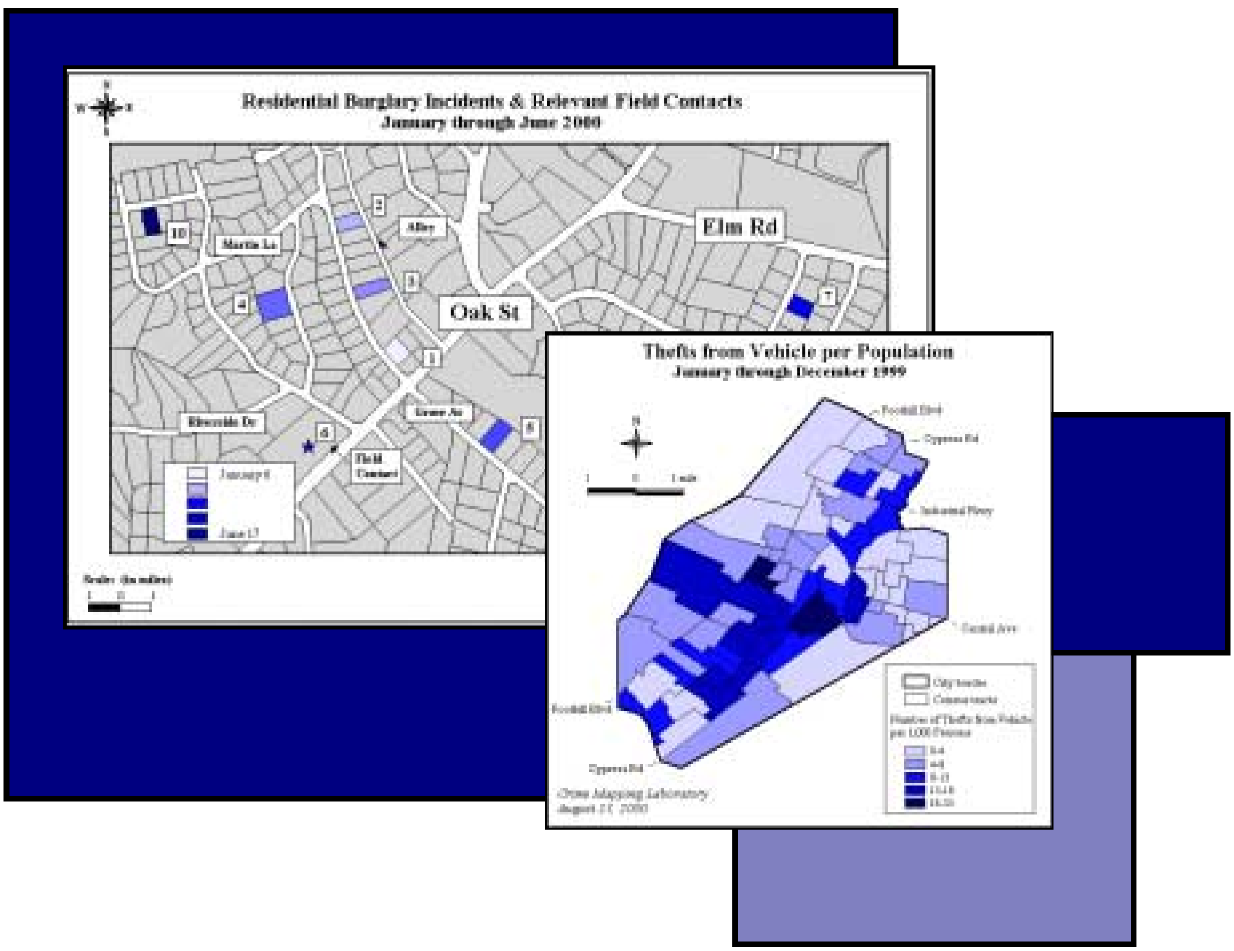
COPS
COMMUNITY ORIENTED POLICING SERVICES
U.S. DEPARTMENT OF JUSTICE

Manual of
Crime Analysis Map Production



Manual of Crime Analysis Map Production

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Table of Contents

List of Maps

I. Introduction

Through discussion and comprehensive examples, this manual provides guidelines for introductory-level crime analysis mapping for use in a law enforcement environment. Mapping is essential to both the analysis and presentation phases of crime analysis, as it facilitates spatial depictions of crime and related law enforcement data. Crime analysis mapping is a valuable problem solving tool because it can lead to the identification of new problems facing law enforcement, lend a visual perspective to an analysis, assist in the development of an effective response, aid in the formation of partnerships by providing a common point of reference, and assist evaluation procedures. To produce accurate and effective crime analysis maps, there are three initial factors to consider: (1) the purpose of the map, (2) the audience of the map, and (3) the types of data to include in the map. These considerations often dictate the type of map that will be used and the method of presentation. This document begins with a brief examination of these initial factors, follows with a discussion of the types of maps and design elements, and concludes with five comprehensive examples that illustrate the process of crime analysis mapping.

Crime analysis mapping is a dynamic process, and the decision to utilize a certain type of map or design element may change based on the purpose of the map, the audience, and/or the available data. In this document, five situations with a particular purpose and audience are posited. The readers are then guided through the process of basic crime analysis map production. The examples in this manual do not represent every possible method of map production and design because, in reality, the possibilities are endless. The examples are not software specific, but they are intended to exemplify relevant practical situations to develop a general conceptual framework for the production of informative and effective crime analysis maps.

II. Guidelines for Crime Analysis Map Production

Purpose

Crime analysis mapping can be used to assist all stages of the problem solving process. If the purpose of a crime analysis map is to assist in the identification of a particular problem, selected data may be mapped to identify patterns of activity that have been previously undetected. For example, to determine if a pattern of commercial burglary incidents is occurring, all commercial burglaries occurring in the city for the past three months may be mapped. By analyzing clusters of activity, a group of incidents occurring in a proximate area may be identified. In this instance, the purpose of crime analysis mapping is to identify a problem; that is, a short-term increase in commercial burglary activity in a particular area.

Another purpose may be that if a particular issue is identified, crime analysis mapping can be used to conduct a comprehensive spatial analysis of the problem. In other words, the purpose of the map is to study the problem more closely by examining it from various perspectives and/or by using a variety of data. For example, after a significant increase of daytime residential burglaries has been identified, crime analysis mapping can be used to analyze the problem by determining where the activity has increased the most. In addition, other types of data may be mapped along with the crime data such as the locations of schools, truancy information, and known offenders as well as demographic information to determine if areas with the most increase are similar to one another. Using various types of maps and data, crime analysis mapping can be used to examine an issue more closely.

Lastly, once a problem has been identified and analyzed, presentation of the map to an audience becomes important, as the purpose of the map may be to develop a response to the problem and to ultimately evaluate that response. Maps for presentation can range from simple to complex, depending on the levels of detail and analysis that are necessary. Monthly maps of a town that depict reported crime are useful for providing general information to the public about changes in hotspots of reported crime; however, a detailed map of each hotspot location may be necessary for patrol officers and investigators who need specific information in order to focus their problem solving efforts. In either case, it is important to prepare maps that are appropriate to the purpose.

Audience

When determining the purpose of a crime analysis map, it is also necessary to consider the audience, i.e. the users of the information. The audience can include police department personnel, the general public, community groups, or city council members, to name a few. By gauging the needs, expectations, and skill level of these individuals, maps that are appropriate for each group can be developed. For example, a map of the residences of all known gang members that includes names and case numbers may be useful to gang enforcement officers compiling intelligence information. However, a map with this level of detail would not be disseminated to the public as it may violate an individual's privacy rights or compromise an investigation. It may be useful to include a brief notation on the map, such as "law enforcement use only" or "external use" to indicate the intended audience. When producing a crime analysis map, the needs of users of the information need to be balanced with political, legal, and ethical concerns.

Data Sources

Crime analysis maps are typically composed of two types of data - tabular and geographic. Tabular data sources contain information about phenomena that are not primarily geographic but often have a geographic component. Crime data and calls for service data are types of tabular data most frequently mapped in law enforcement. For example, these data contain information primarily about crime incidents and calls for service activity such as the type of activity, date, time, priority, and disposition, yet both types have at least one geographic component, such as address, beat, and/or district. Additional law enforcement tabular data sources include arrests, accidents, known offenders, field information relative to criminal incidents, citizen survey results indicating victimization or fear of crime, and the locations of probationers/parolees. Other non-law enforcement tabular data sources include, but are not limited to, school information, risk and protective factors, census data, and land use information.

Geographic data sources are composed of data describing phenomena that are primarily geographic. Even though these types of data may include non-geographic information, the primary focus is the geographic features. For example, census tract data contains information on population and other demographic variables; however, these data are based on the geographic boundaries of the census tracts. Other examples of geographic data sources include land parcels, streets, streams, highways, block groups, and city boundaries. Examples of geographic data specific to law enforcement may include gang territorial boundaries, beat boundaries, and district boundaries.

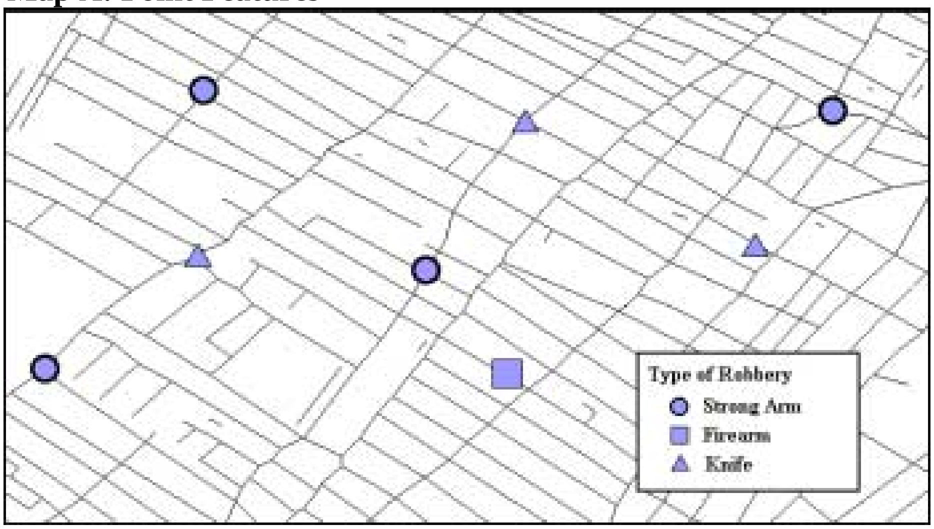
Tabular and geographic data are brought together through the process called "geocoding," whereby tabular data are represented on a map based on a common geographic unit of analysis. (Geocoding is described at length in the report, "Geocoding in Law Enforcement," produced by the Police Foundation's Crime Mapping Laboratory and available on the COPS Web site at www.usdoj.gov/cops.) Once tabular data have been located on a map, symbol styles, sizes, and colors may need to be adjusted according to the data they are being used to represent and the complexity of the map.

Map Features and Symbols

In addition to considering the types and availability of data sources, it is important to determine the best method for representing these data on a map. Maps are composed of point, line, and polygon features. Point features are usually designated by a symbol [] and represent discrete locations with unique latitude and longitude coordinates. Locations of crime, traffic accidents, and schools are all examples of point features. Lines [] are used to represent linear features. Streets are the most common line feature; however, line segments can also represent rivers, pathways, and utility lines. Polygons, which are multi-sided, closed features [], can be used to represent geographic areas such as land parcels, patrol beats, or city boundaries.

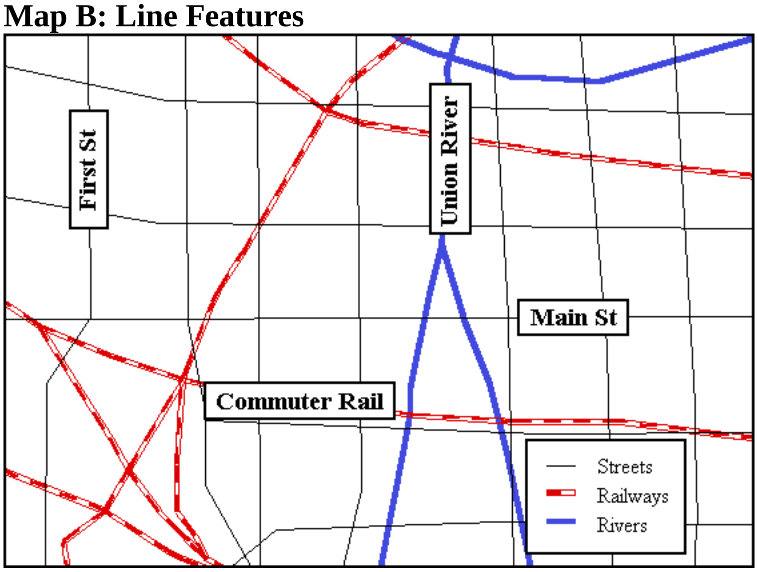
The appearance of point, line, and polygon symbols should be specific to the data they are being used to represent as well as to the purpose of the map. When producing crime analysis maps and adding specific point features such as the locations of crime, calls for service, or known offenders to the map, it is important to differentiate between different types of activity. Map A depicts single incidents of robbery locations as point features. Different symbol styles are used depending on the type of robbery (firearm, knife, strong arm).

Map A: Point Features



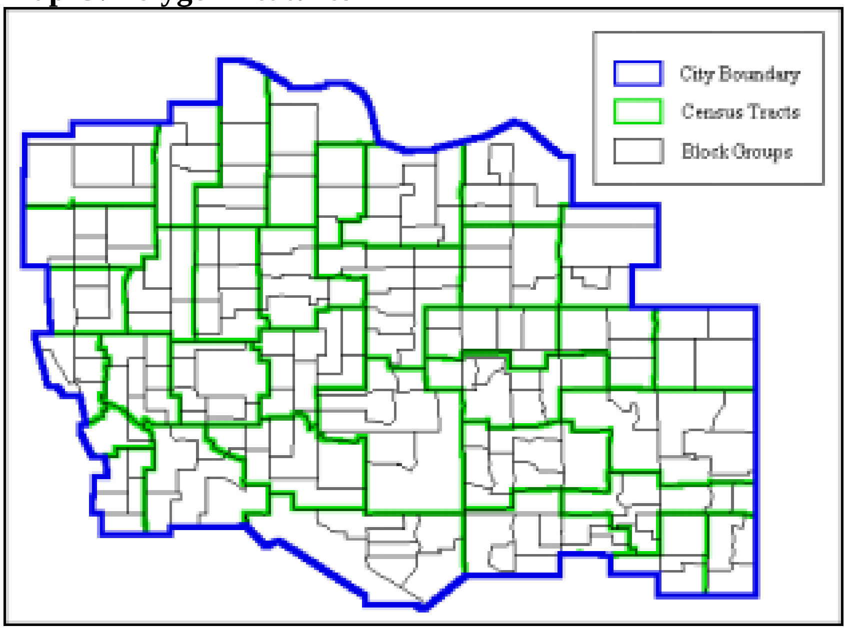
Map B depicts several different line features including streets, railroads, and rivers. Each line feature is represented by a unique symbol so that it can be differentiated from others.

Map B: Line Features



Map C depicts different polygon features, including a city boundary, census tracts, and block groups. A unique symbol style has been used to represent each feature so that each polygon can be distinguished from the others.

Map C: Polygon Features



Similarly, the order in which point, line, and polygon features are placed on a map affects the appearance as well as the overall usefulness of the map. Features such as buildings, streets, police districts, and aerial photographs are all distinct layers of data that are stacked on one another to create a map. It is important to consider the order in which these layers are placed on a map, as closed polygon features or images such as aerial photographs will cover point and line features if they are placed on top. Generally, background features should be placed on the map first while point and line features should be placed on top so that they can be clearly differentiated, as illustrated by Map D.

Map D: Layering of Map Features

Additionally, only those features that are essential to the purpose of the map should be visible. While the use of orthophotography may enhance the map's visual appeal, this level of detail may not be realistic for viewing a map of the entire city.

Types of Maps

After selecting the appropriate symbols to represent basic map features, it is necessary to determine what type of map will allow for the most accurate analysis and presentation. Four basic types of maps are discussed below: single symbol maps, graduated size maps, graduated color maps, and combination maps. These types were chosen as basic types of maps often used is law enforcement. Illustrations of the types of maps are not shown here, but each type of map is used in the examples following this section.

Single Symbol Maps. Similar to the wall maps and push pins that have historically been used by police agencies to map crime, single symbol maps use individual symbols to represent point features such as the locations of crime or traffic accidents, line features such as streets or pathways, and polygon features such as land parcels or police districts. Single symbol maps allow for a detailed analysis, and they are used quite frequently in law enforcement to depict incident locations for small amounts of data. A drawback to using single symbol mapping is that if two or more incidents share a geographic attribute such as the same address, subsequent symbols are placed on top of the original. Thus, it is difficult and time-consuming to determine if more than one incident is occurring at the same address. Additionally, maps of large data sets can become cluttered if too many features are added.

Graduated Size Maps. In a graduated size map, data are summarized so that symbols (point or line features) are altered in size to reflect the frequencies in the data (see next section for classification methods). A graduated size point map reflects more incidents at an individual location with a larger symbol. A graduated size line map reflects more incidents along that line segment with a thicker line. Graduated size maps are valuable for depicting multiple events of the same type at the same location, such as traffic accidents. However, it is difficult to use graduated size maps to depict different types of incidents, e.g. burglaries and thefts, as they too are placed directly on top of one another. In addition, graduated size maps become cluttered if a large number of incidents are mapped, and oftentimes, larger symbols may conceal smaller ones, depending on the map's scale.

Graduated Color Maps. In a graduated color map, either point, line, or polygon features are shaded according to a statistical formula, custom setting, or unique value. There are several approaches to classifying, or grouping information when creating graduated color maps. (Note: these classifications are also used to produce graduated size maps described above.) Each classification method is briefly described below:

Natural breaks:	Identifies natural breakpoints inherent in the data by using a statistical formula.
Equal area:	Finds breakpoints between polygon features so that the total area of the features in each classification range is roughly the same.
Equal interval:	Divides the entire range of values into classifications based on equal sized sub-ranges.
Quantile:	Divides each class into the same number of features.
Standard deviation:	Identifies the mean value and classifies values above or below the mean based on the standard deviation.
Custom:	Classes are determined by the user.
Unique Value:	Classes are based on unique values in the data.

With the exception of custom ranges, which are determined by the user, all of these classification methods are dependent upon the data; that is, for each data set, the values in the ranges will be different depending on the distribution and values within the data.

A graduated color map of polygon features such as police beats or census tracts is referred to as a choropleth map. Choropleth maps are used regularly in law enforcement and are most useful for representing large data sets, such as annual calls for service by police reporting area or crime rate per population.

Combination Maps. As the name implies, combination mapping involves the use of more than one type of map, such as a graduated size and a graduated color map, to depict multiple data sources on the same map. Basic combination maps are most useful for analyzing more than one type of data at the same time.

Design Elements

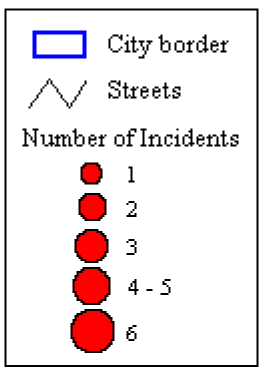
The issues previously discussed include considerations and decisions made in the analysis process. Oftentimes, during the analysis process, five or more maps are produced to find the one that is most appropriate for representing the analysis. Thus, the final step in the crime analysis mapping process is preparing the map to be presented to others. There are five fundamental design elements to include in the presentation of a crime analysis map:

Title: Describes the tabular data sources used in the map and the time span of the data.

Bank Robbery Locations

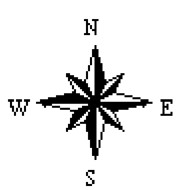
January through December 1999

Legend: Lists the tabular and geographic data sources used in the map and indicates the symbols that are used to represent each data source.



Scale bar: Describes the distance units used in the map.

North arrow: Indicates the geographic orientation of the map.

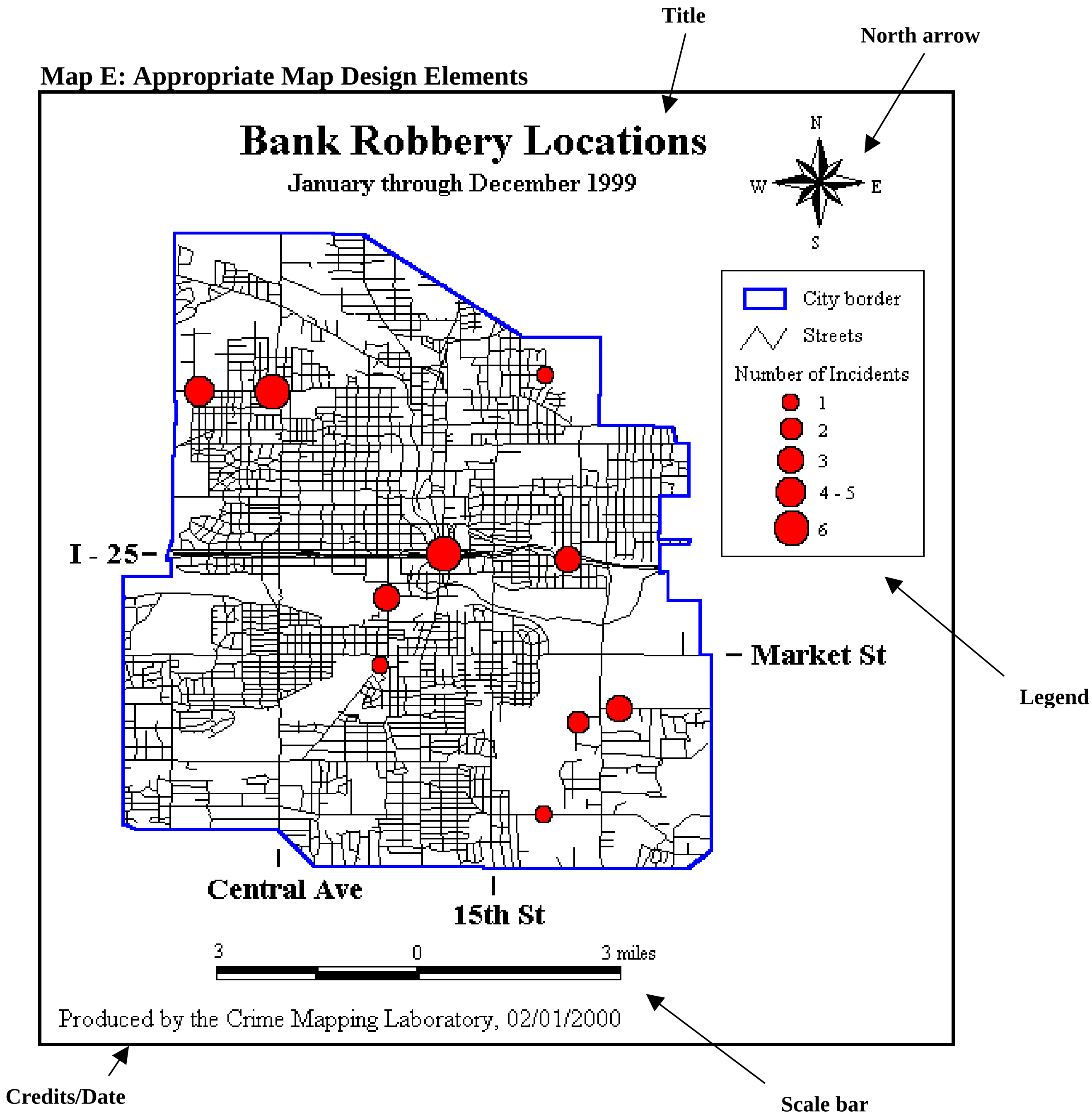


Credits/date: Indicates who created the map and when.

Produced by the Crime Mapping Laboratory, 02/01/2000

Although it may be appropriate to include a brief explanation of the analysis, it is important to design crime analysis maps so that they can stand alone. Once a map is disseminated, additional pages that contain text describing the map may be lost or the map may be photocopied, and this information may be lost. Thus, the text describing the map should be included on the map, and it should also be brief. This ensures that information will not be lost and that maps can be easily interpreted without requiring a great deal of explanation. Map E is an example of a final map containing all of these components.

Map E: Appropriate Map Design Elements



III. Examples of Crime Analysis Map Production

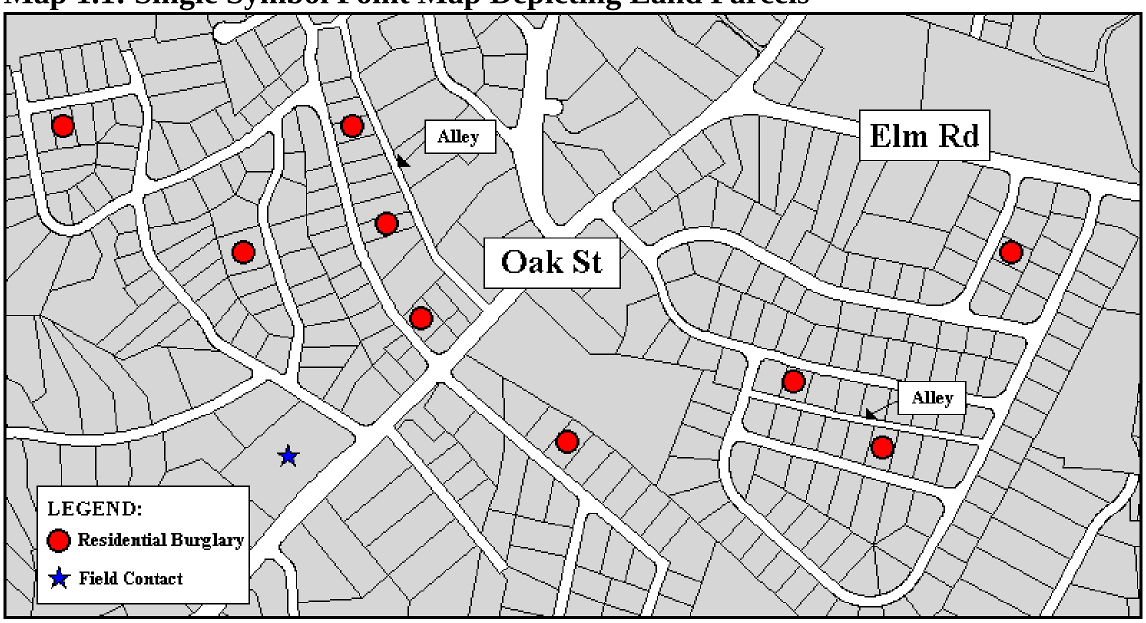
To follow are five comprehensive examples of crime analysis maps that are commonly used in law enforcement. These examples are designed to walk readers through the process of creating different types of crime analysis maps depending on the situation, e.g. deciding which data are relevant, which type of map to use, and how to present the map considering the purpose and audience. Since the maps in the following examples are meant to depict different stages of the analysis process, labels such as street names and design elements such as legends and scale bars have not been included. At the end of each example, a final map with all of the appropriate design elements is included to illustrate how each map would ultimately be presented based on the purpose, audience, and data.

Example 1: Residential Burglary Pattern

Situation:	Patrol officers have noticed that several residential burglaries have occurred in the Oak St./Elm Rd. neighborhood recently. The patrol bureau has requested information on all residential burglary incidents as well as any field contacts involving suspicious persons/activity that have occurred in the general area during the last six months.
Purpose:	To inform police personnel about proximate residential burglary incidents and relevant field contacts in the area to determine if a crime pattern exists and if any potential investigative leads have been contacted.
Audience:	Patrol officers, detectives, and other police personnel
Data:	Geographic - land parcels Tabular - crime data, relevant field contact information

A search of residential burglary data for the Oak St./Elm Rd. neighborhood yielded ten incidents. Because of this small number of burglaries in a relatively small geographic area, a map depicting land parcels has been used (see Map 1.1). Points placed in the center of each parcel - circles to symbolize the burglary incidents and a star to denote the field contact, represent the tabular data, residential burglaries.

Map 1.1: Single Symbol Point Map Depicting Land Parcels

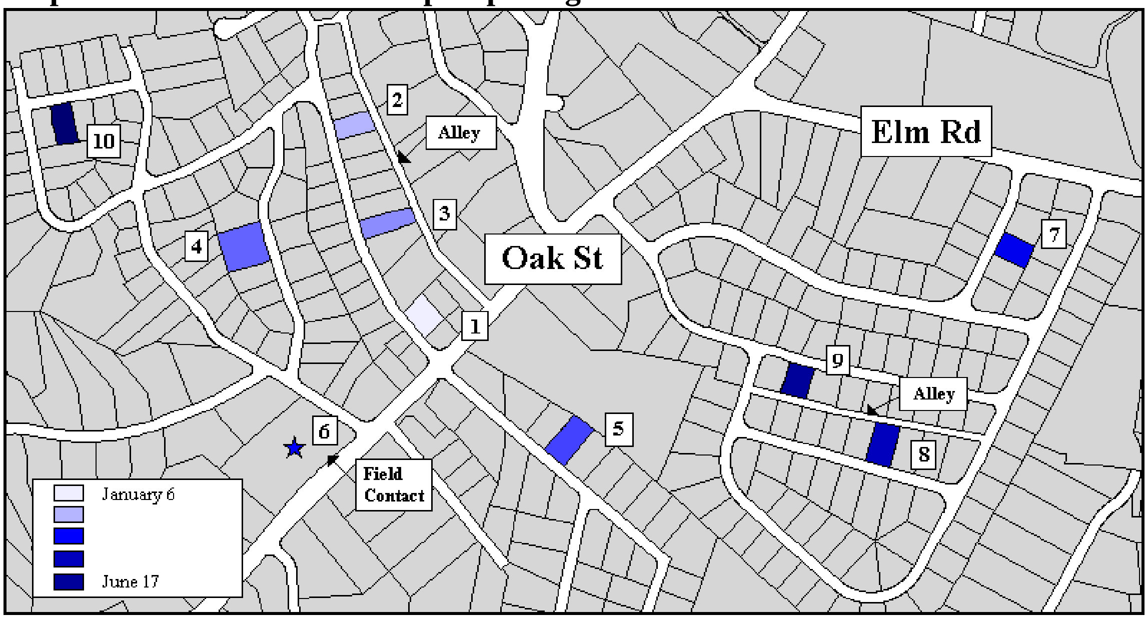


Depending on the proximity of the events, parcel maps are valuable tools that, unlike centerline street maps, allow for detailed spatial analyses of a small area. Using a parcel map to analyze these residential burglary incidents shows that alleys border several of the homes (as indicated in Map 1.1). Further analysis of the method of entry in these incidents may indicate that entry was gained through the alley and into the rear of the residence.

A single symbol point map has been used in this instance because there are only ten incidents. In this case, the data were quickly scanned to ensure that none of the incidents occurred at the same location. If more than one incident had occurred at a particular address, a graduated size point map could have been used.

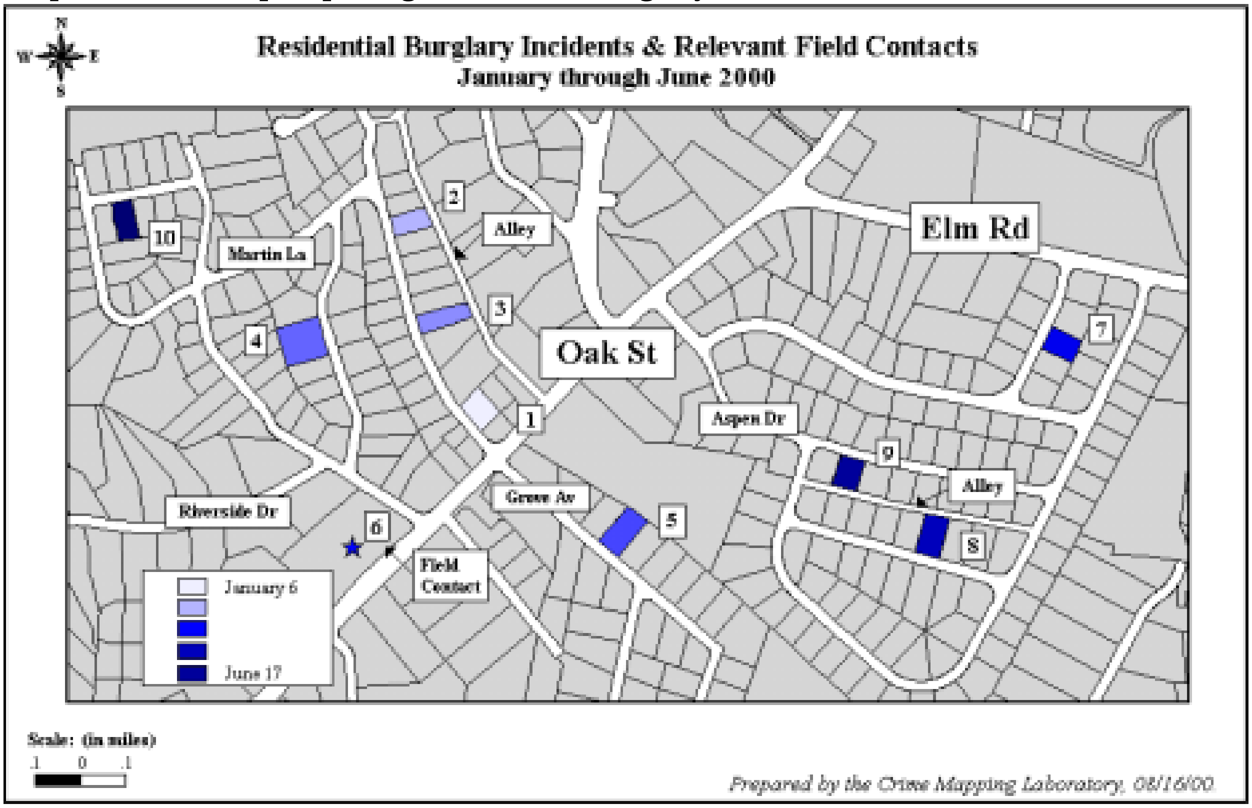
Another method of representing the tabular data is by shading the entire parcel to indicate the occurrence of an incident, as shown in Map 1.2. Additionally, by shading the parcels according to the date of each incident and/or placing numbers next to each incident to indicate the order of occurrence, an overall temporal analysis can be done simultaneous to the spatial analysis.

Map 1.2: Graduated Color Map Depicting Order of Occurrence



As these maps illustrate, point maps are useful for analyzing crime patterns and hotspots and assisting short-term problem solving efforts, as they give patrol officers and investigators a visual perspective of an area so that they can direct patrol and/or prevention efforts. In addition, maps depicting land parcels allow for a detailed analysis of specific plots of land and thoroughfares. Although not shown here, maps that depict the specific locations of buildings within each parcel would be useful for analyzing patterns in the point and/or method of entry. Map 1.3 is the final map that would be accompanied by a detailed summary of the incidents, including information such as case numbers, dates, times, addresses, and modus operandi.

Map 1.3: Final Map Depicting Residential Burglary Pattern and Relevant Field Contacts



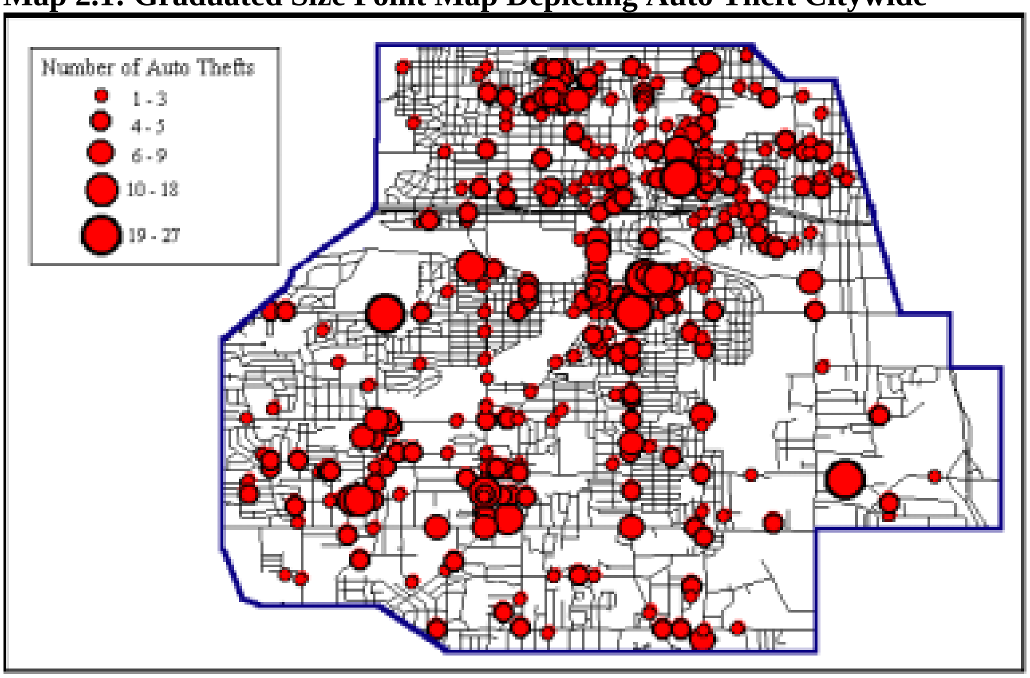
Example 2: Top Auto Theft Locations

Situation:	The police department would like to conduct an auto theft education and prevention campaign. Since they have a limited amount of resources, they would like to focus their efforts and target the prevention campaign at the top locations to assist in an overall reduction of the city's auto theft problem.
Purpose:	To determine the top auto theft locations and their relationship to one another so that police personnel can focus their education and prevention efforts.
Audience:	Crime prevention personnel, auto theft investigators
Data:	Geographic - centerline streets, city boundary Tabular - crime data

A centerline street map has been used in this instance since the map includes a large number of incidents that have occurred throughout the city. The city boundary serves to acquaint the audience with the city's borders. Since the purpose of this analysis is to generally determine the top auto theft locations, a more descriptive map, such as one depicting land parcels, has not been used.

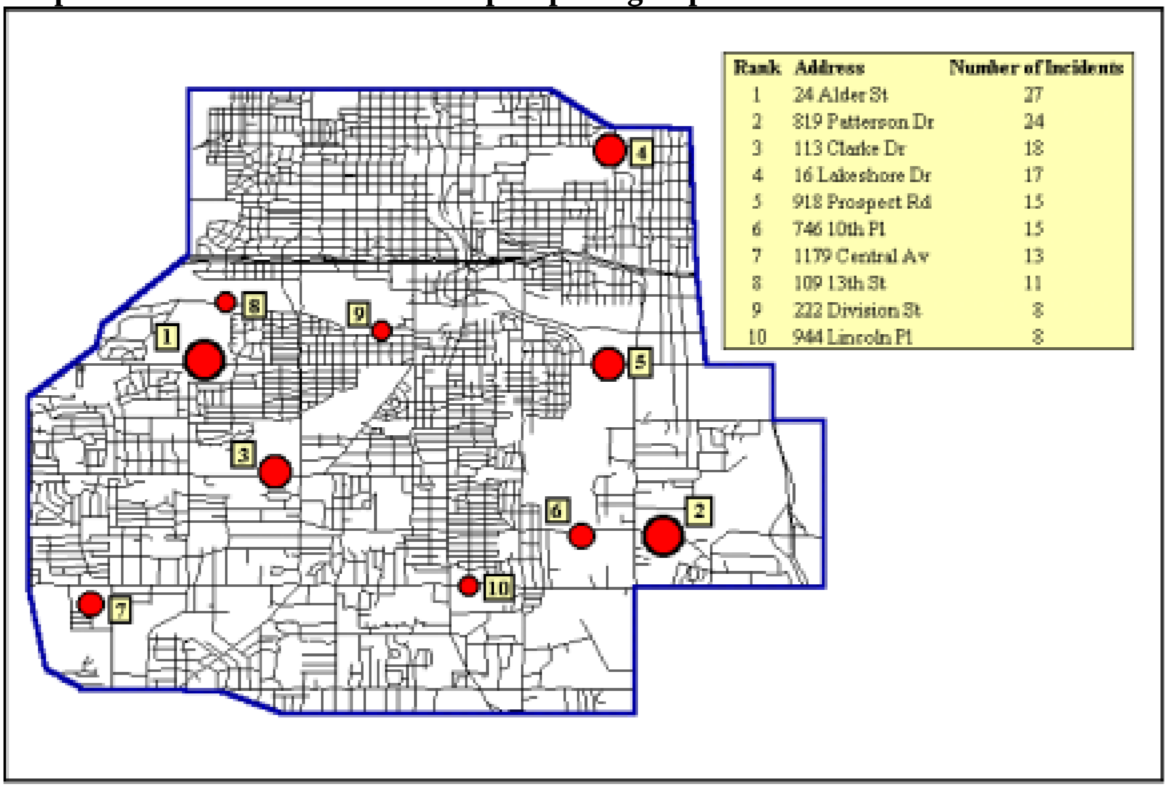
Map 2.1 is a graduated size point map that serves to distinguish the locations with multiple auto thefts, which are depicted by the larger red symbols. This map is a first attempt at mapping all the auto theft incidents that occurred during the past year. However, since the goal of the education and prevention campaign is to target the top locations only, this map contains too much information that is not discernable. The map is cluttered with graduated points, and it is difficult to determine how many incidents have occurred at a particular location.

Map 2.1: Graduated Size Point Map Depicting Auto Theft Citywide



Map 2.2 is a depiction of only the ten locations with the highest frequencies of auto theft. Since it is more realistic for police personnel to focus their time and resources at specific locations, this map can be used to generally inform prevention personnel and auto theft investigators about the most problematic locations for auto theft during the past year. It is important to include a chart, as shown in this example, or to label each hotspot with the corresponding rank or number of incidents so that users can determine how many auto thefts were reported at each location.

Map 2.2: Graduated Size Point Map Depicting Top Auto Theft Locations



Rank	Address	Number of Incidents
1	24 Alder St	27
2	819 Patterson Dr	24
3	113 Clarke Dr	18
4	16 Lakeshore Dr	17
5	918 Prospect Rd	15
6	746 10th Pl	15
7	1179 Central Av	13
8	109 13th St	11
9	222 Division St	8
10	944 Lincoln Pl	8

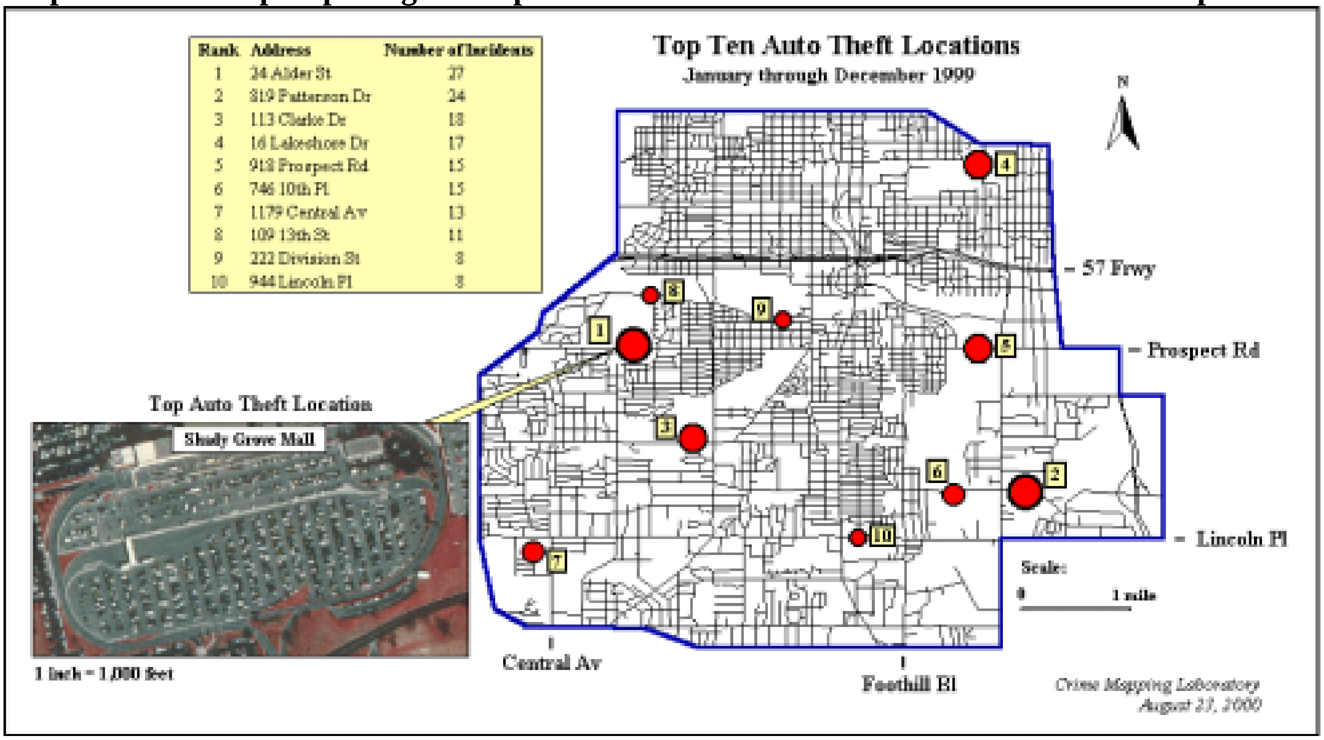
Since Maps 2.1 and 2.2 lack geographic detail in that they show the approximate street location of the auto thefts, not the specific locations, aerial photographs may be used to present a more in-depth picture of a location. They can be used to analyze exit routes and determine whether environmental characteristics, such as poor visibility or maintenance, contribute to the auto theft problem at a particular location.

Map 2.3 depicts the most frequent location for auto theft during the past year, a mall parking lot. Analysis of the police reports indicates that the far corner of the parking lot is the most frequent location for auto theft. Examining the aerial map and conducting an environmental assessment of the mall parking lot may reveal that a lack of surveillance and a convenient exit route contribute to the auto theft problem at this location. The aerial map can be used to help determine the placement of surveillance personnel or a bait car.

Map 2.3: Aerial Photo Depicting the Top Auto Theft Location

Example 2 illustrates that graduated size maps may not be useful for depicting a large number of incidents, but may be useful when the data are truncated; in this case, the total number of auto thefts occurring at the top ten locations in the city. Aerial maps are useful because they allow for a more detailed analysis of specific locations. These maps assist the problem solving process in that they help locate and spatially relate problematic locations for auto theft and inform prevention personnel about where they may need to concentrate their efforts. Map 2.4 includes the final graduated size point map as well as an aerial map of the top location as it might be distributed to police personnel. This information could be supplemented with a report that lists the most frequent times/days of the week for auto theft and/or breaks down the most frequently stolen vehicle makes and models.

Map 2.4: Final Map Depicting the Top Ten Auto Theft Locations and a Detail of the Top Location

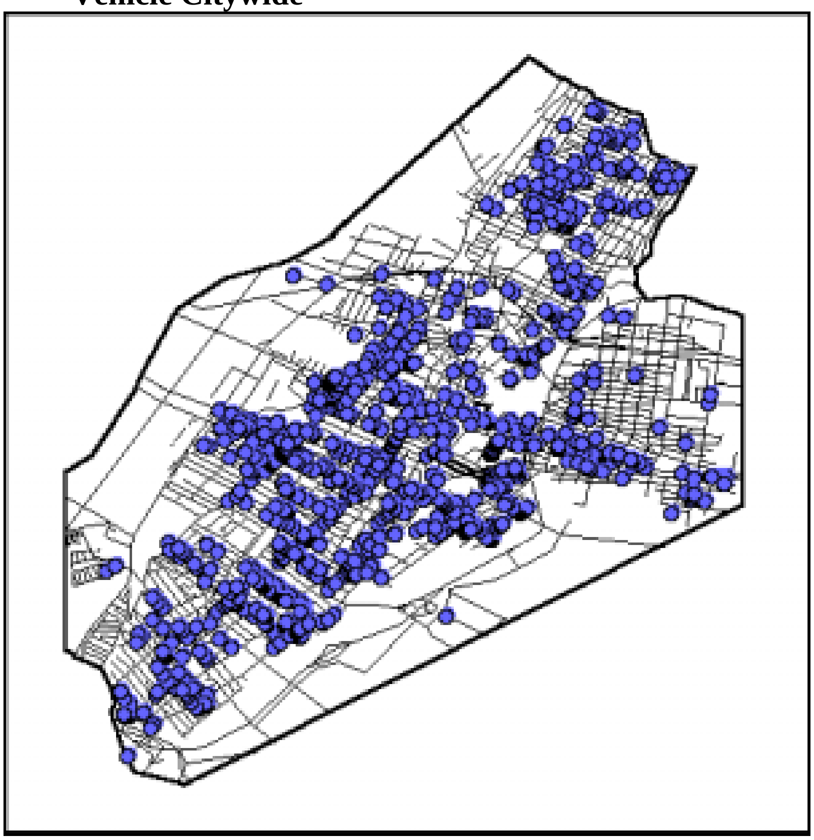


Example 3: Theft from Vehicle Citywide

Situation:	Theft from vehicle was the most reported crime in the city during the past year, accounting for approximately 10% of all reported offenses. Police administrators have requested information to determine which areas of the city have the most reported thefts from vehicle. This information will be used by community policing officers to educate residents about how to prevent vehicle crime. It will also be used by patrol officers to increase surveillance in these areas.
Purpose:	To determine the most problematic areas for theft from vehicle in order to initiate an education campaign.
Audience:	Police administrators, community policing officers, patrol
Data:	Geographic - centerline streets, census tracts, city boundary Tabular - crime data

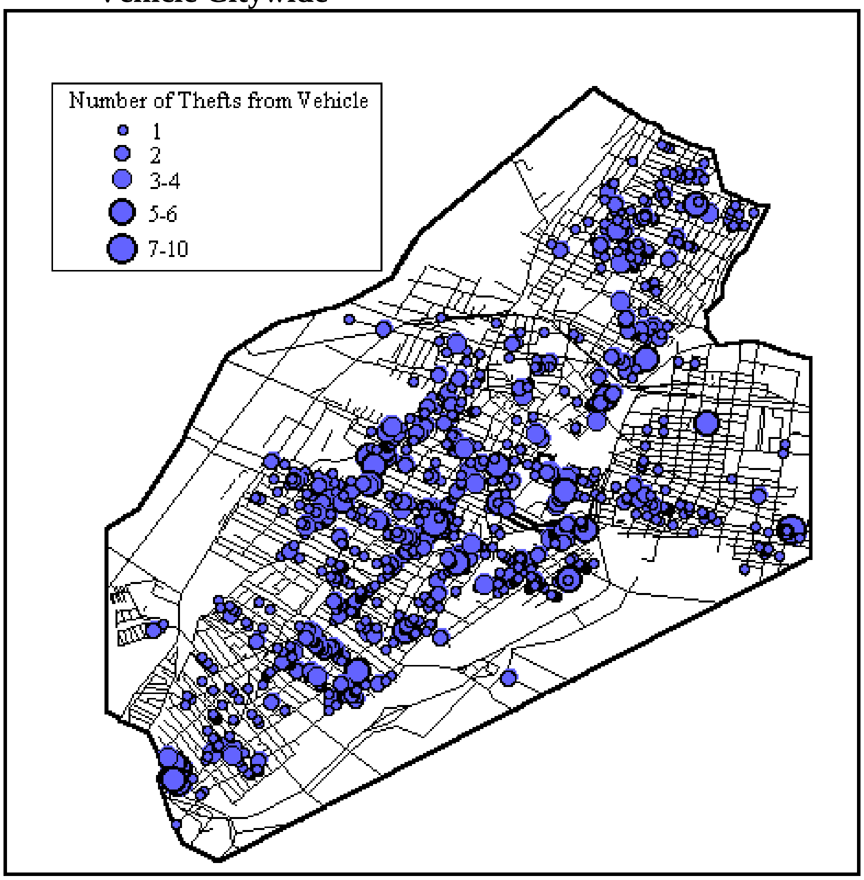
A map of the entire city depicting centerline streets has been used in Map 3.1 since the purpose of the map is to determine which areas of the city have the most thefts from vehicle. Similar to Example 2, the purpose of the analysis is relatively general and at this point, it is not necessary to use more detailed maps, such as parcel or aerial maps. In fact, the centerline street map may even be too specific for this analysis, since the point symbols cover many of the streets.

Map 3.1: Single Symbol Point Map Depicting Theft from Vehicle Citywide



Map 3.1 is a single symbol map depicting all reported thefts from vehicle for the last year. This map is cluttered with points, and it is difficult to distinguish the high frequency areas, which is the reason for creating the map. Additionally, simple point maps are not recommended for a large number of incidents since point data that are geocoded to the same location will be stacked on top of one another. In Map 3.1, there is no way to determine if more than one theft from vehicle occurred at a particular location. Given the limitations of this map, it would most likely not be disseminated since it does not accurately depict the theft from vehicle problem nor does it meet the needs of the audience since it is nearly impossible to distinguish one incident from another.

Map 3.2: Graduated Size Point Map Depicting Theft from Vehicle Citywide

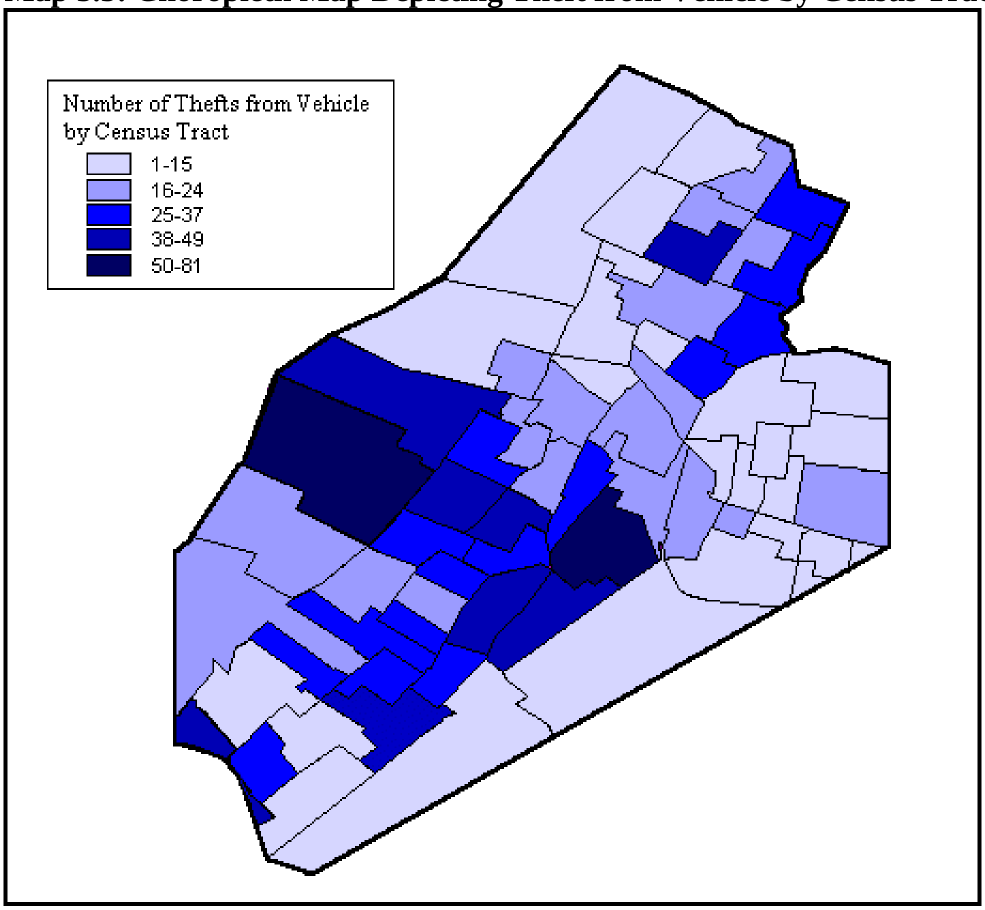


Map 3.2 is a graduated size point map depicting all thefts from vehicle for the past year. The use of a graduated size map has solved the problem of determining whether multiple crimes have been reported at a single location; however, the map is still cluttered. In addition, it is nearly impossible to distinguish between crimes occurring at proximate locations, preventing a substantive analysis. At this point in the analysis, it is important to consider the purpose and the audience for the map. The analysis should help determine what part of the city has experienced the most thefts from vehicle so that police personnel can concentrate their education and

enforcement efforts. Obviously, with such a high incidence of thefts from vehicle during the past year, a point map does not seem appropriate or necessary for representing these data.

Map 3.3 is a choropleth map that depicts the total number of thefts from vehicle by census tract. Census tracts have been used instead of centerline street maps because they allow for analysis of general areas. Although choropleth maps may incorrectly imply that the activity is occurring uniformly throughout the census tract, a choropleth map is useful in this example since the purpose of the map is to merely highlight problem areas, rather than specific locations. Since police administrators and community policing officers plan to focus their efforts at general areas rather than single locations, census tracts are more appropriate than the preceding centerline street maps. In this example, census tracts were used; however, depending on the purpose and availability of geographic layers, block groups (smaller census areas), precincts, or reporting districts can also be used.

Map 3.3: Choropleth Map Depicting Theft from Vehicle by Census Tract

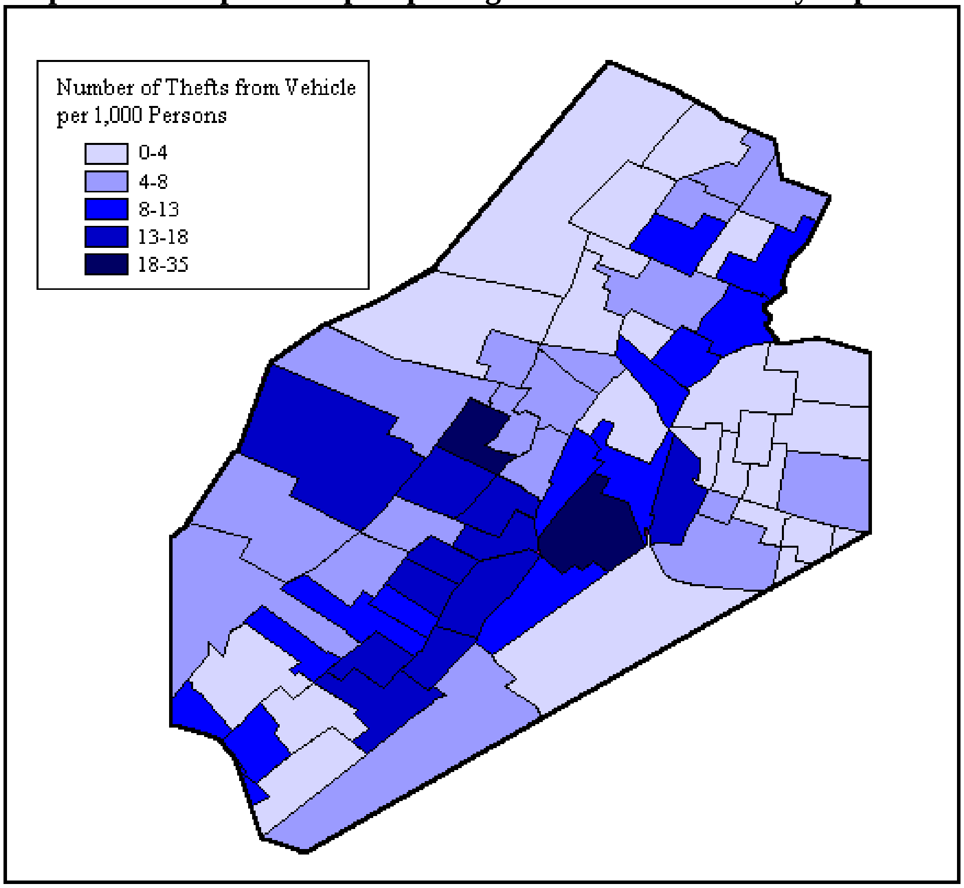


Map 3.3 is more closely suited to the purpose of the analysis, as the darkly shaded census tracts depict the high frequency areas for thefts from vehicle. Although census tracts are used in this example, block groups could also be used to depict theft from vehicle over a more precise geographic area. While this map generally depicts the census tracts with the most theft from vehicle activity, it does not take into account factors such as the size or population of each tract.

As one would expect, larger census tracts are likely to have more vehicles and subsequently, more vehicle crime, as are those with a higher population. These factors are not taken into consideration in Map 3.3. As a result, a map depicting frequencies may not accurately represent theft from vehicle crime unless a common characteristic, such as land use or population, is used.

Map 3.4 is a graduated color map that depicts census tracts shaded by the total number of thefts from vehicle per population. Simply shading the census tracts by the frequency of thefts may not provide an accurate picture of the activity, as larger census tracts with a high population would tend to have more thefts from vehicle. Rather than simply shading the census tracts by frequency, the number of thefts from vehicle per census tract is normalized by the population of that tract so that the data are classified according to a common characteristic. Map 3.4 shows that there are two census tracts (shaded the darkest) with high rates of thefts from vehicle per population where police personnel can focus their problem solving efforts.

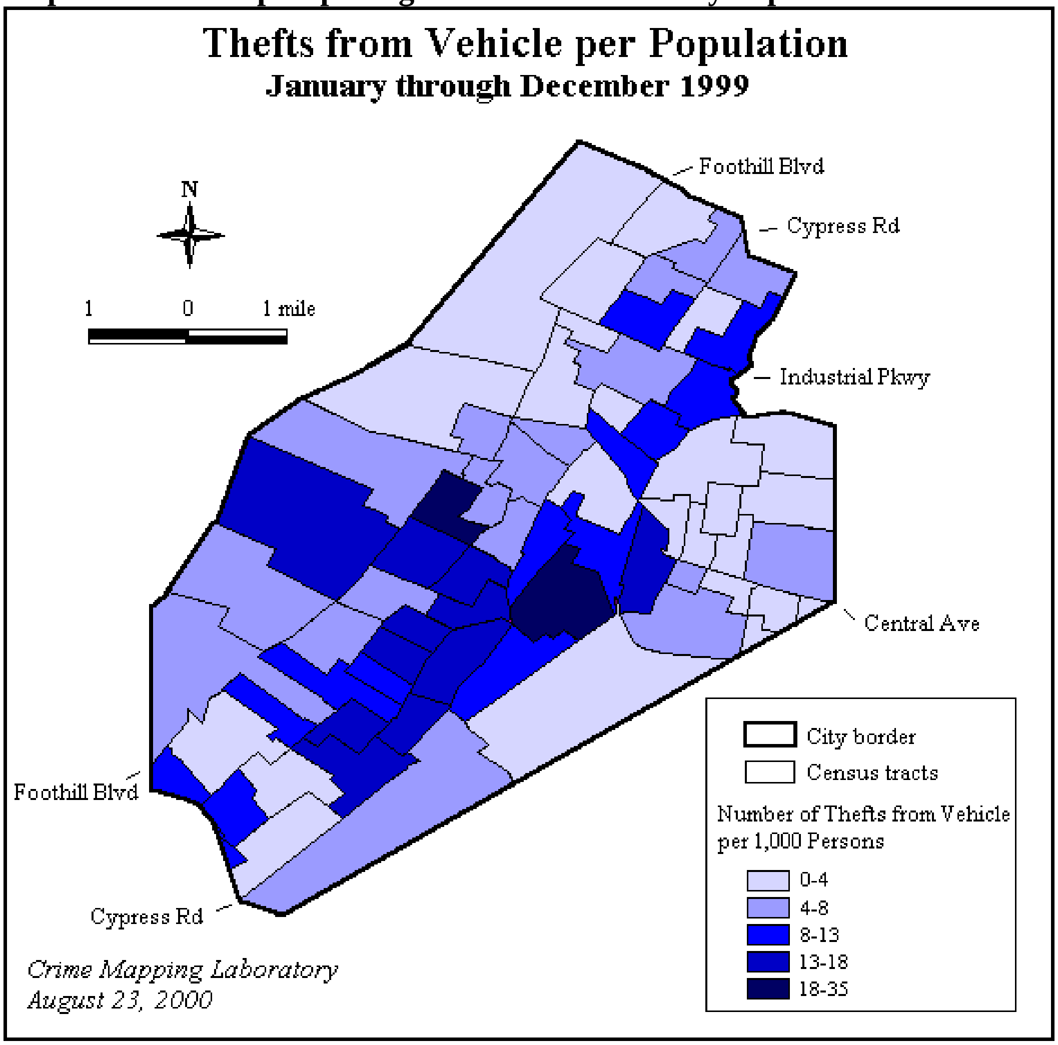
Map 3.4: Choropleth Map Depicting Theft from Vehicle by Population



Another effective method for mapping thefts from vehicle may be to normalize the number of thefts by the number of registered vehicles or by land use, since theft from vehicle often occurs in commercial areas.

Map 3.5 is the final map that might be supplemented with a report that indicates the total number of thefts from vehicle that occurred per census tract during the past year as well as by month. All of this information can be used to determine the scope of the city's theft from vehicle problem and to focus education and prevention efforts at the most problematic areas.

Map 3.5: Final Map Depicting Theft from Vehicle by Population



Example 4: Monthly Calls for Service by Geographic Area

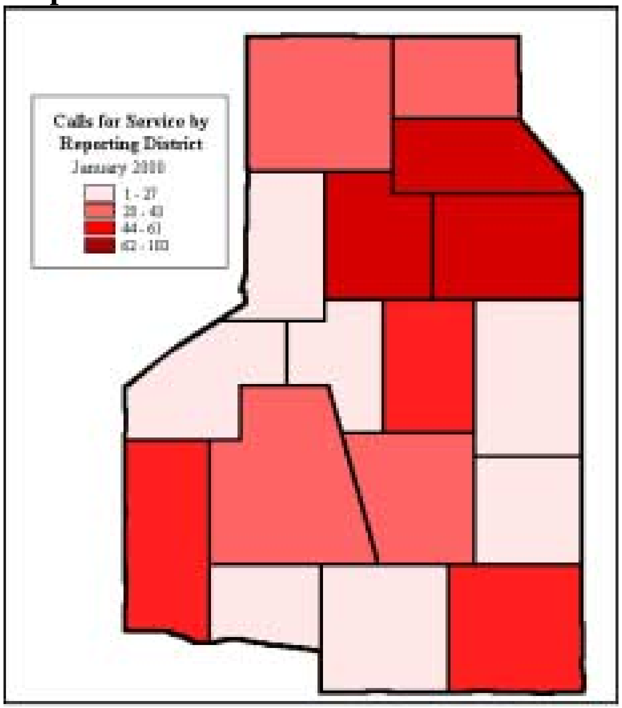
Situation:	The patrol division would like to scan calls for service data on a monthly basis to determine increases and/or decreases in calls for service and to identify hotspot areas for call activity by geographic area (reporting districts).
Purpose:	To spatially analyze monthly calls for service data in order to scan for geographic patterns and increases and/or decreases in call activity.
Audience:	Patrol bureau, police administrators
Data:	Geographic - reporting districts, city boundary Tabular - calls for service data

The geographic features used in this example are police reporting districts and the city boundary since patrol administrators are trying to generally determine the number of calls occurring in each reporting district for comparison purposes. Since there are typically between 1,000 and 1,500 calls for service occurring in the city each month, it is not reasonable to map calls for service data on a centerline street map or to use a single symbol point map.

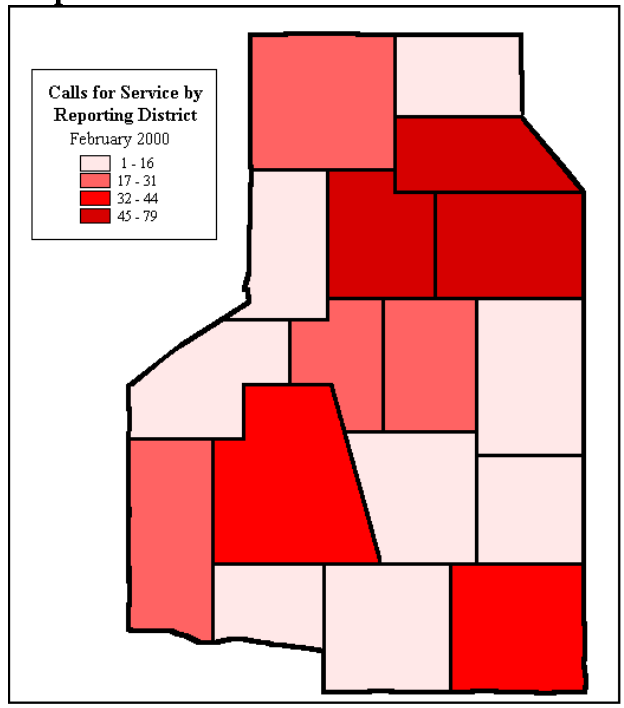
Maps 4.1 and 4.2 (see next page) are choropleth maps that depict the frequency of calls for service shaded by police reporting district for the months of January and February. Choropleth maps are ideal for conducting a comprehensive analysis of a large amount of data and for producing regular maps on a monthly and/or yearly basis to alert administrators to general, long-term patterns of activity, thereby assisting strategic problem solving efforts. Since these monthly calls for service maps will be produced on a regular basis, guidelines need to be established to ensure that the appropriate classification method is used each time the map is produced.

Maps 4.1 and 4.2: Choropleth Maps Depicting Calls for Service by Reporting District, Natural Breaks Classification

Map 4.1



Map 4.2

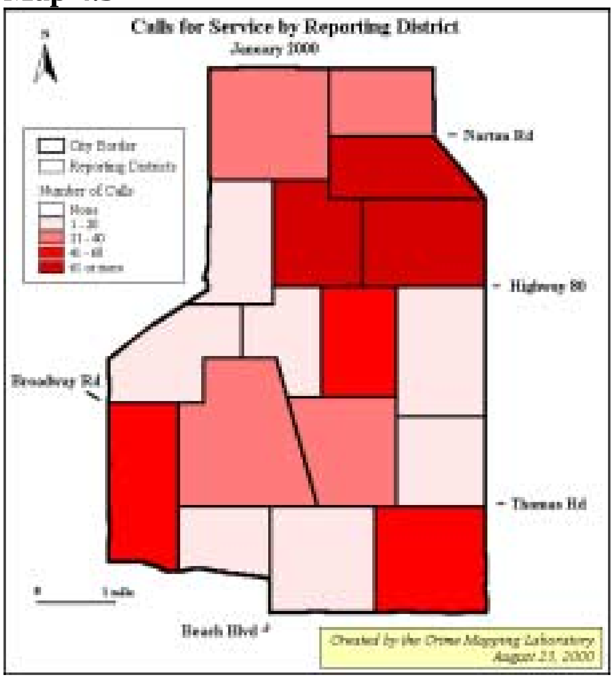


The default classification method in most mapping applications is natural breaks, whereby a statistical formula is used to assign classification ranges based on natural breakpoints in that particular data set. Since each data set is different, a map that uses the natural breaks classification method will vary each time a map based on different data is produced. For example, in Map 4.1, the darkest areas symbolize reporting districts that had between 62 and 103 calls for service whereas this same color represents between 45 and 79 calls in Map 4.2. Because the distribution of calls for service will not be the same from month to month, the classification ranges will depict different ranges each month, which could lead to misinterpretation of the map.

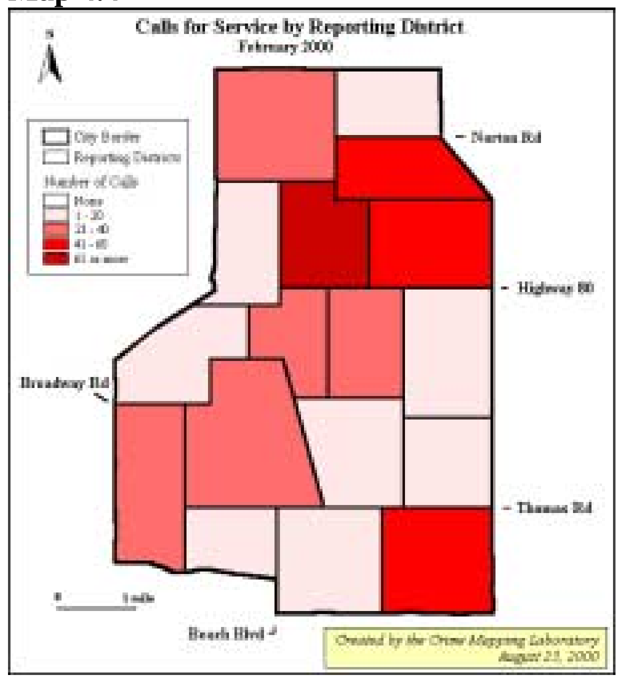
A custom classification range should be developed for maps that compare data across time so that the same range is used each time the map is produced, as shown in Maps 4.3 and 4.4. This will allow for comparisons across time, as the colors and/or symbols will represent the same range each month. For example, the darkest areas will represent 61 or more calls for service each time the map is produced, regardless of the data that the map is based upon.

Maps 4.3 and 4.4: Final Maps Depicting Calls for Service by Reporting District, Custom Classification Range

Map 4.3



Map 4.4



Maps 4.3 and 4.4 are the final maps in this example. They show two months of calls for service data whereby both maps use the same classification range. Analysis of these maps reveals that the reporting districts receiving the most calls for service are located in the northeast portion of the city. Another method for mapping these data may be to map calls for service per square mile, which would compare police reporting districts by land area, thereby normalizing the data according to a common characteristic. By combining this monthly map with a supplemental statistical report that lists the top calls in each reporting district and compares call types and totals in each reporting district with the rest of the city, patrol administrators have a mechanism to scan for problems on a monthly basis.

Example 5: Comparison of Citizens' Fear of Crime and Reported Violent Crime

Situation: The city council has requested a report comparing citizens' fear of crime with reported violent crimes in the city by district (since council members are responsible for different areas of the city). The police department had conducted a comprehensive citizen survey designed to gauge public attitudes concerning issues such as fear of crime, victimization, and satisfaction with police services.

Purpose: To conduct an analysis of survey respondents' fear of crime in comparison to reported violent crimes by city council district.

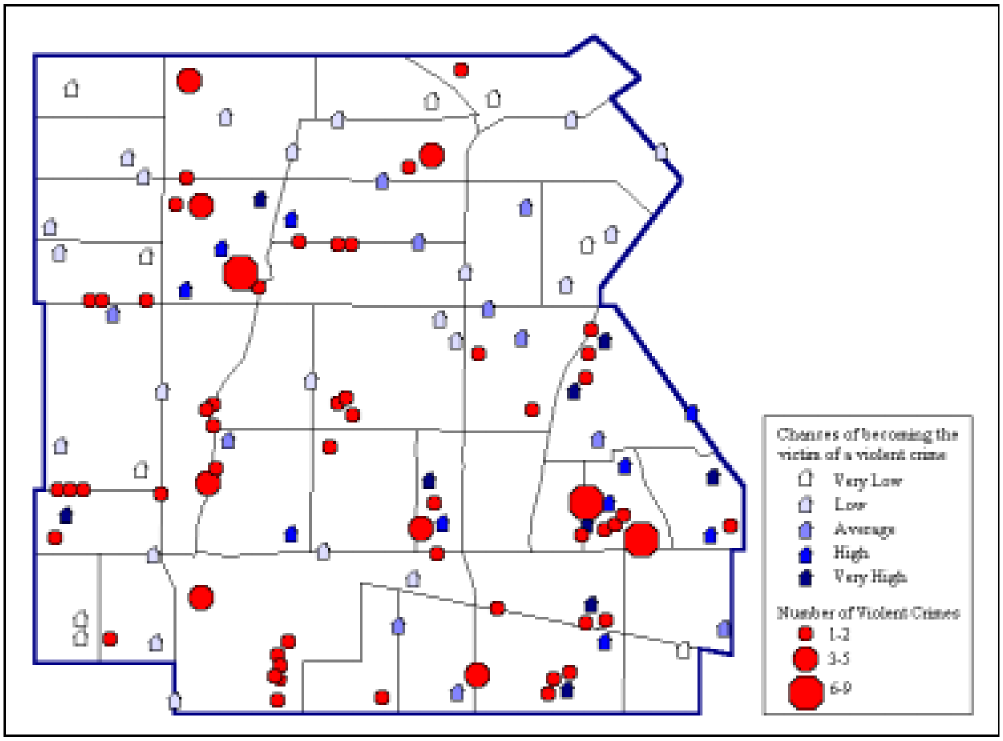
Audience: City council, police administrators, community

Data: Geographic - block groups, city council districts
Tabular - survey results, violent crime data

The geographic data include block groups within one council district. Since each city council member represents a different area of the city, maps that compare fear of crime with reported violent crime would ultimately be produced for each council district. Block groups have been included to give council members a general idea of the areas where violent crimes are occurring in their districts as well as where survey respondents reside.

Map 5.1 is a graduated size map that depicts the locations of violent crime incidents as well as the locations of the respondents' residences. The red graduated symbols represent violent crime incidents (homicide, sexual assault, robbery, aggravated assault) that have occurred during the past year. The points indicating the residences of survey respondents have been shaded according to their responses to a question asking them to rate their chances of becoming the victim of a violent crime in their neighborhoods.

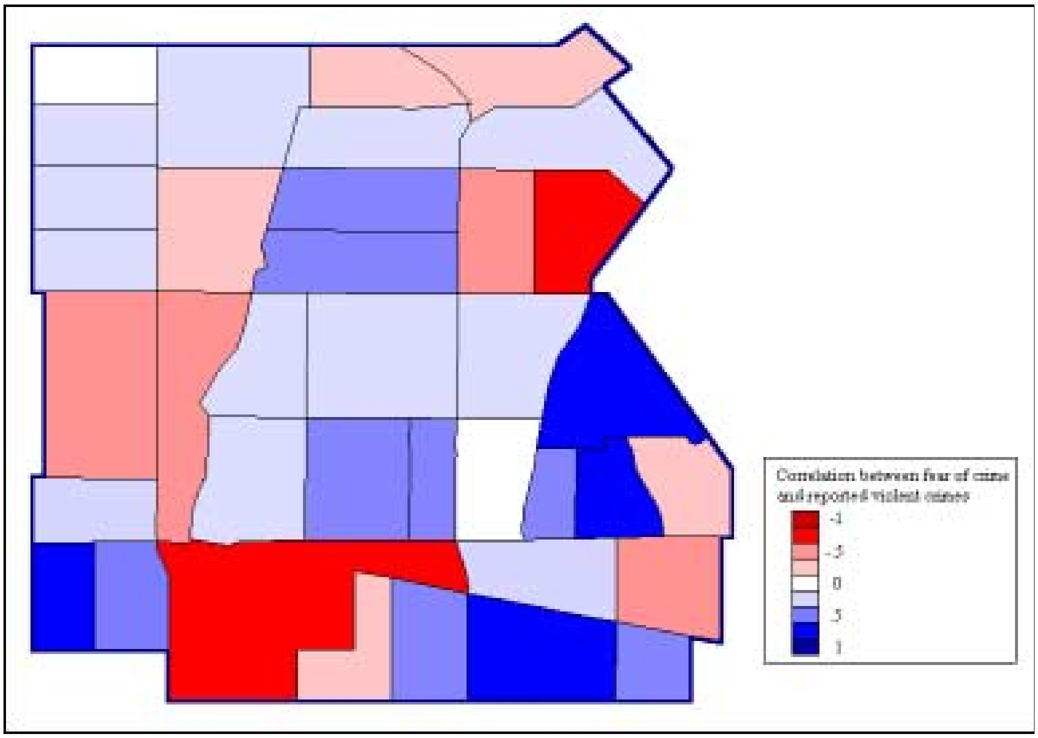
Map 5.1: Graduated Size/Color Point Map Depicting Fear of Crime and Violent Crime Incidents



Violent crime data have been included in Map 5.1 to generally depict how many violent crimes occur in each block group and where. Survey respondents' addresses and fear of crime levels have also been included in this map to determine if fear of crime correlates to the proximity of respondents' homes to violent crime incidents. Although a great deal of valuable information has been included in this map, a combination graduated size and graduated color point map may not be the most appropriate method for representing all of these data. Given the large number of points combined with the thematic shading, it is difficult to draw meaningful conclusions about the relationship between fear of crime and reported violent crime from this map.

Map 5.2 is a choropleth map whereby block groups are shaded according to the statistical correlation between citizens' fears of becoming the victim of a violent crime and the number of violent crimes occurring by block group. One of the goals of this analysis is to compare levels of fear with the number of reported violent crime incidents. For example, if survey respondents indicated a high fear of crime, yet they reside in a block group that experienced a relatively low number of violent crimes, a strong negative correlation (closer to -1) would exist between these two variables. If respondents indicating a high fear of crime reside in block groups with a high number of violent crimes, a strong positive correlation (closer to +1) would exist.

Map 5.2: Choropleth Map Depicting Correlation Between Fear of Crime and Violent Crime Incidents

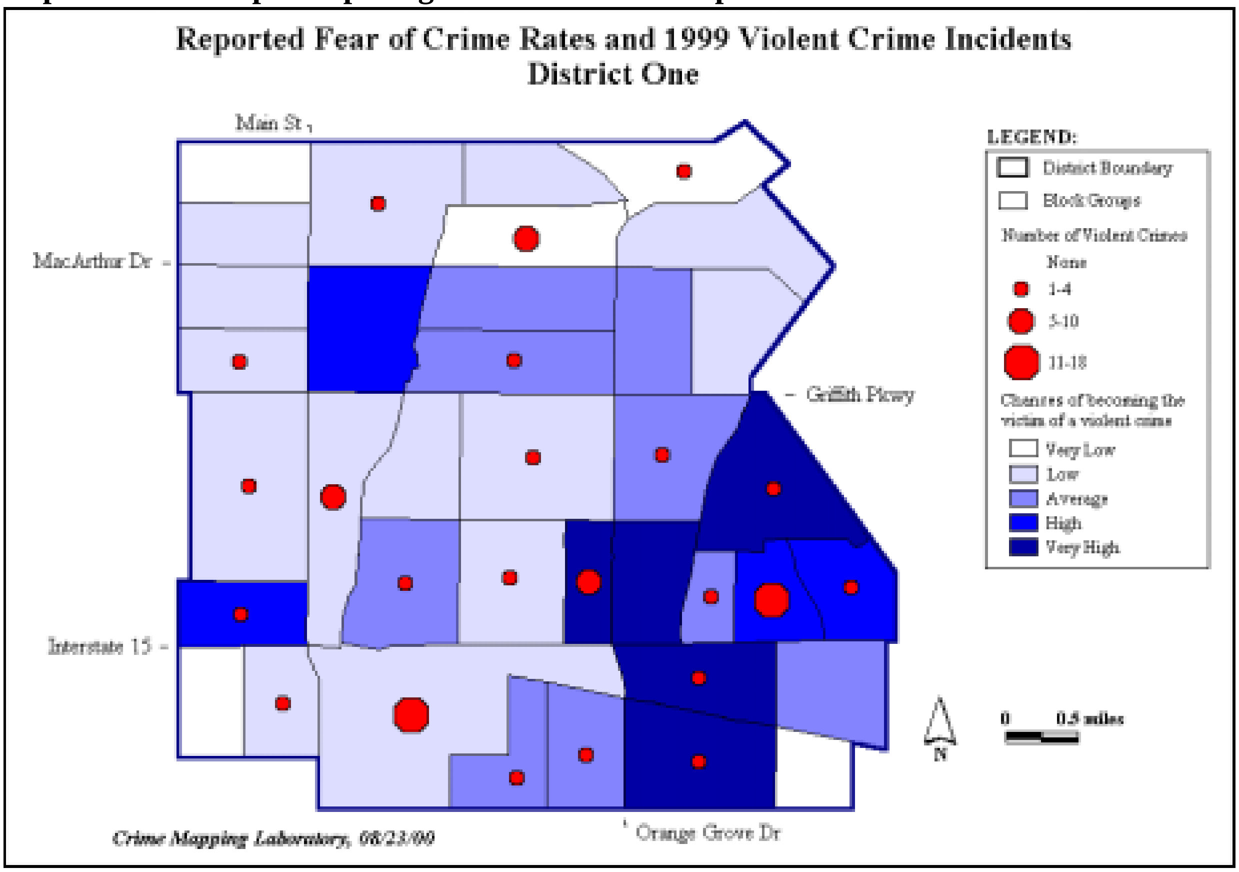


Although Map 5.2 uses an effective measure to determine the relationship between fear of crime and actual reported crime, it may not be the appropriate method for representing this analysis considering the purpose and audience. It may be difficult and time-consuming to explain this method of analysis to the city council in a brief presentation; therefore, a simpler method for representing these data may be more appropriate.

Map 5.3, a combination map that includes data on citizens' fears of becoming the victim of a violent crime and reported violent crime incidents for the past year, is the final map in this example. Map 5.3 is appropriate for the city council in that it is fairly easy to understand and does not require a great deal of explanation. Additionally, it does not reveal sensitive information such as the home addresses of survey respondents or the locations of violent crime incidents.

Combining these data sources reveals that, for several areas, a high fear of crime does not correspond with a high frequency of reported crime. For example, some of the dark block groups in the center of the map where survey respondents indicated a high fear of crime have none or not as many violent crimes as other nearby neighborhoods. This may indicate that the opinions of citizens living in these block groups are influenced by the activity in nearby areas. Alternatively, violent crime may occur in these areas, yet citizens might be reluctant to report it for fear of retaliation. The police may not be aware of this problem were it not for this innovative use of mapping.

Map 5.3: Final Map Comparing Fear of Crime to Reported Violent Crime Incidents



Additional analysis may be conducted by including demographic information about the block groups to help illuminate the analysis. For example, it is widely known that elderly people have a higher fear of crime but are less likely to be victims of violent crime; thus, computing a fear of crime by percentage of persons over 65 in a block group may help to explain the difference in fear of crime and actual reported crime. However, including too many variables in an analysis for this particular audience should be done cautiously as it may not add to the analysis but only confuse it.

IV. Conclusion

This manual outlines a number of fundamental concepts concerning the production of crime analysis maps and seeks to establish basic guidelines for introductory crime analysis mapping in law enforcement. The five examples are designed to walk readers through the process of crime analysis mapping and to illustrate the importance of considerations such as purpose, audience, available data, and type of map to the crime analysis mapping process. These examples are not meant to instruct law enforcement practitioners and researchers on how to create maps, but rather to help them think critically about the crime analysis mapping process so that they can produce accurate and informative maps.