A Guide for Crime Analysts

# Identifying Hot Spots of Juvenile Offending

COPS
Community Oriented Policing Services
U.S. Department of Justice

GEORGE MASON UNIVERSITY

by
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This project was supported by cooperative agreement number 2012-CK-WX-K026 awarded by the Office of Community Oriented Policing Services, U.S. Department of Justice. The opinions contained herein are those of the author(s) and do not necessarily represent the official position or policies of the U.S. Department of Justice. References to specific agencies, companies, products, or services should not be considered an endorsement by the author(s) or the U.S. Department of Justice. Rather, the references are illustrations to supplement discussion of the issues.

The Internet references cited in this publication were valid as of the date of publication. Given that URLs and websites are in constant flux, neither the author(s) nor the COPS Office can vouch for their current validity.

Recommended citation:

Gill, Charlotte, Zoe Vitter, and David Weisburd. 2015. *Identifying Hot Spots of Juvenile Offending: A Guide for Crime Analysts.* Washington, DC: Office of Community Oriented Policing Services.

ISBN: 978-1-932582-98-7

Published 2015

# Contents

# Letter from the Director

Dear colleagues,

Science and technology have been drivers of improvements in many spheres of our daily lives, including policing and public safety. Technology can be a tool for good or bad, as many pundits have observed. Within the discipline of policing, prudent executives recognize that technology cannot and should not be a replacement for good police work and sound policy. The technological advances and increased availability of unmanned aerial vehicle (UVR), for instance, should not mean that the profession abandon important privacy principles and relax stringent policies defining the limited and appropriate use of UVRs. The use of any technology must be informed and shaped by policies that are well reasoned and clearly written. Technological tools and the techniques enabled by such policies must be used in ways that uphold the broader principles of fair, impartial, and legitimate policing.

Hot spot policing has gained popularity among law enforcement agencies across the country. A strong and growing body of scientific evidence demonstrates that hot spot policing, when implemented correctly, can help reduce levels of a wide variety of crime and disorder. As a place-based strategy, hot spot policing has shown to be both tactically effective in helping to identify where police can most expediently deploy resources and strategically useful for assisting with long-range agency planning, in refining community outreach efforts, and in building partnerships. Furthermore, the analytical techniques for hot spot policing also are becoming more sophisticated and specific to particular types of problems.

It is within this context that I am pleased to announce the publication *Identifying Hot Spots of Juvenile Offending* as a significant innovation to the field. The authors from George Mason University's Center for Evidence-Based Crime Policy provide law enforcement practitioners with a technical overview of how to specifically identify hot spots of juvenile offending and discuss how, given the unique nature of juvenile offending, this information can inform problem-solving approaches that stress prevention and place-management strategies over enforcement strategies.

This guidance, grounded on an applied research project in Seattle, represents an important advancement in place-based approaches that will help refined police practice and policy, as well as help illustrate the critical nexus between community policing practices, juvenile justice, and public safety. Police executive and managers, as well as crime and intelligence analysts, will find useful guidance in this publication. It will enable them to enhance both the effectiveness and fairness with which their agencies address juvenile offending.

Sincerely,

Ronald L. Davis, Director
Office of Community Oriented Policing Services

# Acknowledgments

We wish to thank the Office of Community Oriented Policing Services for its support of our efforts to study community oriented policing at juvenile offending hot spots in Seattle. In particular, we thank our program manager, John Markovic, for his continued support and insights throughout this project.

A number of individuals contributed to this report, either directly or indirectly. We thank the anonymous peer reviewers who provided useful feedback on earlier drafts of this report.

We are grateful for the assistance of Mark Bridge, Sergeant Christine Robbin, and Sergeant Peter Verhaar of the Seattle Police Department with data extraction and analysis throughout this project.

Dr. Cody Telep, formerly of George Mason University and now at Arizona State University, assisted us in developing a problem-solving approach for this project.

Claudia Gross-Shader of the City of Seattle Office of City Auditor and Kay Godefroy, Linda Spain, and Tari Nelson-Zagar of the Seattle Neighborhood Group were an integral part of implementing and monitoring the community oriented policing initiative in Seattle.

Last, but certainly not least, we thank the Seattle Police Department officers and staff who work so hard to deliver community oriented policing to juvenile offending hot spots in downtown Seattle: Captain Jim Dermody; Captain Chris Fowler; Lieutenant Michael Magee; Sergeant James Danielson; Acting Sergeant Jim Garner; Officers Matthew Chase, Thomas Christenson, Michael Eastman, Kevin Oshikawa-Clay, and Jeremy Pinkerton; and West Precinct administrator Noreen Tanaka.

# Introduction

In line with its mission to make scientific research a key component in decisions about crime and justice policies, the Center for Evidence-Based Crime Policy (CEBCP) in the Department of Criminology, Law and Society at George Mason University produced this guide as part of a larger research project focused on identifying juvenile offending hot spots and documenting the unique problem-solving interventions that were applied to hot spots in Seattle as part of a COPS Office-funded cooperative agreement.

Following prior research on crime prevention at places, these interventions will address immediate risk factors at hot spots; minimize the use of arrest; and partner police with community groups, place managers, and juvenile service providers. The goals of this program are to increase the capacity of the police to identify and address problems relating to juveniles at small places and to increase opportunities to work in partnership with local communities to reduce offending, thus ultimately enhancing police-community relations.

This guide provides an overview of the procedures developed by the CEBCP in collaboration with the Seattle Police Department to identify and map hot spots of juvenile offending. It is intended as a resource for relatively experienced crime analysts who are familiar with extracting CAD/RMS data to conduct hot spot analysis and to enable them to tailor their analyses to juvenile offending issues. If possible, analysts who are less familiar with these procedures should seek assistance from department or municipal IT staff to enhance analysts' capacity to extract and analyze requisite data. This guide also explains why juvenile offending hot spots should be examined separately and then provides information about the procedures the CEBCP employed to extract and process the relevant data for this research project and the Seattle Police Department.

A practitioner-oriented summary of the research findings and policy implications of the wider research project on juvenile hot spots will be the focus of a future COPS Office publication. The results will also be submitted to an academic journal for publication.

# Analyzing Juvenile Offending Hot Spots

## What are hot spots?

Crime is not evenly spread across cities or neighborhoods. In most cities, a small number of hot spots tend to have greater than average numbers of crime and victimization. These hot spots can be as small as single addresses; single street segments (the two sides of a block face between two intersections); or small groups of connected segments, such as a drug or prostitution market that spreads across several blocks.

Research shows that hot spot blocks are spread across cities and are often stable over time. One block in a neighborhood could be a hot spot for many years while the blocks surrounding it rarely experience any crime. This research also shows that as many as half of all incidents or calls for service recorded in a city can be concentrated at a very small number of hot spots. For example, studies in Seattle, Minneapolis, and Tel Aviv have found that 50 percent of crime in those cities occurred at just 3 to 6 percent of addresses or blocks (Sherman, Gartin, and Buerger 1989; Weisburd and Amram 2014; Weisburd, Bushway, Lum, and Yang 2004; Weisburd, Groff, and Yang 2012).

Many crime analysts are familiar with identifying hot spots and assessing small geographic areas at which different types of crimes concentrate. Crime analysis plays a crucial role in the success of hot spot policing strategies, which are increasingly popular in U.S. police departments. Hot spot policing is now known to be one of the most effective approaches in the policing toolkit: there is strong evidence that preventive patrol, problem-oriented policing, and crackdowns at small geographic areas reduce crime (see Braga and Bond 2008; Braga, Papachristos, and Hureau 2012; Lum, Koper, and Telep 2011; Sherman and Weisburd 1995; Telep, Mitchell, and Weisburd 2012; Weisburd and Eck 2004; Weisburd and Green 1995). Hot spot policing approaches appeal to police leaders because these approaches allow the police to deal with a large proportion of crime by focusing resources efficiently at a small number of places (Weisburd and Telep 2010).

## How are juvenile offending hot spots different?

Hot spots are usually identified based on the highest concentrations of overall crime and disorder reports or clusters of specific crime types, such as Part I offenses or robberies. Looking specifically at offenses by juveniles (individuals younger than 18) is often not a high priority for analysts. Calls for service data do not usually include an accurate representation of the suspect's age; such information is usually available in incident reports when a suspect has been arrested or otherwise positively identified. Police officers also tend to exercise more discretion when deciding whether or not to arrest juveniles, so incident reports may not provide the full picture of juvenile offending. Nonetheless, emerging research suggests that specific efforts should be made to identify juvenile offending hot spots as part of strategic crime analysis approaches that form the basis for juvenile-tailored interventions.

The authors suggest that juvenile offending hot spots should be examined separately from hot spots of general crime for the following three reasons:

1. **Juvenile offending follows more specific patterns.**

   Juvenile offending is even more highly concentrated at a small number of places than crimes and calls for service in general. While this remains an emerging area of research, Weisburd, Morris, and Groff (2009) have found that in Seattle, Washington, just 86 street segments of almost 29,000 in the city accounted for one-third of all incidents in which a juvenile was arrested over a 14-year period.

Why is juvenile offending so tightly connected to certain places? Environmental approaches to crime prevention suggest that people's daily or routine activities, which are determined by the types of places they frequent, shape opportunities for crime and affect people's decisions to commit crime or their risk of becoming a victim (see Cohen and Felson 1979; Felson 1994). This is the case for people of all ages, but the routine activities of juveniles tend to be much more limited and predictable, meaning that crimes committed by or against juveniles are likely to occur at a more specific set of locations (see Felson 2006).

**Formal processing can in fact increase recidivism among some young people, especially compared to those youth who are diverted to needed services.**

For example, juveniles are required to be in school at certain times, and offending tends to cluster around schools at times when students are arriving or leaving (Roman 2002; 2005). Routes of travel to and from school tend to be more predictable and defined than the commutes of adults and produce opportunities for offending when victims and offenders cross paths (Brantingham and Brantingham 1995). Juveniles, to a much greater extent than adults, are also subject to restrictions in where they congregate. For example, they cannot go into bars or may be subject to exclusion from certain areas during curfew hours. These factors also determine the clustering of juvenile offending at particular places and times.

The research of Weisburd and colleagues (2009) in Seattle appears to confirm these ideas. They found that arrests of juveniles were highly concentrated at the types of places where young people were likely to be hanging out without supervision or structured activities, such as at shopping malls, outside school, and in public spaces. In contrast, places with relatively low rates of juvenile arrests were most often nonpublic spaces, particularly private dwellings. This suggests that anonymous, poorly supervised public places are conducive to higher levels of juvenile offending. Research has shown that unstructured socializing is linked to juvenile delinquency and violence (see Osgood et al. 1996).

### 2. Traditional policing approaches may not work for juveniles.

Research suggests that arrest and formal juvenile justice system processing may not be appropriate for juvenile offenders—especially those who commit less serious crimes. Formal processing can in fact increase recidivism among some young people, especially compared to those youth who are diverted to needed services (Petrosino, Turpin-Petrosino, and Guckenburg 2013). Arrests, court adjudications, and incarceration can stigmatize young people, leading to social exclusion and increased scrutiny from the justice system. Furthermore, other youth they encounter in the system can reinforce delinquent behavior. If a young person loses the support of family, friends, school, and other positive social influences as a result of arrest or incarceration, he or she may become further involved in delinquency (Lowenkamp and Latessa 2004). On the other hand, at-risk youth who receive community-based interventions that focus on supervision and problem solving have better outcomes (see Braithwaite 1989; Gill forthcoming; Greenwood 2008; Lipsey 2009).

The research above on juvenile processing indicates that traditional law enforcement strategies such as crackdowns or intense focus on frequent offenders may not be appropriate for most juveniles. Thus, combining juvenile and adult offending in hot spot analysis prevents police leaders from providing the

most appropriate level of intervention for the population. Law enforcement agencies should instead identify hot spots of juvenile offending separately and consider more community- and problem-oriented hot spot approaches at these locations that minimize the use of arrest and focus on partnerships with community groups and service providers, on multi-agency working groups, and on civil remedies against crime and disorder problems (Lum et al. 2011; Mazerolle and Ransley 2005; Taxman and McEwen 1997; Weisburd and Eck 2004). While established hot spot policing approaches have not yet been tested at juvenile offending hot spots, the research on outcomes for juveniles in the justice system versus those in the community suggests that the partnership approaches discussed in the community- and problem-oriented policing literature should be considered.

### 3. Traditional data sources may not give the full picture of juvenile hot spots.

Hot spot analysis can be based on any type of police data depending on the operational needs of the police department. Calls for service information is the most inclusive source of data—it includes all issues reported to the police, whether or not they result in an incident report, and therefore gives the broadest picture of citizen concerns and issues that come to the attention of officers on patrol. Alternatively, analysis can be based on incident reports, which tend to include a more accurate classification of the nature of the crime and are based on confirmed cases. Arrest reports are also used to identify patterns of police activity and decision making but may be less useful in providing an overall picture of concentrations of crime because of the number of variables involved in an officer's decision to make an arrest, including the nature of the offense and the suspect's age, demeanor, and history (Weisburd et al. 2012).

Calls for service data cannot be used to accurately identify hot spots of juvenile offending. Most police departments do not record the precise age of the suspect in the initial call or report, and the ability of a member of the public or a police officer who has not yet engaged with the suspect to judge age is likely to vary extensively. Thus, incident or arrest data must be used to extract information about the age of suspects or arrestees. This obviously means that analysis of juvenile offending hot spots cannot include all incidents. Rather, assessing the age of the suspect requires that the responding or investigating officer has made a positive and accurate identification. Furthermore, police discretion may be particularly evident in situations involving nonserious and juvenile offending. About 20 percent of juvenile arrests are handled within the police department with no referral to court (Snyder and Sickmund 2006), but there are no good national estimates of how many juveniles come into contact with the police on the streets but are never arrested or even identified.

Given these limitations, it is important to use multiple data sources to assess the location of juvenile offending hot spots. Data on incident or arrest locations can be triangulated with data on victimization of juveniles: there tends to be substantial overlap between victims and offenders in terms of age and other characteristics, so it is also logical that where offending concentrates, victimization concentrates too. Victimization data may also help to identify offenses that were not captured in the arrest or incident analysis: e.g., a victim made a complaint but did not identify an offender. Information on status offenses such as truancy and underage drinking could also assist in showing where other types of juvenile offending might occur.

These three research findings have four important implications for crime prevention at juvenile offending hot spots:

1. Juvenile offending is concentrated at a very small number of places, allowing police and crime prevention resources to be deployed more efficiently.

2. Traditional and offender-focused policing approaches may not be appropriate in areas where juvenile offending is highly concentrated. Juvenile offending problems may call for community-led problem-solving approaches that increase supervision and watchfulness and build supportive networks for troubled youth. Enforcement may still be necessary to tackle entrenched or repeat offending at places, particularly with adults who draw youth into offending behavior such as drug dealing. However, multiagency collaboration could help address the variety of issues that may explain juvenile offending at a specific place (see "Using the hot spot analysis to inform a problem-solving approach" on page 23).

3. Identifying juvenile offending hot spots requires a broader range of data sources than are needed for general crime hotspots.

4. Identifying juvenile offending hot spots can help police departments to better focus community oriented policing efforts and more fully engage in problem-solving with multiagency partnerships. These efforts may in turn help to build positive police-community relations.

Crime analysts will play a key role in moving these new ideas forward and supporting innovative police-community partnerships at hot spots of juvenile offending. Several useful publications aimed at enhancing the capacity of crime analysts to support hot spot and problem-oriented policing efforts are already available (see Boba 2001; Clarke and Eck 2005; Eck et al. 2005; Taylor, Boba, and Egge 2011). This guide builds on existing resources by providing specific detail on tailoring hot spot analysis to issues of juvenile offending to support operational strategies tailored toward the unique needs of youth.

This guide is based on work conducted by the Center for Evidence-Based Crime Policy (CEBCP) in partnership with the Seattle Police Department. The CEBCP relied on Esri's ArcGIS and Microsoft Office Suite to conduct analysis and produce maps, examples of which are included in the following sections. Many crime analysts have familiarity with and access to these tools. However, the analysis process described here could be performed with a variety of software tools. Similar types of analyses and maps could be produced, for example, with MapInfo Professional or Quantum GIS for mapping and Google Sheets for spreadsheets. The authors of this guide used incident reports as their unit of analysis, but this approach can be tailored to the operational needs and resources available to the analyst, and other sources of data such as victimization should be explored. In addition, as discussed in the section "Using the hot spot analysis to inform a problem-solving approach," analysis of crime data at the hot spot level is just one part of a problem-solving response and should be supplemented with other sources of data, information, and intelligence.

# Juvenile Offending Hot Spot Analysis Process

## Extracting data from CAD/RMS

The data used for the Center for Evidence-Based Crime Policy's (CEBCP) juvenile offending hot spot analysis came from two datasets extracted from the Seattle Police Department's (SPD) records management system (RMS). Many RMS and computer-aided dispatch (CAD) solutions are primarily geared toward data entry/capture rather than reporting, making data extraction challenging. Crime analysts usually use additional software products to extract and format the desired data from the underlying data tables in the RMS, including products that facilitate the writing and automation of structured query language (SQL) queries.[1]

As guidance for analysts already familiar with SQL processing, the below sidebar provides a sample SQL query used by SPD's crime analysts to pull pertinent information for the CEBCP's analysis. Analysts should contact their department's IT staff, or city or county IT support services, to explore options for optimizing data extraction. The sample query has been modified to remove information about SPD's data structure that cannot be shared publicly.

### Sample SQL Query

```
SELECT

INCIDENT_NUMBER.PRIMARY_KEY, INCDATA, OCCURRENCE_DATE, INCDATA.OCCURRENCE_TIME,
INCDATA.ADDRESS, CALL.TRANSLATION, INCDATA.DAY_OF_WEEK, INCDATA.DATE, INCDATA.DISTRICT,
INCDATA.AREA, INCDATA.BLOCK, INCDATA.STATUS, INCDATA.PERSON_COUNT, INCDATA.BUSINESS_
COUNT, INCDATA.OFFENSE_COUNT, INCDATA.FOLLOW_UP_COUNT,
INCDATA.MIDPT_X, INCDATA.MIDPT_Y,

FROM ((DATATABLE. INCDATA
INNER JOIN DATATABLE.EVEN_OFF ON INCDATA.CALL=EVEN_OFF.EVEN_PAST)
INNER JOIN DATA2.DATA_SET ON INCDATA.CALL=DATA_SET.PAST)
INNER JOIN DATATABLE.CALL_TRANSLATION ON (EVEN_OFF.UCR=DATA_CALL.TRANSLATION AND
EVEN_OFF.REXT=DATA_CALL.EXTENTION)

WHERE (INCDATA.OCCURRENCE_DATE>='01-JAN-2012' AND INCDATA.OCCURRENCE_DATE<'01-
JAN-2013')
```

1. Seattle Police Department uses Versaterm systems for RMS and CAD, and the analysts with whom the CEBCP worked used Crystal Reports (www.crystalreports.com) and Aqua Data Studio (www.aquafold.com) to query databases and write SQL code.

The data fields of interest, "GO [General Offense] Data" and "Entity Data," were pulled from two RMS tables and provided to the CEBCP in Microsoft Excel. The GO Data includes offense-level details of all calls for service that generated a police report. Crucial fields for the hot spot analysis include the following:

- Date of incident
- Time of incident
- Day of the week
- Location of incident (address; X-Y coordinates)[2]
- Incident/crime type
- Details of persons involved and roles (arrestee, victim, suspect, or witness)

Each incident receives a unique identifier (primary key) in SPD's CAD system that follows it through to the RMS. The data extracted from SPD's system is provided at the level of the specific offense/event within an incident, so there may be multiple rows per primary key. For example, if someone is arrested for assault and is found to be in possession of drugs and if the responding/investigating officer records both offenses, the incident will have two rows in Excel: one for the assault and one for the drug offense. Each person involved in the incident also receives a personal identification number (PIN), which uniquely identifies him or her in different datasets and incidents.

The second extracted dataset, Entity Data, is crucial to identifying specific juvenile offending incidents. This dataset pulls information from the Entity table, which contains detailed descriptive information on each individual involved in a GO incident record. The Entity table is linked to the GO data by the primary key (for the incident), and persons are linked to incidents by primary key and PIN. Crucial fields for a juvenile offending hot spot analysis from the Entity table include the following:

- Primary key
- PIN
- Date of birth
- Role
- Juvenile flag, if available

Arrestee, suspect, and victim are the most useful types of roles. The CEBCP combined arrestees and suspects in the offending analysis but examined victimization separately.

As for juvenile flags, SPD's system includes a flag if a person is younger than 18 or involved in a status offense (e.g., a 20-year-old in an alcohol-related incident), but officers must fill out this field. Thus, the CEBCP's analysis used both the flag and the date of birth to identify juvenile arrestees, suspects, and victims in case some were not flagged.

2. Many systems include X-Y coordinates (latitude and longitude) for identifying the location of an incident. SPD's CAD system does not generate coordinates but looks them up in a pre-defined table. Addresses geocode to the face block. If coordinates are unavailable, address data will need to be cleaned and manually geocoded. The CEBCP used ArcGIS for this process; many other geocoding solutions are available.

Age is not automatically calculated from the date of birth in SPD's Entity table. This can be done using a formula in Excel ((date of incident – date of birth)*365.25) during the cleaning process (see next section) or as part of the SQL extraction query.

## Cleaning and normalizing the data

It is important to clean and code the extracted data so that aggregated trends can be examined. Most CAD/RMS systems are designed for data entry rather than analysis, so there can be problems with inconsistent documenting of offense types, formatting (e.g., dates formatted as strings), and so on. The cleaning process also involves weeding out reports that are not necessary for the analysis, such as noncrimes (e.g., natural death) or offenses that cannot be linked to a place (e.g., drunk driving).

Excel, Access, or statistical software such as IBM SPSS or Stata, if available, can be used for this task. Statistical software is recommended if available because it enables users to automate repetitive cleaning tasks. At this stage, the CEBCP ensured that all offense types and roles were consistently coded, variable storage was properly set (to numeric, string, etc.), and an identifier for juveniles was created using the existing juvenile flag or the formula in the previous section.

## Merging the datasets

The clean incident and person datasets should next be merged in Access or a statistical package to identify the incidents that involved juveniles. The datasets should be sorted by primary key and PIN and merged on a 1:Many basis from the GO (incident) dataset.

It is important to note here that the CEBCP used the incident (as defined by the primary key) as the unit of analysis. This is a common approach in place-based analyses, unless there are operational reasons for examining events within incidents (i.e., individual charges) or mapping persons.[3] Given that many incidents included multiple events and persons, the CEBCP dropped all but one event (offense) from the incident. The decision of which events to drop depends on the purpose of the analysis in a specific agency, and analysts may prefer to examine certain offense types, such as violent crimes, rather than all crimes. The CEBCP included all crimes in the analysis, but because youth violence was the focus, the CEBCP prioritized person crimes over property crimes, and property crimes over disorder. This process is akin to employing the Uniform Crime Report (UCR) hierarchy rule when defining multi-offense incidents by the most serious charge.[4]

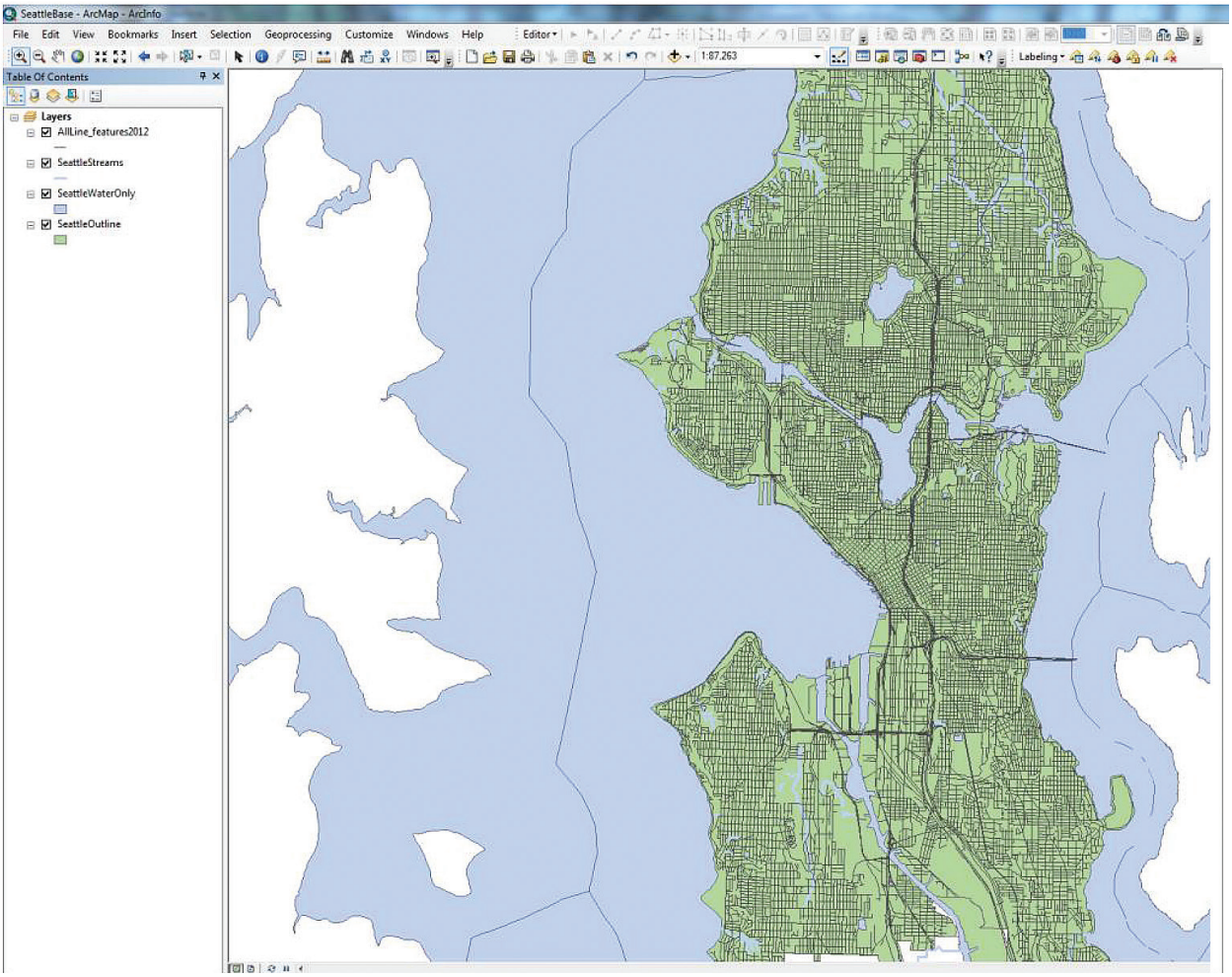
## Mapping the hot spots

The following instructions detail the process of mapping juvenile hot spots from the extracted data. The CEBCP used Esri's ArcGIS desktop software (version 10.0), which is used by many crime analysts, but the process can be adapted for other desktop mapping systems, such as MapInfo Professional or Quantum GIS, or for other versions of ArcGIS. Data can be imported into the mapping software from a variety of sources. The CEBCP used Microsoft Excel in this example.

3. For example, departments may wish to know if certain incidents involve multiple juveniles or frequent offenders. The police response will differ depending on whether, for instance, a problem park or shopping mall attracts repeat or one-time offenders and small or large groups.
4. The FBI's UCR hierarchy rule specifies that reporting agencies count only the most serious Part I offenses when reporting crime incidents involving multiple charges. Although this UCR hierarchy rule affects official crime report data, these reporting processes have no effect on the number of charges for which the defendant may be prosecuted.

In the mapping program, begin with a base map of the target area (figure 1), including streets and other features that are integral to the structure of the area. For example, the CEBCP included bodies of water in the Seattle base map because they shape and heavily influence the city.

Figure 1. Seattle base map showing city outline, streets, and waters




## 1. Create a buffer around streets to collect incident points.

When creating a buffer around streets (figures 2 and 3), a 1- to 10-foot buffer is sufficient; the street centerline essentially follows the yellow line down the center of the street, and most streets are more than 10 feet wide. The key here is that during the geocoding process, data points (incidents) should be coded within the chosen buffer distance, so make a note of the size. The CEBCP used buffers of 6 feet and offset points (incidents) from the street centerline by 5 feet.

There are two benefits to creating the buffer. First, streets are lines, but the buffers created around them are polygons. When points (i.e., individual incidents) are joined to polygons, the number of points within the polygon (and other attributes in the table) is summed. The joined buffer allows ranked crime statistics to be displayed on each street segment. Second, in ArcGIS, points and street labels need to be offset from the street by different degrees so that the program can display both at the same time.

To create a buffer in ArcGIS, do the following:

- Navigate to Geoprocessing > Buffer to open the dialog window shown in figure 2.
- Under "Input Features," select the street shapefile for which the buffers will be created.
- "Output Feature Class" designates where the buffer file will be saved. Add a predictable file name such as "AllStreetsBuffer" here.
- "Distance" should be set to "Linear Unit." Here, specify the number of feet (or other distance unit) by which the buffer extends from the centerline.
- The CEBCP recommends changing "End Type" to FLAT to eliminate the opportunity for addresses near intersections to migrate to an adjacent street.
- The CEBCP recommends retaining the default settings for "Side Type" (FULL) and "Dissolve Type" (NONE). The FULL side type allows the buffer to extend to both sides of the centerline. Without a "dissolve" setting, each street segment is retained as an individual unit.

Figure 3 shows the result of creating a buffer with the above settings. The light blue buffer can be faintly seen around the darker street centerlines.

Figure 2. ArcGIS dialog window for buffer function

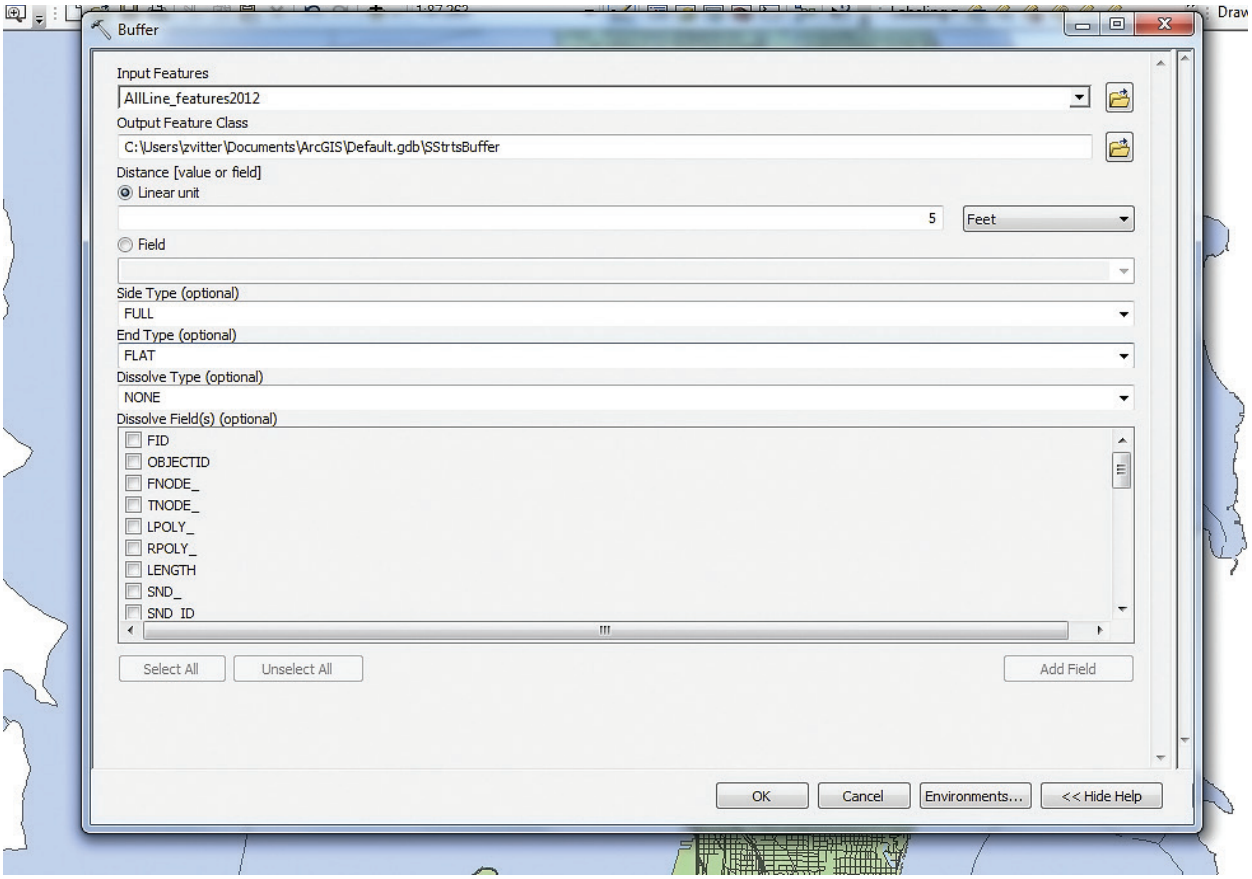
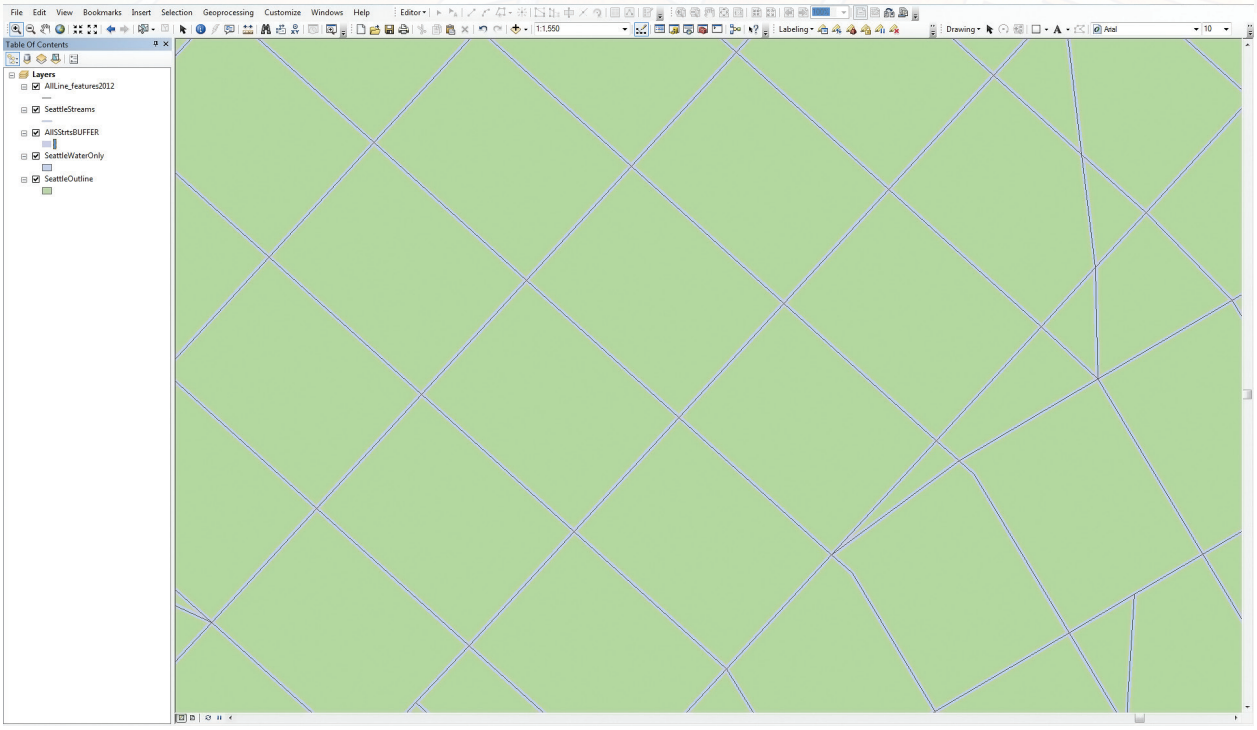


Figure 3. Close-up of streets and their buffers




## A note regarding X-Y coordinates

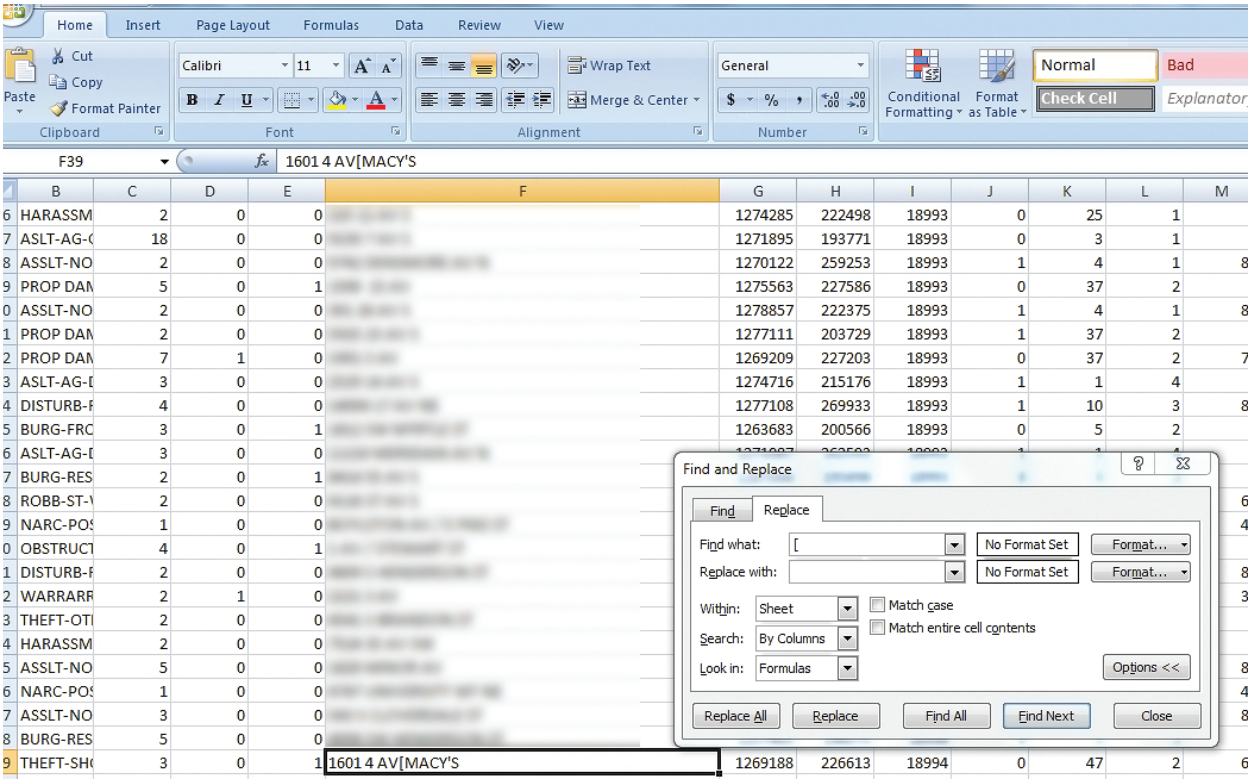
Steps 2 and 3 may not be necessary if X-Y coordinates are available. However, in Seattle the coordinates locate to the center of the parcel. The close grid of city streets, especially in the downtown area, often makes it impossible to determine whether an incident occurred on the street in front of the parcel or the adjacent cross-street. Geocoding the actual address eliminates this problem. This is an important consideration if single street segments are the unit of place for the hot spot analysis.

## 2. Clean address data for geocoding.

When cleaning address data for geocoding (figure 4), find and replace any addresses in the data file that will not geocode successfully. Most geocoders understand street numbers with streets (e.g., 123 S MAPLE ST) and intersections (e.g., S MAPLE ST / PINE AV). Some abbreviations and shorthand notes can be added as options, but ArcGIS does not understand business names (e.g., 123 S MAPLE ST[MACYS]).

Using the "Find and Replace" dialog window (figure 4), the user can identify cells containing common features of problematic addresses, such as a bracket denoting a business name, and subsequently replace the problematic address (123 S MAPLE ST[MACYS]) with the standard address (123 S MAPLE ST). Alternatively, commands can be written in statistical software to remove such characters prior to geocoding. The most efficient method will be determined by the specific features of the jurisdiction's data systems and the skill set and resources of the crime analyst.

Figure 4. Example of unsupported address format

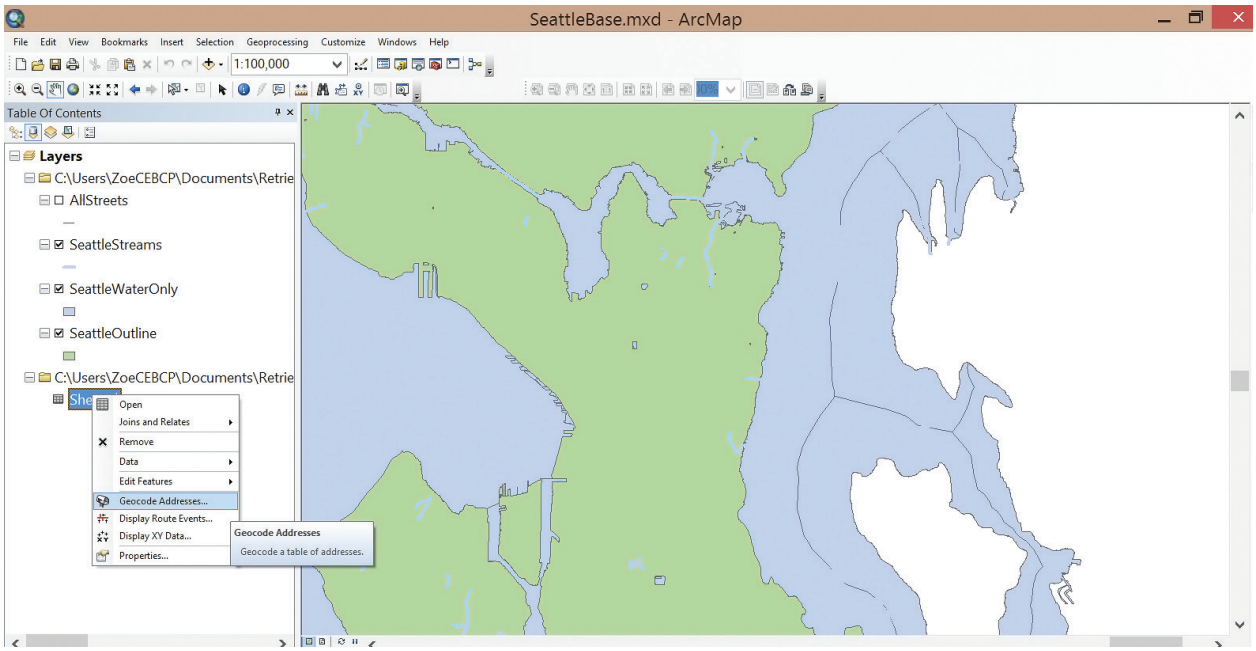


## 3. Geocode the addresses.

The next step is to geocode the addresses (figures 5–8). A best practice is to create a custom address locator for geocoding even though older versions of ArcGIS (versions 10.0 and 10.1) still provide free locators. A police department's CAD system may standardize addresses with the locality's street centerline file, and the CEBCP recommends checking with IT support staff to verify this. An address locator created from the same file has the best chance of success. The mapping software should also include information about creating custom address locators in the manual or through the software's Help menu.

To set the input fields and options, analysts *must* be familiar with the address data: the format of the addresses, the columns the various pieces of information are stored in, the ways in which intersection addresses are separated, and other particulars of the local data. It is best to create a custom address locator if one does not already exist. Set the offset to a distance within the buffer area, and be sure to offset from the end of the street so that points at intersections do not become confused with those at the end of the block.

Figure 5. Importing the address data



### A note regarding intersections

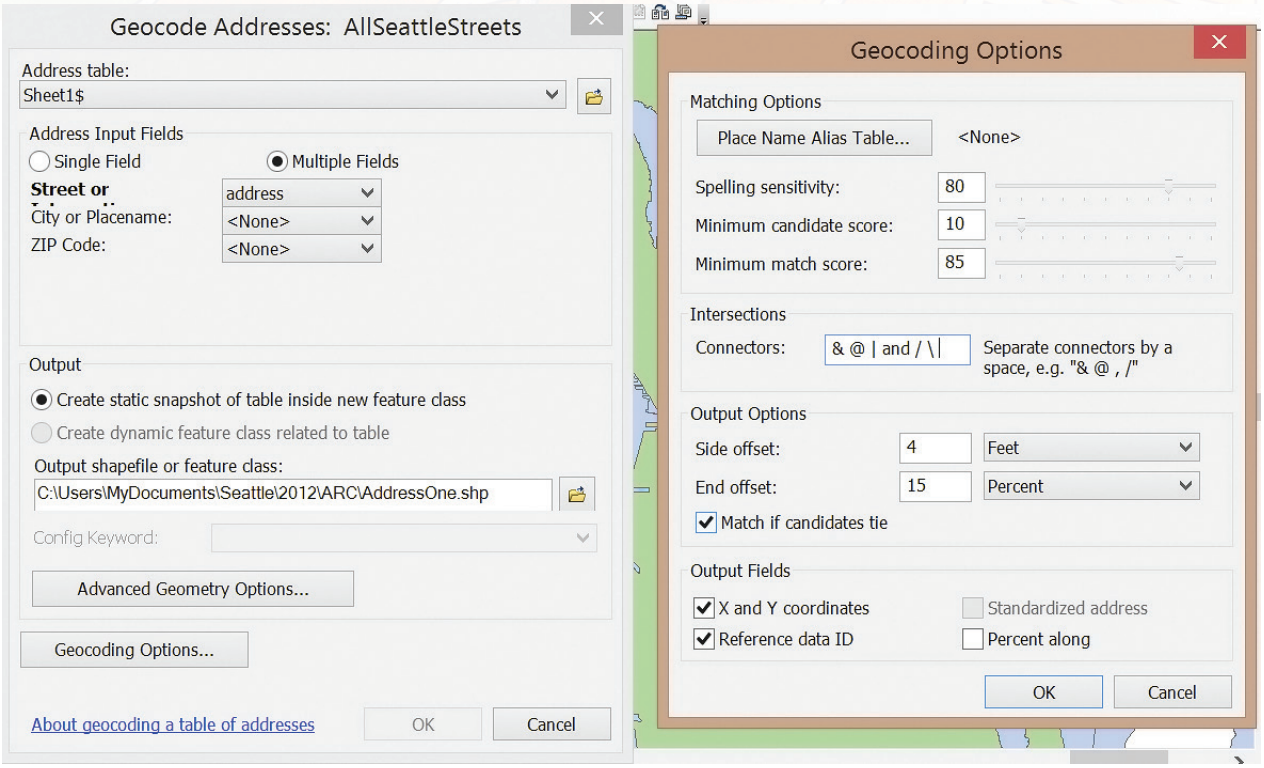
Some hot spot analyses in the research literature have excluded incidents at intersections because it is not possible to determine which individual street segment those incidents should be assigned to. However, there may be an operational need or desire to focus on small groups of street segments for analysis and intervention. For example, for the research in Seattle, the CEBCP allowed hot spots to be larger than a single street segment in some cases because the CEBCP focused on only a small number of hot spots, and police leadership judged crime problems at some locations to be connected across neighboring segments. Thus, analysts should examine what type and proportion of incidents occur at intersections before deciding whether to include or exclude them. In the CEBCP's analysis, only 10% of incidents were located at street segments. Weisburd and colleagues (2004) found in their research, also in Seattle, that most incidents located at intersections involved traffic offenses, which may not be the preferred target for problem-solving efforts, particularly with juveniles (see also Weisburd et al. 2009).

As discussed in the sidebar "A note regarding X-Y coordinates" on page 12, geocoding is not necessary if the incident dataset contains usable X-Y coordinates. Select "Display XY Data" at this stage instead.

To geocode the addresses, do the following:

- In ArcGIS, import the Excel file containing incident data that was created in step 2 using "Add Data." Right-click the file in the "Table of Contents" menu (see figure 5), select "Geocode Addresses...," and then select the appropriate address locator when prompted. Once the selection is confirmed, the "Geocode Addresses" dialog window will open (see figure 6).
- Make sure the correct incident data spreadsheet is selected in the "Address Table" dropdown menu. The column headings from that spreadsheet should appear in the "Address Input Fields" dropdowns. Check that ArcGIS has assigned them correctly.
- The CEBCP recommends retaining the default setting of "Create static snapshot of table inside new feature class."
- Choose a predictable name and location for the output shapefile to be produced.
- Click the "Geocoding Options" button to open its dialog window (see figure 6). Most of the defaults can be retained in this window, but the settings will depend on the dataset. For example, if streets in intersection addresses are not separated by a character listed in "Intersections: Connectors" (e.g., the slash in "4TH AVE / MAIN ST"), the additional character needs to be added.
- Under "Output Options," "Side Offset" must be set to a value within the buffer area defined in step 1. The value for "End Offset" depends on the desired extent to which incidents occurring on intersections need to be separated from those occurring on blocks. If this is not a key consideration, the default setting is sufficient. If more distinction is required, this field should be set to 10 to 15 percent. Click OK to close this window, and click OK again in the "Geocode Addresses" dialog window to process the data.

Figure 6. Specifying the geocoding parameter settings




During the geocoding process in ArcGIS, the window shown in figure 7 provides a running status of the geocoding hit rate. If the proportion of unmatched or tied addresses is high at the end of the process, repeat steps 2 and 3 as needed to ensure all addresses are in a recognized format.

Figure 8 shows the final map complete with points (crime incidents) after X-Y coordinates are plotted or addresses are geocoded.

Figure 7. Validating the addresses

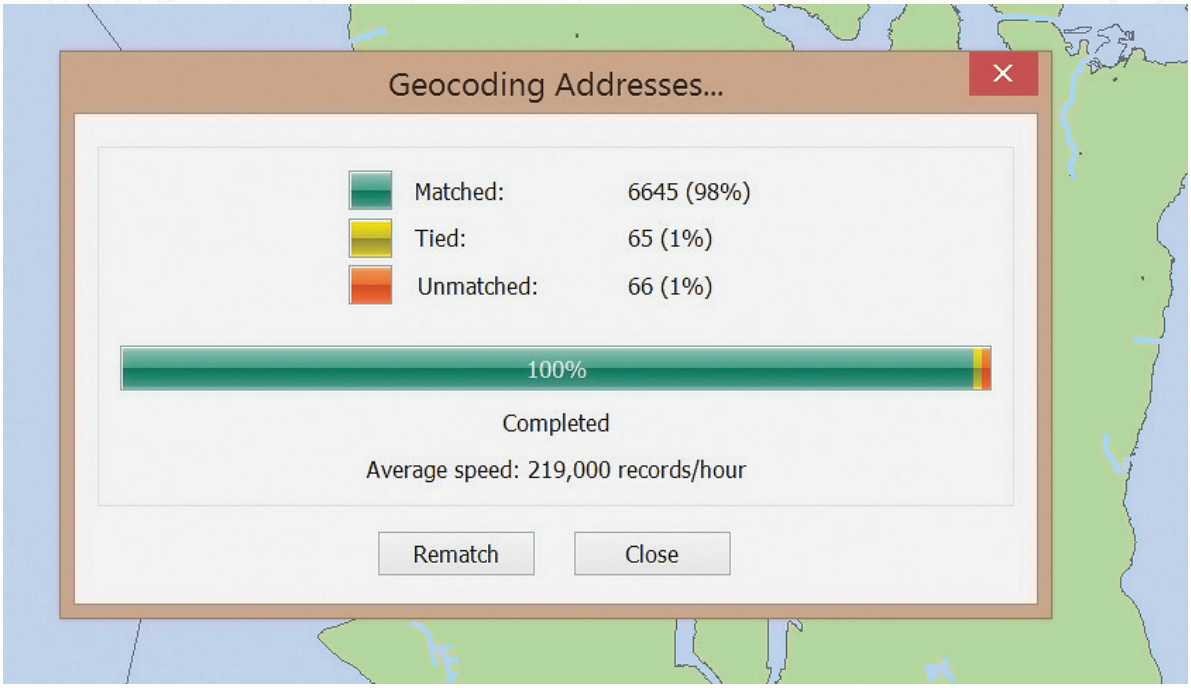
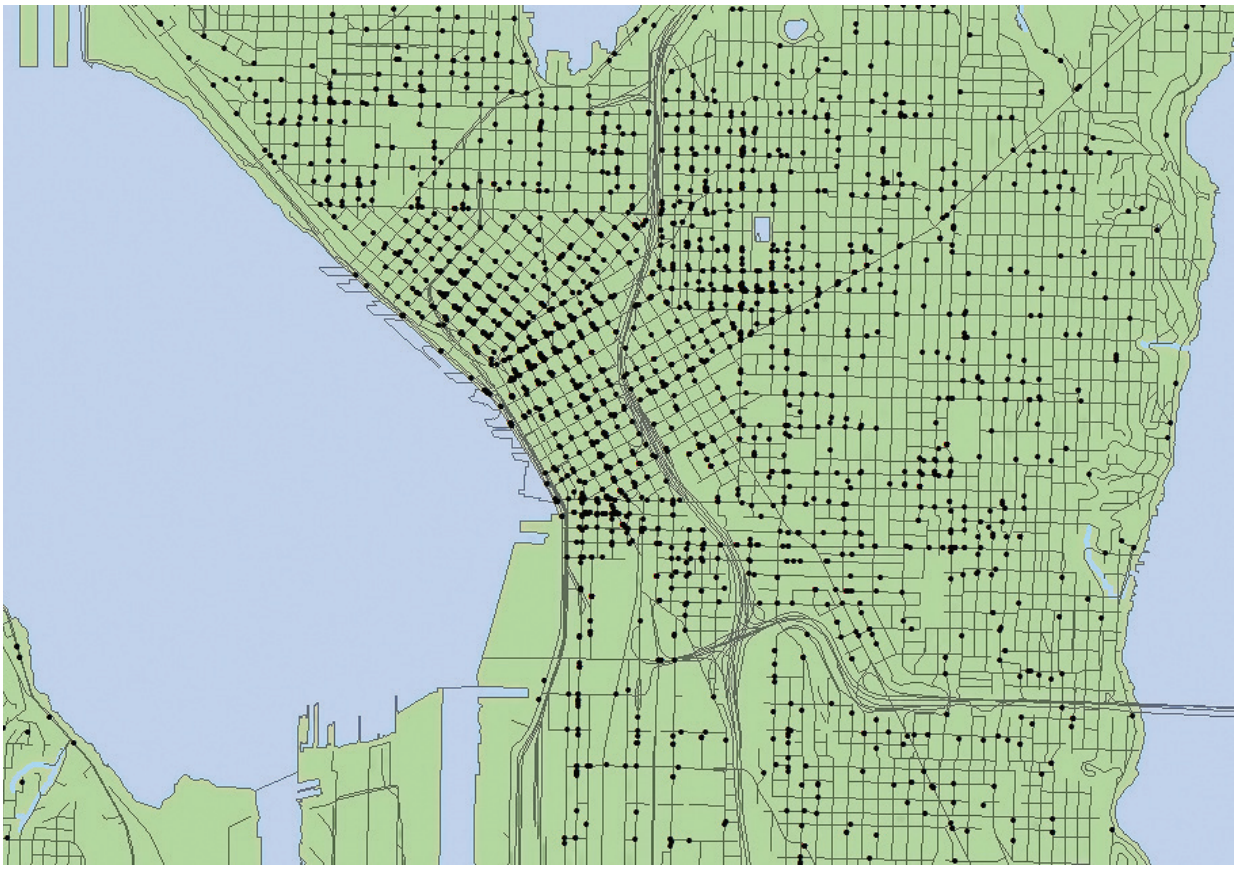



Figure 8. Final map with geocoded points (incidents)



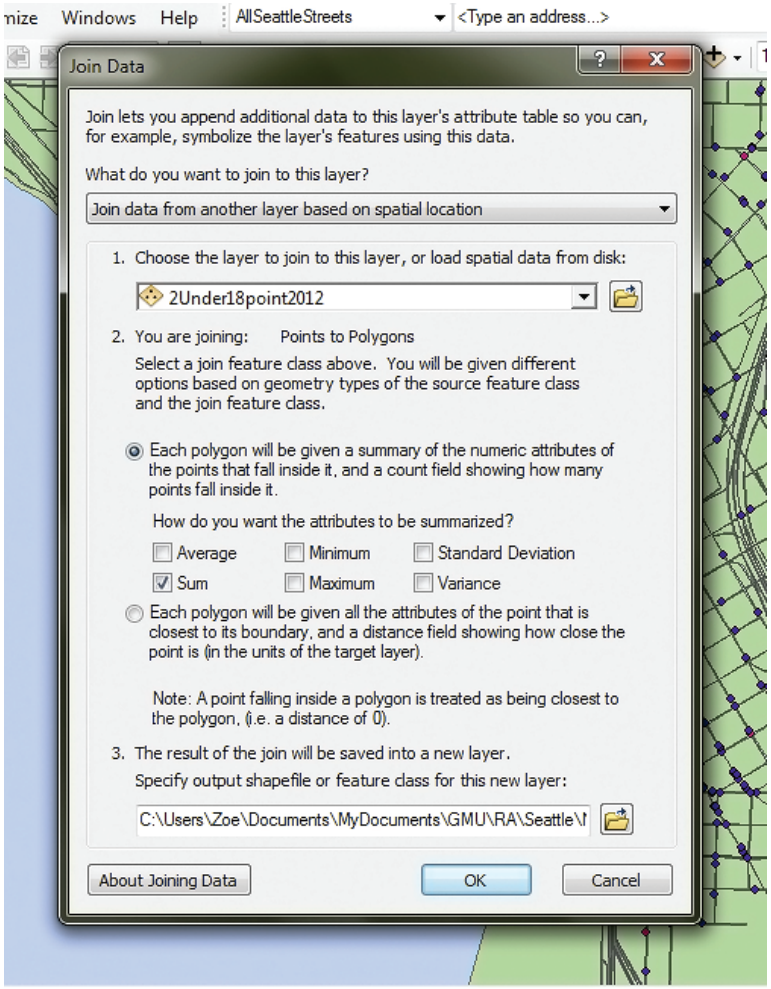
## 4. Join street buffers to points.

This step allows incidents at street segments to be summed, ranked, and coded (e.g., by color) to identify variation in the concentration of crime. Selecting "Sum" in the dialog window in figure 9 will provide a count of the crime incidents falling on a particular street segment. Other statistics (such as average, maximum, and minimum) may be selected as desired.

To join street buffers to points, do the following:

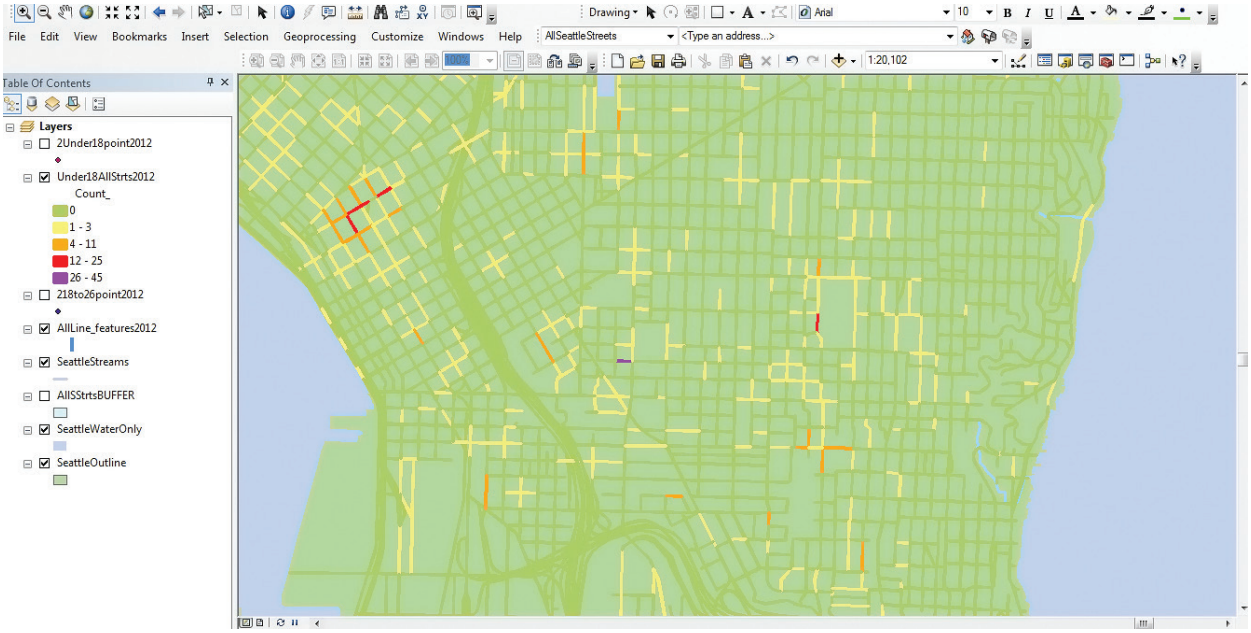
- Right-click on the buffer shapefile (see figure 5) created in step 1 and select Joins and Relates > Join...
- In the "Join Data" dialog window that appears (see figure 9), select "Join data from another layer based on spatial location" from the first dropdown menu.
- Under "1. Choose the layer to join to this layer…," select the point file (incident data) from the dropdown menu. The text beside "2. You are joining…" should automatically detect the join type and change to read "Points to Polygons," but confirm this is correct.
- In the last dropdown menu of the dialog window, save the output file with a predictable name and location.

Figure 9. Spatial join dialog window in ArcGIS



The CEBCP set the joined streets to display the count of juvenile incidents by street according to a five-color scheme (figure 10). The natural breaks (Jenks) method in ArcGIS was used to create the five categories. Using this method, the cut-off point for defining a hot spot varies. Given the relatively small number of incidents in the CEBCP's analysis, the CEBCP further examined street segments in category three or higher.

Figure 10. Street map showing concentrations of juvenile offending




## 5. Join points to street segments.

The CEBCP made a second join from the points back to the streets and their buffers so that Seattle's unique street identifier, "SND_ID," would be assigned to each data point (figures 11 and 12). This identifier allows all events on a particular street segment to be assembled without double-counting incidents at intersections. This step also allows the additional data about the hot spot streets from the Excel file to be extracted.

To create the second join, do the following:

- Right-click on the points (incidents) shapefile (see figure 5) and select Joins and Relates > Join....
- Like in step 4, in the "Join Data" dialog window that appears, select "Join data from another layer based on spatial location" from the first dropdown menu.
- This time, under "1. Choose the layer to join to this layer…," select the buffer shapefile from the dropdown menu (see figure 11).

- In this case, the text beside "2. You are joining…" should automatically read "Polygons to Points." As shown in figure 11, the settings will look different from those in figure 9 because of the different join type. The default settings can be retained here because the geocoding options selected earlier in the process ensure the points fall inside the buffer polygons.
- In the last dropdown menu of the dialog window, save the output file with a predictable name and location.

Figure 11. ArcGIS join dialog for street identifier join

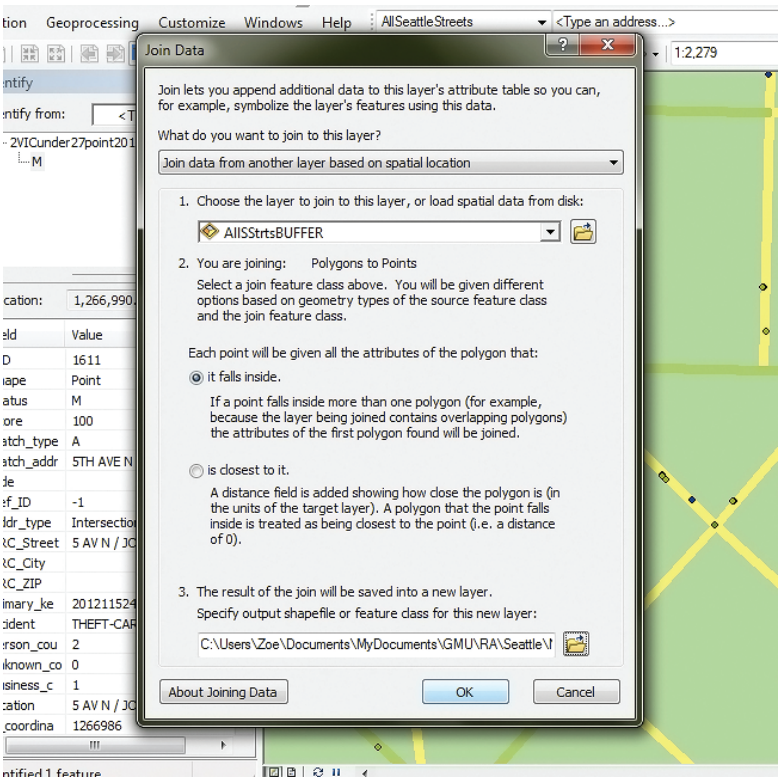
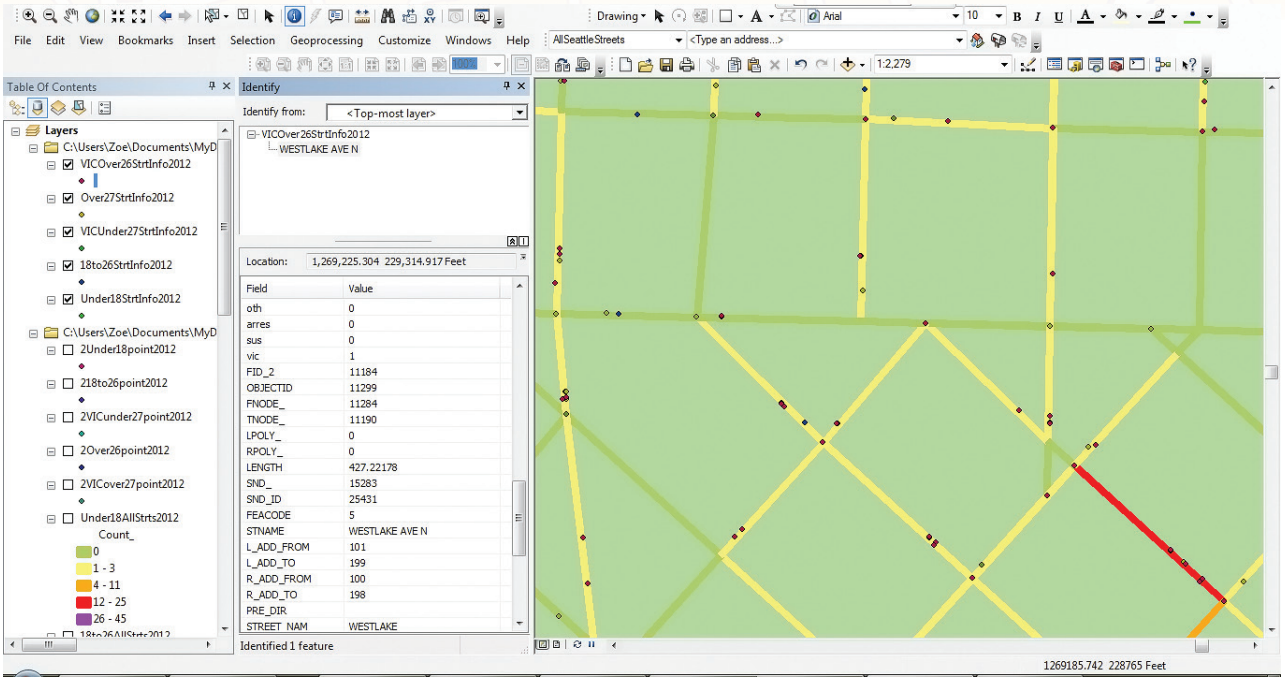


Figure 12. Highlighted data point with street identifier information




The identifier was exported back to Excel to be matched with the CEBCP's dataset (figure 13). Note that in ArcGIS, the export must be done from the table and not the layer. The CEBCP then used a variety of sources to assemble additional information about the hot spot street segments:

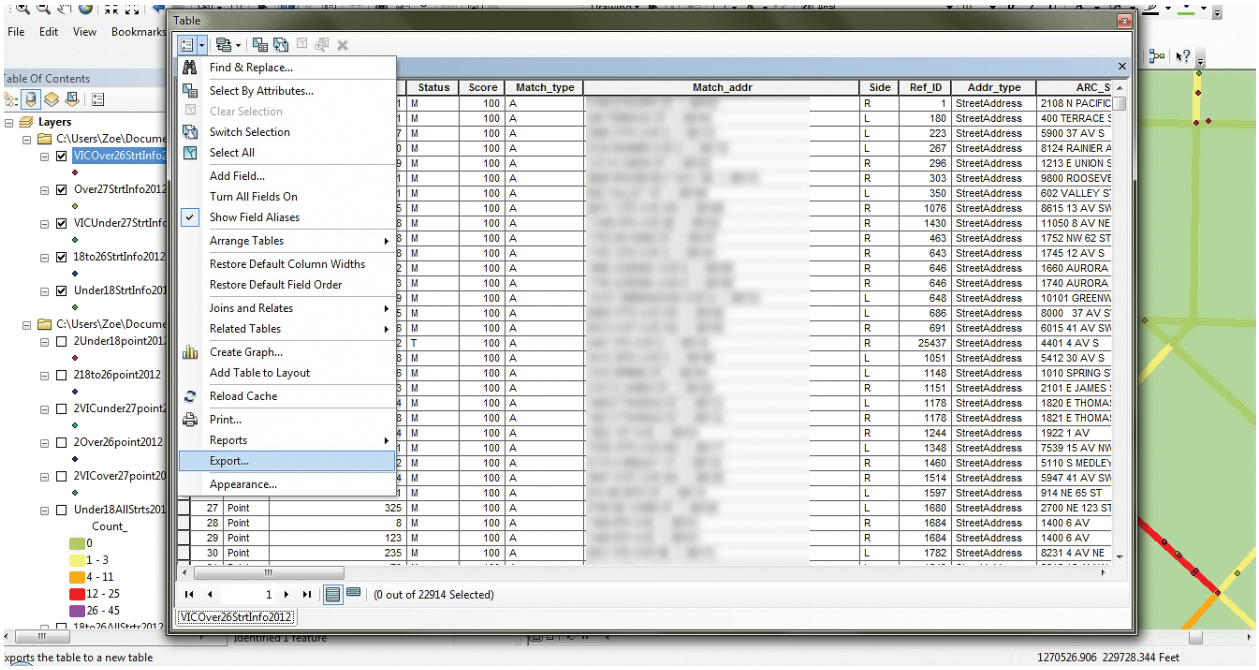
- Tax parcel / land use layers
- Major buildings
- Transit lines and stops
- Bodies of water, such as streams
- Parks
- Schools

To export the identifier back to Excel, do the following:

- Right-click on the joined point layer (in which incidents are joined with the street identifier information) in the "Table of Contents" menu and select "Open Attribute Table."
- Click on the "Table Options" dropdown and select "Export..." to export the list of addresses and their associated variables to an Excel or other spreadsheet/database file for further analysis. It is not necessary to add the table to the map.

As with most functions in ArcGIS, there are several different ways to link the data. An alternative method to joining the street identifier is to select all points contained within a certain distance from a street segment or within a polygon that defines a target area and export them into Excel. However, the advantage of the CEBCP's approach is that the street identifiers allow it to choose a new street segment to examine at any time directly from the Excel file, rather than having to go back to ArcGIS.

Figure 13. Exporting data points and new variables back to Excel




## 6. Visualize and analyze data.

After the data and map layers have been configured, analysts can visually examine maps and analyze data to inform and support operations. The data that corresponds to each hot street block may be analyzed using tables, bar charts, line graphs, and other visual and statistical techniques to reveal patterns in juvenile offending at the location by time of day, day of week, offense type, and so on.

Figure 14 shows a map that focuses on one of the hot street segments identified in the larger map but with additional features about the street visible to inform analysis. In this example, there is an elementary/middle school on one side of the street and a high school on the other, suggesting that numerous young people will converge at this location during school hours. This might provide context to data analysis showing a spike in incidents involving youth between 15:00 and 16:00, indicating that the most efficient time for crime prevention resources to be applied could be in the hours immediately after school, when students may congregate at the marked transit stops or visit the retail stores or community center.

Of course, this analysis only tells where the hot spots are (and at what time), not what an agency should do. A juvenile offending hot spot analysis should be used as part of a collaborative problem-solving approach between the police and community partners that focuses on tailored interventions that address specific risk factors at the place and are in line with research suggesting a potential benefit of focused, community-based approaches for youth.

Figure 14. Enlarged street segment view with additional land use features


## Using the hot spot analysis to inform a problem-solving approach

Analysts and police staff can use data and maps like the examples in figures 1–14 to identify patterns of offending activity and external factors, such as environmental features, that provide clues as to why juvenile offending concentrates at a specific location and how police and community partners might intervene to prevent such offending.

However, hot spot analysis and maps provide only a small part of the full picture of problems at a given location. These initial findings about the location and timing of juvenile offending should be supplemented with additional data from other sources to develop a richer understanding of how best to address the specific problems at the location. What type of offending is most common here—fighting and assaults? Robberies? Theft from retail stores?

In the initial stages of the problem analysis, officers could increase their patrol in the area during hot times and observe how the space is used and how environmental features of the location contribute to problems. For example, the trail in the lower right corner of the map in figure 14 could provide a quick escape route from the schools and stores for individuals involved in offending. Intelligence from specialist police units, such as the gang unit, might be incorporated to learn whether violent crime in the area is related to rivalries between groups or is a result of the pressures of numerous youth converging at the same place at the same time (e.g., after school).

School resource officers, school staff, and business owners or employees could provide deeper insight into juvenile offending problems. Analyzing the patterns of robbery or theft can clearly display the location or time where these offenses are concentrated. However, speaking to or surveying individuals who know these locations may be useful in identifying reasons that these patterns exist. For example, some students may target others to steal cellphones and other electronics. The problem may be particularly acute immediately outside the school when students are being dismissed. Similarly, patterns of shoplifting at convenience and drug stores may also correspond with school locations and dismissal times.

The police department could work with the school district or a local university or research organization to conduct a more formal survey of youth in the area or use data from existing surveys to find out whether young people offend because there are few opportunities for legitimate activities, such as sports or after-school clubs, that alleviate boredom.

In combination with hot spot maps, student survey data or even information informally gleaned from community members can serve as supplemental data sources that provide the crucial detail needed to develop collaborative problem-solving strategies around the issues revealed. This supplemental information also will be critical in identifying possible solutions and tailoring strategies to the features and needs of the place. Based on the two previous examples, police officers could work with community groups and other municipal entities, such as the parks department or public works, to apply situational crime prevention techniques at the trail to reduce its appeal as an escape route. The trail could be closed at certain times of day, or activities or features like public art could be set up there to encourage legitimate use of the path. These modifications have the potential to increase guardianship, deter illegitimate use, or increase the risk of being caught for those who continue to offend.

Surveys might reveal that youth fight or shoplift after school because there is a long wait for the bus and nothing for them to do. The police department could work with community center staff to ensure structured programs are in place to reduce youth hanging out and to alleviate boredom. The department could also communicate information to the school district and transit authority to help them refine the bus schedules while bringing in the gang unit to crack down on known gang-involved individuals who require more of an enforcement-oriented response. Issues relating to youth converging at the same place at the same time could be addressed by the school district, which might investigate staggering release times. Finally, intelligence from surveys and interviews with local stakeholders can help the school district or specific schools to refine their policies around bringing electronic devices to school, or such intelligence could inform police programs to advise and assist store owners with loss prevention methods.

# Summary

Interest in the concentration of crime at place and its implications for targeting police resources at specific hot spots has increased in the last two decades. Hot spot policing and other geographically focused police interventions have a strong evidence-base for effectiveness. This guide aims to advance understanding of how police can be most effective at places where juvenile offending is most likely to occur. Research indicating that young people require a different criminal justice system response from adults suggests a different approach at youth crime hot spots from the traditional arrest- and crackdown-focused strategies that have been studied at hot spots of general crime. Juveniles require a more community oriented response that focuses on problem solving around the social and physical risk factors that promote delinquency at certain places, and responses to juvenile offending require police-community partnerships to ensure that youth are directed into structured, pro-social activities.

This guide is intended for crime analysts who want to assist command and patrol staff in developing community oriented strategies at juvenile offending hot spots. The exact nature of the analysis will vary across different data systems and according to the priorities of the police department and community, but this guide aims to provide ideas for experimenting with different techniques for defining and assessing offenses of interest.

The authors of this guide would stress further that mapping juvenile offending hot spots is just part of the broader analysis process and one step in problem-solving efforts to identify solutions. Mapping provides a robust and objective method to identify hot spots, but determining the underlying dynamics that are contributing to these hot spots requires the collection and coordination of additional analysis and the gathering of intelligence from across the police agency, government partners, and the impacted community. The ultimate goal of this guide is to help promote a more robust evidence-base around juvenile offending hot spots and to help foster further discussion about using community policing and problem-solving approaches to address the unique aspects of juvenile offending.

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# About George Mason University

George Mason University (Mason) is a public, comprehensive, research university established by the Commonwealth of Virginia in the National Capital Region. Mason is an innovative and inclusive academic community committed to creating a more just, free, and prosperous world.

The Department of Criminology, Law and Society (CLS) at Mason seeks to provide a rich educational experience for its students and to generate research and scholarship that informs public policy and criminal justice system practice. At the undergraduate level, the mission of CLS is to provide students with a strong foundation in a liberal arts education through focused study on the justice system, with the goal of encouraging students to go beyond narrow technical topics to grasp the larger role of the criminal justice system in society. At the graduate level, CLS aims to foster the ability to apply academic expertise to real-world justice problems and enable students to become the future generation of leaders in the fields of criminology, and law and society. CLS seeks to translate scholarly research to policy and practice, both within the criminal justice system and in the broader society.

The Center for Evidence-Based Crime Policy (CEBCP), housed within CLS, seeks to make scientific research a key component in decisions about crime and justice policies. The CEBCP carries out this mission by advancing rigorous research studies in criminal justice and criminology through research-practice collaborations, and proactively serving as an informational and translational link to practitioners and the policy community. The CEBCP was founded in 2008 and is the home of *Translational Criminology* magazine.

The CEBCP is committed to Mason's vision—to be a place of consequential research. The CEBCP engages in primary research on criminological and criminal justice issues, evaluations of justice interventions, and studies of knowledge translation. Of special interest to the center are

- using experimental and other rigorous methods to evaluate justice programs;
- a place-based focus on explaining crime and developing criminal justice interventions;
- developing translation tools to improve communication between research and practice;
- building collaboration with practitioners;
- actively seeking avenues to disseminate information to the public.

# About the COPS Office

**The Office of Community Oriented Policing Services (COPS Office)** is the component of the U.S. Department of Justice responsible for advancing the practice of community policing by the nation's state, local, territory, and tribal law enforcement agencies through information and grant resources.

Community policing is a philosophy that promotes organizational strategies that support the systematic use of partnerships and problem-solving techniques, to proactively address the immediate conditions that give rise to public safety issues such as crime, social disorder, and fear of crime.

Rather than simply responding to crimes once they have been committed, community policing concentrates on preventing crime and eliminating the atmosphere of fear it creates. Earning the trust of the community and making those individuals stakeholders in their own safety enables law enforcement to better understand and address both the needs of the community and the factors that contribute to crime.

The COPS Office awards grants to state, local, territory, and tribal law enforcement agencies to hire and train community policing professionals, acquire and deploy cutting-edge crime fighting technologies, and develop and test innovative policing strategies. COPS Office funding also provides training and technical assistance to community members and local government leaders and all levels of law enforcement. The COPS Office has produced and compiled a broad range of information resources that can help law enforcement better address specific crime and operational issues, and help community leaders better understand how to work cooperatively with their law enforcement agency to reduce crime.

- Since 1994, the COPS Office has invested more than $14 billion to add community policing officers to the nation's streets, enhance crime fighting technology, support crime prevention initiatives, and provide training and technical assistance to help advance community policing.
- To date, the COPS Office has funded approximately 125,000 additional officers to more than 13,000 of the nation's 18,000 law enforcement agencies across the country in small and large jurisdictions alike.
- Nearly 700,000 law enforcement personnel, community members, and government leaders have been trained through COPS Office-funded training organizations.
- To date, the COPS Office has distributed more than 8.57 million topic-specific publications, training curricula, white papers, and resource CDs.

COPS Office resources, covering a wide breadth of community policing topics—from school and campus safety to gang violence—are available, at no cost, through its online Resource Center at www.cops.usdoj.gov. This easy-to-navigate website is also the grant application portal, providing access to online application forms.

For nearly two decades, the COPS Office has been promoting community policing and problem solving as adaptable approaches to address various types of crime and disorder. A common theme across these approaches is that strategies informed by community policing should be leveraged whenever possible to promote approaches that support prevention efforts over those that promote strict enforcement and formal processing of low-level offenders. These principles are particularly relevant to juvenile offending. In this publication, researchers from George Mason University's Center for Evidence-Based Crime Policy illustrate in concrete and practical terms how emerging practices of hot spot policing can be specifically applied to juvenile offending. This innovative guide breaks new ground by providing technical guidance to assist crime analysts seeking to produce juvenile hot spot maps. It also provides insights about place-based interventions that can be targeted to prevent juvenile offending at micro-hot spots: specific street blocks and intersections found to have elevated levels of juvenile offending.

COPS
Community Oriented Policing Services
U.S. Department of Justice

U.S. Department of Justice
Office of Community Oriented Policing Services
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Washington, DC 20530

To obtain details on COPS Office programs,
call the COPS Office Response Center at 800-421-6770.

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ISBN: 978-1-932582-98-7
e051427644
Published 2015