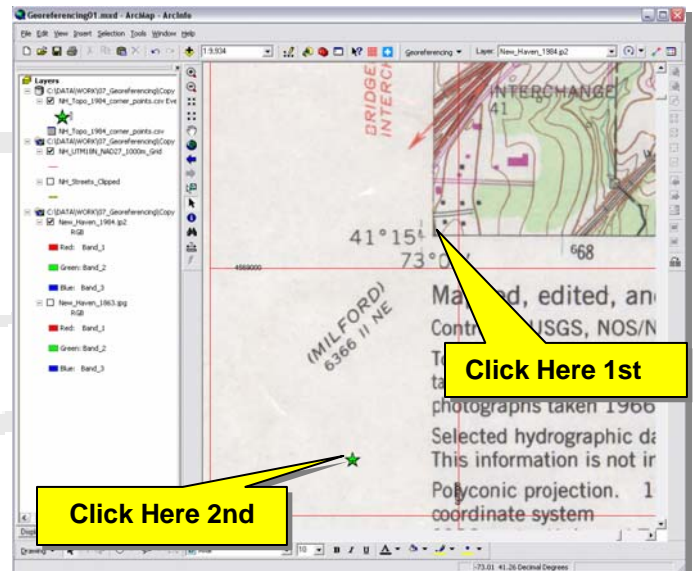
Tool  and the **Fixed Zoom Out Tool**  to **Adjust** your view of the map (You could also right-click on the **New_Haven_1984.Jp2 Layer** in the **Table Of Contents** and **Zoom To Layer**).

20. Once all four control points have been added, **Click** on the **Georeferencing Button** and **Select Update Georeferencing**. This will write the spatial coordinates of the scanned map to a file that allows you to add the image to **Arcmap** documents along with its geographic referencing.

21. **Zoom** into any area along the edge of the scanned map and observe whether the **Blue UTM Tick Marks** on the scanned image are overlaid by the **NH_UTM18N_NAD27_1000m_Grid**.

22. If everything has gone well, they should be VERY CLOSE!

23. **Save** your work.



HOW TO CONVERT DEGREES MINUTES & SECONDS TO DECIMAL DEGREES

The **NH_Topo_1984_corner_points.csv** is a table that contains the latitude & longitude coordinates of the corners of the topo map you are georeferencing. Since the coordinates of the corners are known, the simplest means of georeferencing the map is to use these known coordinates. However, the corner points are recorded on the map in Degrees, Minutes & Seconds format.

Before creating the spreadsheet, these corner coordinates should be converted to Decimal Degrees. [Here is an excellent explanation of how to do that:](http://www.warnercnr.colostate.edu/class_info/nr502/lg1/notes/dms_and_dd.html) (http://www.warnercnr.colostate.edu/class_info/nr502/lg1/notes/dms_and_dd.html). If you want to work within Excel, [here is a tutorial with VB Code](http://support.microsoft.com/kb/213449) (<http://support.microsoft.com/kb/213449>).