

What You Will Need

- ArcGIS 8.X (ArcInfo, ArcEditor, or ArcView license)
- Sample data from the *ArcUser Online* Web site (www.esri.com/arcuser)
- An Internet connection

Taming TIGER Data

Create Emergency Management Maps Using Census 2000 Data

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The decision making process for fire chiefs has become increasingly complex. In the past “professional credibility” provided the basis of a chief’s program. Now decisions are based on cost and consequence. Fire chiefs need the best available and most pertinent information on a community to support decision making.

Topologically Integrated Geographic Encoding and Referencing (TIGER) files, a product of the United States Census Bureau, include vector data on features such as transportation and hydrography, landmarks, Congressional Districts, and census blocks and tracts. TIGER 2000 data was acquired and enhanced across the country as part of Census 2000 and is readily available for the entire United States in a shapefile format from the Geography Network at no charge.

2000 TIGER in the keyword search box.

3. Choose TIGER/Line Files, Redistricting Census 2000 from the results page and click on the Link to Content button. Choose California by clicking on the state outline or choosing from the drop-down box. Choose San Luis Obispo County from the drop-down list on the California download page. This will generate a download page of the data layers available for San Luis Obispo County.

4. Not all the data layers listed are required. Download only the layers listed in Figure 1. It is often a good idea to split data into several downloads. After selecting data layers, click the Proceed to Download button. An archive file containing the selected layers will be generated. Save this file in the SLOTIGER\ZIPFiles\LatLon83 subdirectory.

5. Use WinZip or a similar decompression utility to view and extract the zipped files from this archive. Extract all zipped files to the SLOTIGER\ZIPFiles\LatLon83 subdirectory.

6. Each zipped file name is a concatenation of the abbreviation of the type of data it contains and the Federal Information Processing Standard (FIPS) code for the county. The Readme file that comes with the data contains information about the file names. Unzip each data layer archive and place these shapefiles in the SLOTIGER\SHPFiles\LatLon83 subdirectory.

7. In ArcCatalog, select any of the shapefile files, click on the Spatial tab in the Metadata area, and notice that projection and datum information available for raw TIGER data is minimal. Each shapefile includes only three files but no projection (PRJ) file. As a result, ArcCatalog assumes that the datum is North American Datum of 1927 (NAD27). All recent census data is registered in the North American Datum of 1983 (NAD83) so the first step will be to provide this critical information! Click back on the SLOTIGER root to release any associations with individual shapefile sets.

This *ArcUser* exercise walks the reader through acquiring and processing TIGER data, defining a projection and datum, loading data and tables, using a lookup table to take advantage of Census Feature Class Codes (CFCC), and importing legends. This data can then be used to create a basemap for fire and public safety planning.

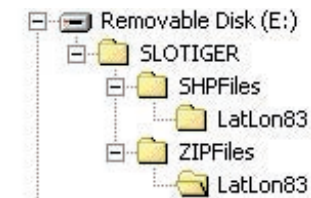
The exercise data describes San Luis Obispo County and is contained in the sample dataset. San Luis Obispo County is a rapidly growing area on the central California coast located about halfway between Los Angeles and San Francisco. Between 1990 and 2000, the county’s population increased approximately 14 percent with much growth in the communities of San Luis Obispo and Los Osos.

Obtaining and Inspecting TIGER Data

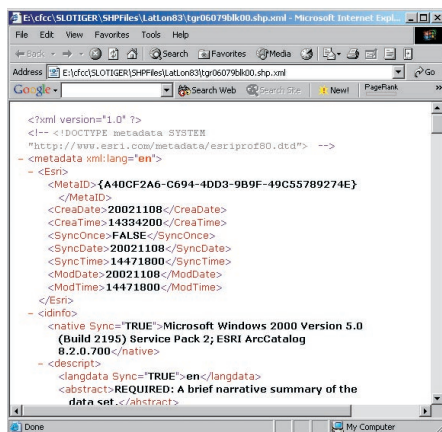
Census 2000 TIGER/Line shapefiles are available from the Geography Network Web site. This exercise uses data from San Luis Obispo County, California, but the methodology described will work for any area of the country. When downloading census data for another county, be careful not to exceed 20 MB in a single download.

1. In ArcCatalog, create a new directory named SLOTIGER. Under this directory, create two subdirectories called SHPFiles and ZIPFiles. Create a subdirectory for both the SHPFiles and ZIPFiles called LatLon83.

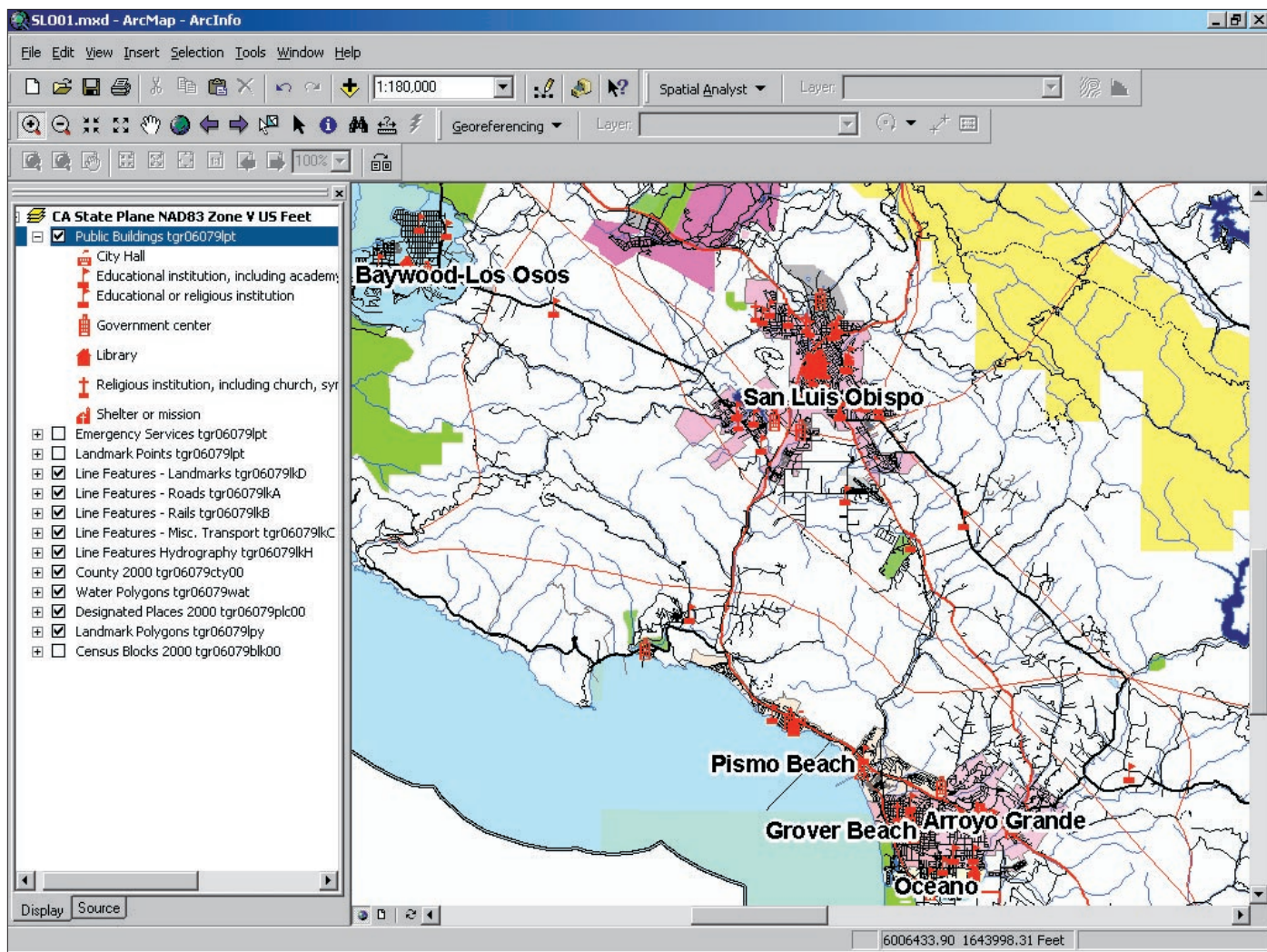
2. Go to the Geography Network Web site (www.geographynetwork.com). Type Census



In ArcCatalog, create a new directory named SLOTIGER, create two subdirectories called SHPFiles and ZIPFiles, and create a subdirectory for both called LatLon83.



Viewing the metadata for each dataset causes ArcGIS to generate an XML metadata file containing the correct projection and datum, which provides a nearly effortless way to start building metadata. These files can be viewed in a browser.



Census TIGER files available from the Geography Network can provide an excellent start-up framework for public safety modeling.

Figure 1: Required TIGER data with abbreviations and file sizes

Data Layer	Abbreviation	File Size
Census Blocks 2000*	blk00	2.1 MB
County 2000	cty00	24.1 KB
Designated Places 2000	plc00	44.0 KB
Landmark Points	1pt	10.8 KB
Landmark Polygons	1py	708.1 KB
Line Features — Hydrography	1kH	1.5 MB
Line Features — Landmarks	1kD	5.7 KB
Line Features — Misc. Transport	1kC	58.7 KB
Line Features — Rails	1kB	21.1 KB
Line Features — Roads	1kA	3.0 MB
Water Polygons	wat	131.9 KB

* Users with low bandwidth Internet connections can skip this set.

Defining Projection, Datum, and Units in ArcToolbox

ArcToolbox provides easy access to the powerful data processing and analysis functions in ArcGIS.

Launch ArcToolbox by clicking the red toolbox icon in ArcCatalog or choosing ArcToolbox from the Start menu in Windows.

1. In ArcToolbox, choose Data Management Tools > Projections > Define Projection Wizard

(shapefiles, geodatabase).

2. In the wizard, click on the file folder icon and browse to the location of the SLO\TIGER\SHPF\Files\LatLon83 subdirectory. Highlight all TIGER shapefiles and click Add. Click Next.

3. In the next panel, click Select Coordinate System and then click on the Select button to pick a predefined coordinate system.

4. Choose Geographic Coordinate Systems > North America > North American Datum 1983.prj. Click Add. In the Spatial Reference dialog box, inspect the text now shown under Details, click OK, and click Next.

5. In the next panel, verify that the summary of input is correct and click Finish. Close ArcToolbox.

Return to ArcCatalog and check the metadata for each shapefile to verify that each has been reset to NAD83. Viewing the metadata for each dataset causes ArcGIS to generate an XML metadata file containing the correct projection and datum, which provides a nearly effortless way to start building metadata. If these files are not visible in ArcCatalog, choose Tools > Options and add XML as a new file type. The XML files are also visible in Windows Explorer.

Loading TIGER Data Into ArcMap

The TIGER data is now in NAD83 but it is in decimal degrees. The next step is to create an ArcMap document and change the projection for these shapefiles to California State Plane Zone V, with feet as the unit of measure. Because a projection and datum have been defined for all datasets, the projection-on-the-fly capability of ArcGIS can be used to reregister the vector datasets.

1. Start an ArcMap session with a new map document. In the Table of Contents, right-click on the Data Frame and choose Properties. In the Properties dialog box, click on the General tab and rename the Data Frame from Layers to CA State Plane NAD83 Zone V US Feet.

2. Still in the Data Frame Properties dialog box, click on the Coordinate System tab and choose Projected Coordinate System > NAD 1983 StatePlane California V FIPS 0405. Click the Modify button and set the units to Foot_US for US Survey Feet, a more precise measure than Foot (or international feet). A U.S. Survey foot equals 0.3048006096 of a meter, while an international foot is equal to 0.3048 of a meter exactly. Return to the General

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tab to verify that Map and Display Units have been set to Foot_US. Click OK twice to apply these changes. Save the map document as SLO01.MXD.

3. To add the TIGER data to the map, click the Add Data button in the ArcMap toolbar. Navigate to the SLO01\MXDFiles\LatLon83 subdirectory and select all eleven TIGER shapefile sets (five polygon layers, five line layers, and one point layer).

4. Save the map document again. Using the list in Figure 1, rename the TIGER layers with more meaningful names. Use the data layer names in Figure 1 to translate the names (e.g., the layer tgr060791pt is renamed Landmark Points-tgr060791pt).

TIGER Tables and CFCC Codes

Right-click the Landmark Points tgr060791pt layer, the only point set, and open its attribute table. The five fields include a partially populated Name field. Right-click on the CFCC field name and choose Sort > Ascending. Note that most CFCC codes begin with the letter D followed by two numeric characters. There appears to be some relationship between the CFCC and NAME fields.

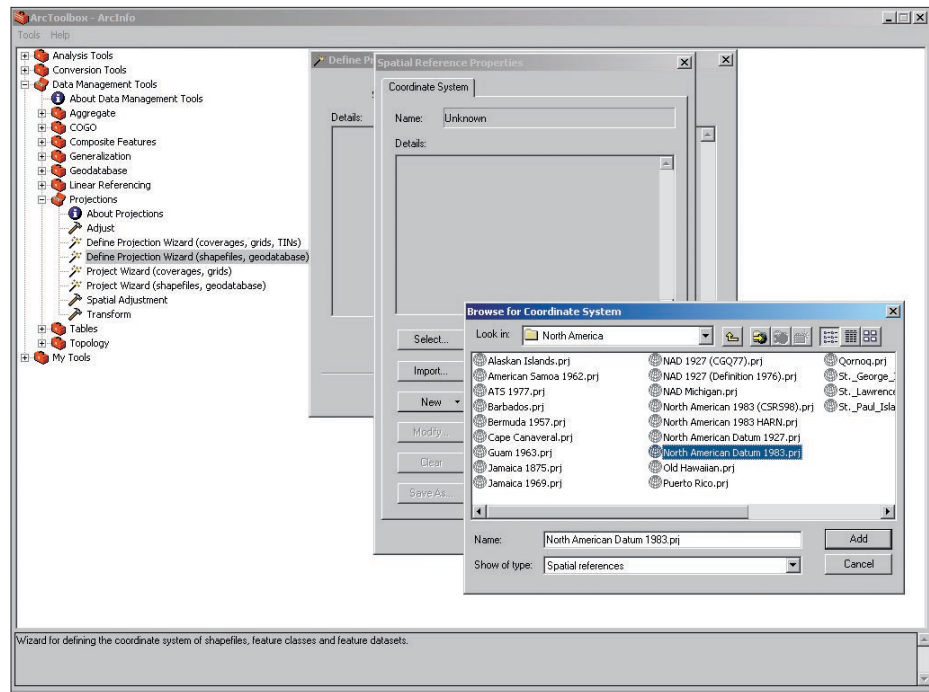
Cartographers identify various types of vector features using these CFCC codes. It certainly would be nice to have a lookup table that provides friendly text for these codes! Actually, a CFCC lookup table, CFCC.DBF, is available from several sources including the data that comes with ArcGIS.

CFCC.DBF was included with the sample data for this exercise. Add this file to the map document by clicking on the Source tab in the Table of Contents and clicking on the Add Data button. Browse to the location of CFCC.DBF and add it. Save the map document. The Census TIGER data in the sample dataset has been enhanced with the CFCC field as well as other fields for purposes of this exercise. When inspecting these TIGER files, note that the CFCC field is found in many, but not all, of the attribute tables.

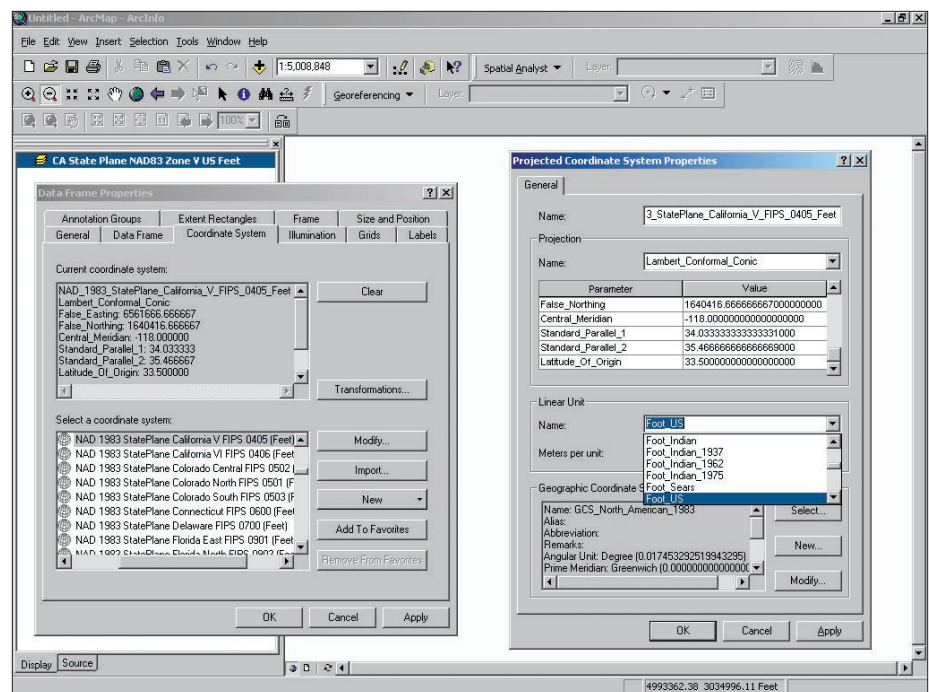
Creating Thematic Legends

The next step is to join the CFCC lookup table to each of the TIGER files containing CFCC codes based on a common attribute field. For information on creating a tabular join in ArcGIS, look at the ArcGIS online help or read the article "Mapping Rural Growth Using Census 2000 Block Data," in the July–September 2002 issue of *ArcUser* magazine. This article is also available from the *ArcUser Online* Web site.

Once all the layers with CFCC files have been joined to the CFCC.DBF table, inspect the joined attribute tables and verify that each



In ArcToolbox, choose Geographic Coordinate Systems > North America > North American Datum 1983.prj.



Still in the Data Frame Properties dialog box, click the Modify button and set the units to Foot_US for US Survey Feet, a more precise measure than Foot (or international feet).

contains a new text field named DESCRIPTIO. Save the map document.

Now, thematic legends could be created for most of the TIGER data by assigning a symbol for each unique value in the DESCRIPTIO field. To simplify this process, ArcMap layer

files for each TIGER set were included with the sample data. Right-click on each layer and choose Properties. In the Layer Properties dialog box, click on the Symbology tab and choose Import legends. The Layer files have names corresponding to the abbreviations listed

in Figure 1. Apply the appropriate layer file to the data layer. Accept the defaults for each legend. Arrange the layers in a logical sequence (i.e., points, then lines, then polygons) and experiment with layer display. When all Layer files have been applied, save the map document.

Resolving Emergency Management Questions

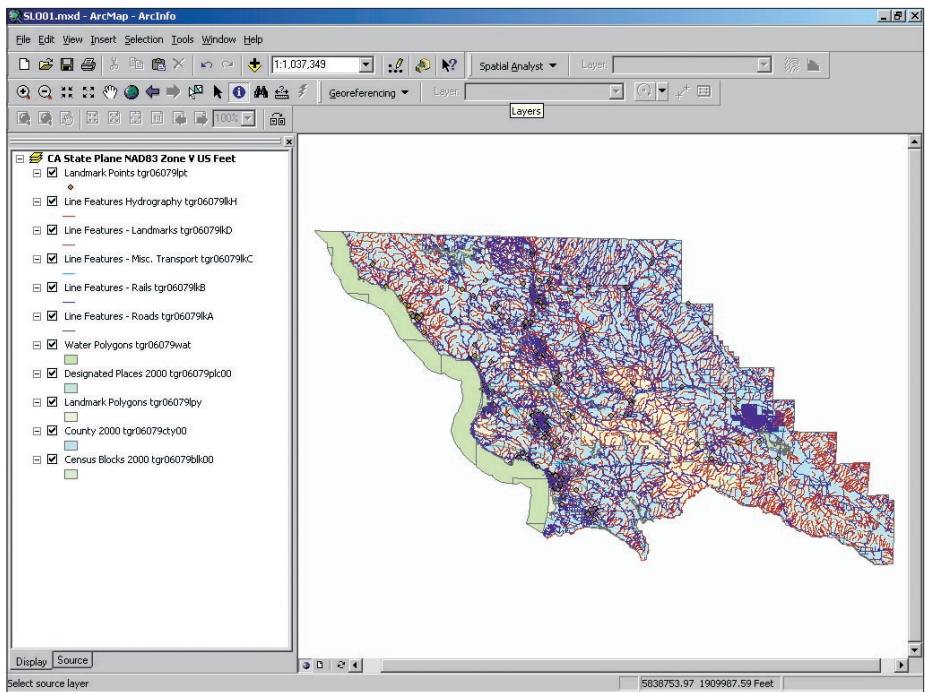
The original goal of this exercise was to create a basemap for fire and public safety modeling in rapidly changing San Luis Obispo County. The map created thus far includes geocoded streets, surface hydrology, census blocks, municipal boundaries, and location points. The location points are especially interesting because they contain locations of public safety facilities such as fire stations, police stations, hospitals, and public buildings (e.g., city halls, churches, and schools).

Two additional data layers—Emergency Services `tgr06079lpt` and Public Buildings `tgr06079lpt`—were included with the sample data. These files show the locations of public safety facilities in relation to public buildings. Click the Add Data button and add these two layers now and save the map document again.

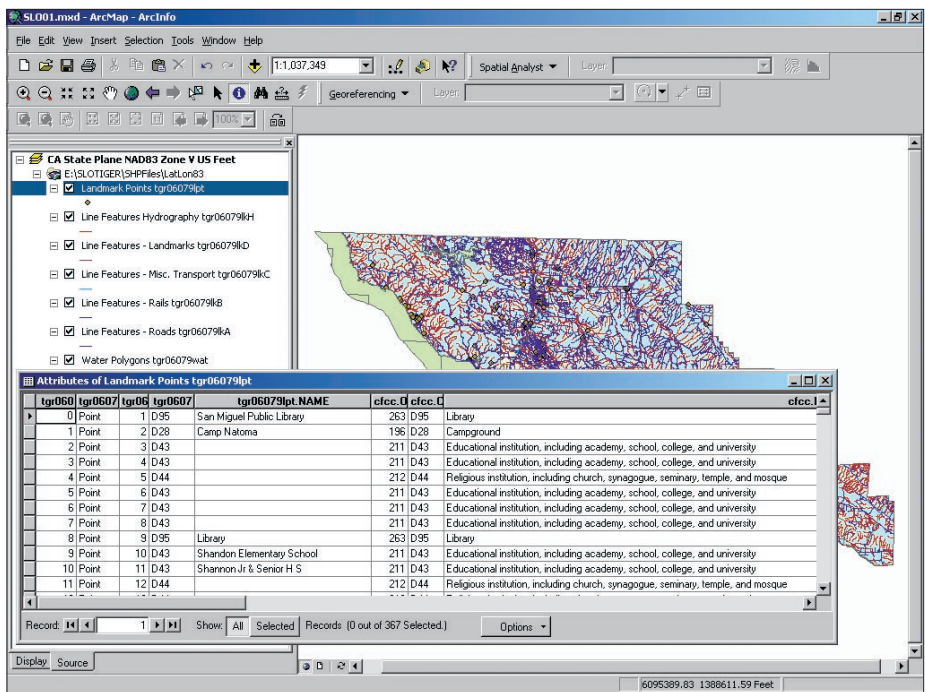
Zoom into the City of San Luis Obispo. How many fire stations are there? How many hospitals and police stations does the city have? Are public safety facilities located reasonably close to schools and churches? Because schools and churches can serve as evacuation centers during emergencies, determine if there is a good distribution of these facilities in the city and if access is reasonably close. What facilities might be at risk, and what roads might be closed if San Luis Obispo Creek flooded? Exploring the data leads to other questions. Imagine the questions that can be answered if the demographic data associated with the census blocks was included. That could lead to an entirely new project!

Summary

This exercise demonstrated how to use Census TIGER files for public safety modeling. TIGER data is often enhanced and expanded by state and local public safety agencies and data providers. Local agencies must field check and validate the information and make additions when appropriate. Digital elevation models, parcel data, and values at risk can also be included. TIGER data can provide an excellent start-up framework for local agencies trying to map, plan, and better understand their jurisdictions. Through GIS, today's fire chiefs are empowered and enabled as never before to quickly and effectively solve real-world problems!



After adding the TIGER data to the map document, rename each layer using the table of abbreviations in Figure 1 to translate the names into more meaningful names (e.g., `tgr06079lpt` is renamed `Landmark Points-tgr06079lpt`).



Join the CFCC lookup table to each of the TIGER files containing CFCC codes based on a common attribute field, CFCC. Now apply the layer files supplied with the sample data. Alternatively, you could build your own thematic legends based on information in the `DESCRIPTIO` field.