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Districting and Resource Allocation: A Question of Balance

By Christopher Bruce
President, International Association of Crime Analysts
Danvers, Massachusetts

Early in my crime analysis career, I was introduced to the “Bud-Shell Method” of creating police districts. I believe the term was coined by Dr. William Stenzel of Northwestern University, and it describes a police administrator who sits down one night with a “six pack of Budweiser and a Shell station road map” and uses a magic marker to draw lines down major streets. If you have a major east-west artery and a major north-south artery—*voilà!*—you have four districts! Never mind that one contains mostly upper-class residential housing and another contains a hospital, a high school, and a methadone clinic.

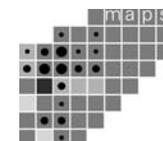
It would probably be too much to say that the “Bud-Shell Method” was the predominant method of districting during the first 90 percent of the 20th century—I think that most police agencies tried for some kind of geographic or workload balance—but until the advent of affordable desktop geographic information system (GIS) software, the task was too difficult to accomplish any other way. In a 1977 publication, *Crime Analysis in Support of Patrol*, the authors discuss “sophisticated approaches based on mathematical techniques [that] have been attempted to provide more realistic distributions of patrol forces,” but conclude that “there is no evidence in the literature that they have actually been implemented in any police department,” and fault, in part, the limitations of existing computer programs (pp. 13–14).

Early resource allocation models focused on achieving a balance between calls for service and geographic area. Police administrators wanted to ensure that each patrol division had a relatively equal workload and could meet the agency’s response-time goals. But even early publications saw flaws in using calls for service as a measure of workload. “The demand for patrol services has been commonly assessed in terms of raw counts of incidents,” wrote G. Hobart Reinier. “However, for incident and manpower analysis,” he noted, “it is not how many but rather how much time is demanded for various levels of service” (Reinier et al., 1977, pp. 4-15–4-18). But computer-aided dispatch systems of the time could not make these calculations. Although some police agencies commissioned and implemented expensive and complicated allocation systems, the theory of the era generally surpassed the technology.

As GIS and other computer systems improved, “operations analysis”—the analysis of internal operations as a way of allocating police resources more effectively—began to achieve a higher status in crime analysis literature. At the same time, analysts began making recommendations for temporal and geographic allocation of patrol resources.

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As an observer of the field for the last 15 years, I think that the majority of analysts have not internalized this role. Most of the literature on operations analysis has taken the form of case studies, and the profession still awaits a comprehensive, authoritative operations analysis text. Even training on the subject is rare. Hence, when analysts have set out to create allocation plans, they generally have invented their own formulas and processes, with varying degrees of success. Meanwhile, modern GIS systems and databases are sitting out there, waiting for us to use them. Today, the technology has surpassed the theory.

In Danvers, Massachusetts, the need for redistricting has become alarmingly apparent during the last 4 years. Continued commercial and residential development in one of our four patrol areas has resulted in an imbalanced workload. Area 1 officers have little to do for most of their shifts, while Area 4 officers have overwhelming workloads (see table).

- Should a supervisor’s time count?
- Should time spent by officers who technically are off duty on road details or private work count?
- Should time spent by mutual-aid units (i.e., cars brought from other cities) count?

To create more balanced officer workloads, I answered these questions and tried to create new districts that balanced total calls, call hours, and geographic area. These tasks cannot be completed mathematically because towns have natural divides like rivers, highways, and forests that put limitations on how commanders can redistrict.

Districts should be shaped so that officers can travel easily from one end of the district to the other. The shape should be sensible, and officers should be able to memorize the district’s boundaries and roads so they know where they are located when they are on patrol. Some important questions to consider during this process include these:

Danvers Police Workloads for Calendar Year 2007

	Area 1	Area 2	Area 3	Area 4
Calls for Service	21 percent	27 percent	23 percent	29 percent
Call Hours	19 percent	25 percent	22 percent	34 percent

Creating even basic statistics like these can involve answering a host of questions, such as the following:

- Should officer-initiated activities (e.g., motor vehicle stops, field interviews) be calculated as part of the service total?
- What about directed patrols and selective enforcement assignments?
- Should I exclude calls for service to the police department itself?
- If an incident occurred in a different area than the one the call came from, toward which area should it count? Should we count it at all?
- Should we weight calls for service so that certain types of calls count more?
- Should call-for-service hours account for the total time of everyone who responded to each call, or just the patrol car from that area?

- Should we divide hot spots among all districts or try to keep them within one district?
- Should boundaries go down the middle of major streets, or is it better to create them through backyards and open land?
- How important is neighborhood integrity?

If an agency lacks the funds to purchase a comprehensive computer model, redistricting can become a lengthy process that involves testing, adjusting, and retesting before the ideal districting plan emerges.

In Tucson, Arizona, Crime Analyst Autumn Kistler went through the same process, but adopted a more scientific approach than I did, developing a model that assigns varying importance to total hours, call priority, street length, geographic area, population, and response times. In “Tucson Police Officers Redraw Division Boundaries to Balance Their

Workload,” she discusses how she developed and implemented this model, which created a balanced distribution in her city. Phil Mielke’s tips on using ArcGIS’s redistricting tool will help analysts who want to achieve the same success in their own agencies.

While Autumn and I struggle with assigning districts, new technologies are challenging the concept of “districting” in the first place. In “Tactical Deployment: The Next Great Paradigm Shift in Law Enforcement?” Chief John Douglass of the Overland Park Police Department discusses how some agencies now use tactical deployment points, which

have transcended the concept of districts—dispatches are simply based on the closest unit, as determined by automatic vehicle location (AVL). East Orange, New Jersey, Crime Analyst Allison Mayer talks about further uses of an AVL tool in tactical and strategic deployment.

Only time will tell if AVL will eventually render the concept of districts obsolete, but one thing is certain: between GIS and AVL, the typical police department does not make the most of the available technology. The tools of operations analysis have matured. Let’s make sure the science follows.

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Tucson Police Officers Redraw Division Boundaries to Balance Their Workload

Autumn Kistler
Tucson Police Department
Tucson, Arizona

When Tucson, Arizona, officers’ workloads got out of whack, commanders decided to redraw the division boundaries.

The city of Tucson holds more than 500,000 people and covers more than 200 square miles. Police work was originally divided into five operational divisions that varied in size and workload. But uneven urban growth within each division created an unbalanced workload for officers, leading to an imbalance in staffing, morale problems, and span-of-control issues. So in late 2005, Tucson Police Department (TPD) commanders began to redesign division boundaries to equalize the workload.

Assessing the Workload Problem

Before beginning the project, the TPD examined its management strategies to assess whether different management practices could help resolve the problem. They examined the following concerns:

- Whether officers in all divisions were held accountable for productivity in field interviews, traffic stops, traffic citations, and primary-to-backup ratios.¹

- Whether all divisions followed the same procedures (e.g., if calls are cleared after paperwork is complete, workload will appear higher than if they are cleared after the officer leaves the scene.)

After assessing management strategies, staff examined what factors contribute to workload and developed a system to weigh factors and help with appropriate redistricting. A survey of existing literature on law enforcement redistricting showed that total hours worked, including all time assigned to a call from dispatch to clearance, provides the best measure of workload. Several other factors contribute to workload to a lesser degree. Total hours worked was given a weight of 75 percent, and the other factors were weighted as follows:

- Number of call responses (10 percent).
- Average response time (7 percent).
- Total length of all streets within the division (3 percent).
- Area (square miles) of the division (3 percent).
- Population (from the 2000 census) (2 percent).

Using Software to Create New Division Boundaries

TPD staff used a redistricting software program called Geobalance,² in coordination with geographic information systems (GIS), to redraw boundary lines.

Creating Redistricting Cells

Using Geobalance software involves breaking the city down into cells that can be consolidated into divisions. Cells should be:

- Bordered by logical boundaries (streets, alleys, rivers, etc.).
- Large enough to contain meaningful data (e.g., hot spot locations, bar locations).
- Small enough that they can be combined in different ways to form divisions.

The TPD used GIS mapping files, called shapefiles, to divide Tucson into numbered grid squares one-quarter of a square mile in size. Because most of the city’s streets are laid out on this grid, this was a natural fit.

Populating the Cells with Data

Staff then populated the cells with workload data for a full calendar year's worth of calls.

An analyst determined the response time and total hours worked for each call, using SAS software. The software, which is designed for data mining, determined the time from the officer's arrival on the scene to the officer's clearance of the scene,³ and returned a total count of hours spent on each call.

An analyst used Environmental Systems Research Institute's ArcMap software to create a map of calls for service based on the latitude and longitude recorded for each call. She added the redistricting cells to the map and used the "spatial join" function to append the cell number where each call occurred to the call's record.

She used the same process to assign cell numbers to street network segments and census blocks where the call occurred to the call's record. The analyst used ArcMap's "summarize" function for each shapefile to calculate totals for each of the six parameters (i.e., total hours worked, average response time, etc.) (see example in Figure 1). She then used the "attribute join" function to attach summary tables to the cell's shapefile. This created a shapefile for the entire cell with six overall summary tables corresponding to the six parameters.⁴

Populating cells with data can be the most difficult step of the redistricting process—the procedure is time-consuming and may require a fair amount of trial and error. The "join" and "summarize" procedures within ArcMap software produce many new files. Each file must be named separately to prevent confusion. Use a naming convention and keep a log with the name of each file, how it was created, and what it includes.

Designing New Boundary Divisions

After all the data were added to a master redistricting cell shapefile, the analyst put the master file into Geobalance, specified the six elements of data the software should read (each contributing factor), and assigned each a weight based on the percentage it contributes to an officer's overall workload (described above).

Geobalance allows the user to assign each cell on a map to a different division (see Figure 2). The software recalculates officers' workloads each time a cell is added to a division. It produces running totals for the divisions, allowing the user to see immediately how moving cells from one division to another affects officer workload.

Initially, the analyst assigned cells to the current division boundaries, creating a model to compare with new scenarios. She then created 12 new division scenarios with differing boundaries and team configurations.

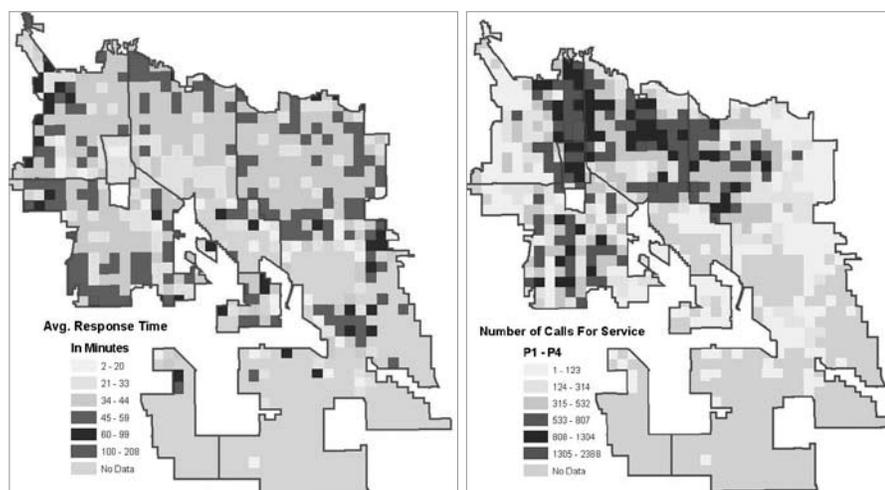


Figure 1. Redistricting grid cells that include data. The categories shown on the maps are for visual display only and were not used in the analysis.

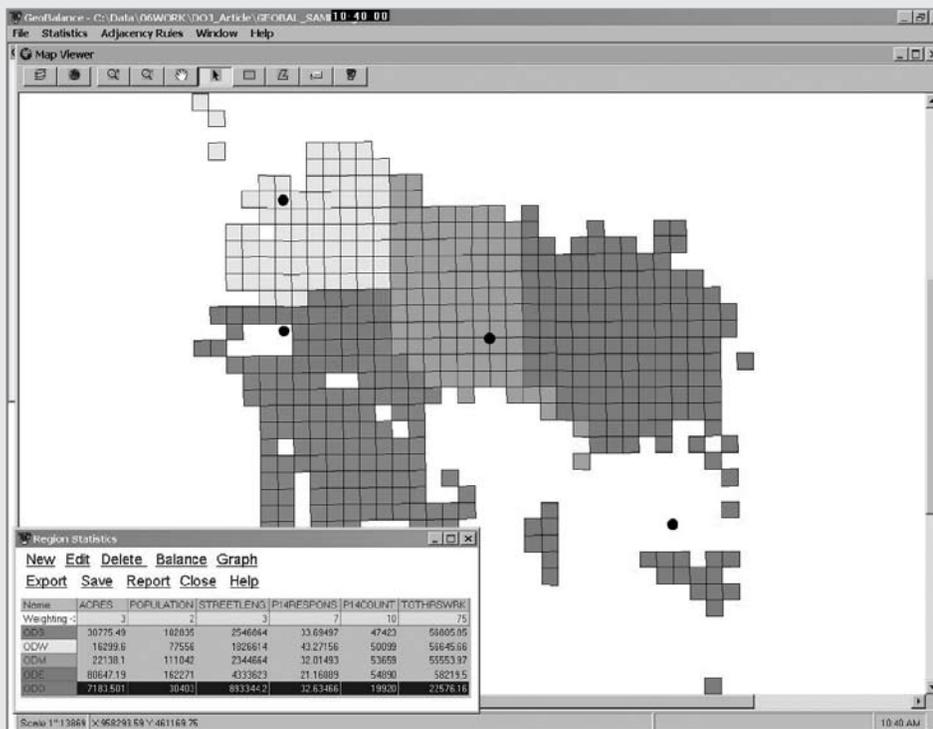


Figure 2. A screenshot of the Geobalance software shows how cells can be allocated to divisions

Creating new scenarios. The challenge of redesigning division boundaries is to create divisions that have both comparable workloads and acceptable, logical boundaries. All cities have characteristics that affect where division boundaries can go. For example, most cities have areas with particularly high call loads, fast population growth, or limited access.⁵

For Tucson, some additional considerations included the boundaries of gang territories,

city council wards, neighborhood associations, and the Davis-Monthan Air Force Base. The TPD also wished to keep the divisions compact to minimize travel time and to prevent establishing boundary divisions that would frustrate patrol officers.

Narrowing the list. Command staff analyzed the options available and narrowed the list to four designs (see Figure 3). An analyst created a mapping file for each and regenerated the six data parameters for those

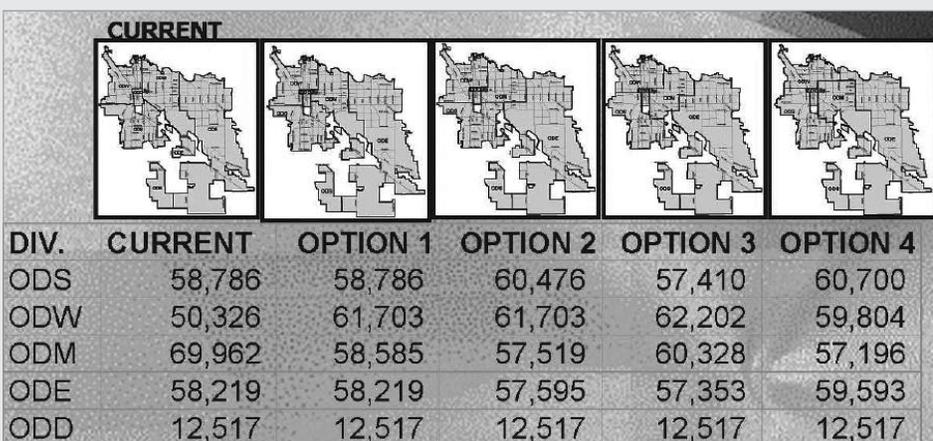


Figure 3. A sample of the data that the analyst presented to the commanders, which allowed them to choose from among the four final options.

files without using the redistricting cells. This refined the data and made them easier to understand. The commanders then made their final selection.

Implementing the New Divisions

After the final design for the new divisions was chosen, the TPD planned implementation. This involved doing the following:

- Reallocating sergeants, patrol officers, and vehicles.
- Making modifications to the TPD's computer-aided dispatching and record management systems.

The morning of the implementation date passed seamlessly and without incident.

For a year afterwards, the TPD evaluated call load and hours worked in each patrol division on a monthly basis. The divisions maintained workload ratios that were almost identical to those projected during the redistricting study, never fluctuating more than 3 percent. To date, these division boundaries have been successful in balancing team workload and ensuring efficient and effective law enforcement.

Notes

¹This ratio describes the rate a primary officer is on call compared to a backup officer.

²For more information, see www.coronasolutions.com/products/geobalance-features.shtml.

³Clearance of the scene is the point at which the officer is finished processing the scene (i.e., is no longer at the scene and has finished filing all reports).

⁴TPD used shapefiles of streets, census data, grid cells, and calls for service. These shapefiles were already maintained locally. If law enforcement agencies do not have mapping files, they should check with other local agencies, such as transportation and planning offices, to find out if such files are available. If not, the agency should build extra time into the redistricting study. If the skills to create the shapefiles are not available in house, the agency may need to contract with an outside provider.

⁵For instance, rural communities where officers have limited access to roads in winter weather.

Tactical Deployment: The Next Great Paradigm Shift in Law Enforcement?

John Douglass
Overland Park Police Department
Overland Park, Kansas

Overview

Before World War II, car radios—available to some of the larger law enforcement organizations—experienced limited use nationwide. Telephones were the communication technology of choice. Call boxes in major cities formed the functional communication network of their time, and beat officers were strategically placed to take advantage of these stationary communication devices.

Following the technological breakthroughs of the war, municipal law enforcement in the United States tentatively began to embrace the use of portable and transient radios in their day-to-day activities, though it would take nearly a decade to filter down to most police departments.

Despite this evolution in police communications, the advent of the radio in the mobile environment would be structured for many years around the fixed-grid structure of deployment, most notably the police district. This method of deployment stemmed from certain erroneous beliefs such as these:

- Given enough previous information, workloads and calls for service could be structured into efficient and dynamic police districts.
- Assigning these police districts would guarantee that the closest car got the call.
- Officers assigned to specific districts would become familiar with those who lived, worked, and shopped in their districts and, thus, would be best-suited to fight crime in these areas.

Unfortunately, this blueprint for service deployment proved to be unworkable in practice. Any officer with more than a year of experience knows that within the first half-hour of reporting for duty the call-for-service carousel begins. You leave your district to answer a call in another district; while you are gone, another officer from another district

is sent to answer a call in your assigned area. And so it begins, one call leading to another until, shortly, no officers are close to their assignments.

For most of my career, districts were created or re-created every 2 or 3 years. We prided ourselves on doing sophisticated call-load analysis to frame the exact boundaries of that district, assuming that we would get the most efficient productivity as a result. We failed to take into consideration, however, that crime and criminals move rapidly from one opportunity to another. Consequently, our system of service delivery proved inadequate in tackling the day-to-day criminal activities and public safety needs of the people within our districts.

The Turning Point: Desert Storm Brings Change

The tactics and technologies employed in Operation Desert Storm and the use of the smart bomb and Global Positioning System (GPS) munitions changed the way we looked at service delivery; the military had begun using sensors and geological information to identify and target specific bomb sites. Law enforcement faced a parallel problem: we needed to use the maximum resources needed to tackle a problem swiftly and effectively without wasting resources.

It became apparent that information systems could also be used to enhance police service delivery.

Though this idea was not entirely new, we previously lacked the technology to make it happen. With the advancement of computer-aided dispatch (CAD) and record management systems (RMS) however, officers began to perform sophisticated strategic and tactical crime analysis. This kind of analysis provides real-time information, which allows law enforcement to virtually locate crimes as they occur and respond with the resources necessary to make a difference.

Overland Park, Kansas: Real-Time Policing in Action

The transition from dispatch model to incident-command model using hot-spot-based technology was relatively simple in Overland Park.

We started with a comprehensive CompStat-like program called ABSTRAT¹ and leveraged the expertise of our extremely competent Crime Analysis Unit to develop tactical-level information and analysis for operations and watch commanders, sergeants, and officers. This information is delivered to them on a nearly real-time basis—less than 24 hours after a crime occurs.

Next, we replaced the traditional district model with three sectors, each with a sergeant and corresponding staff. Equipped with the crime analysis information, the sergeants, operations commanders, and watch commanders make specific resource assignments to the sector where the crime is occurring.

Finally, operations commanders were moved from their offices in administration to a front-row seat in dispatch, from which they could direct all department operations in real time.

Interestingly, this hot-spot-based use of technology in law enforcement became common in multiple areas of the country almost simultaneously. This most likely occurred because we all watched the same strategies being employed successfully by the military and had access to the same tools.

The Future of Tactical Deployment

The use of geographic information systems to guide patrol efforts is only 6 or 7 years old at most, and most initiatives are still being defined and structured. As with most change, the transition has not been easy, and officers are still adjusting to this new format. Nonetheless, preliminary results are encouraging.

There are numerous stories of improved apprehension opportunities nationwide and the occasional account of how law enforcement has been able to predict

and prevent a crime with the help of this technology. This, however, is just the beginning.

At Overland Park, plans include the creation of a desktop application that would allow a patrol sergeant to view the hot spots identified by our crime analysis unit and use the application's "drag-and-drop" function to deploy patrol units to these areas. These deployments could change from place to place and hour to hour based on the volume of criminal activity. As a result, a patrol officer could be assigned to any number of deployments throughout his or her shift.

Additionally, the crime analysis unit will have the capability to retrieve information on a given deployment using data from our CAD, RMS, and GPS systems. This information would include the amount of time an officer was within his or her deployment area, the number of calls for service answered, the number of citizen contacts made, the number of reports written, all field contacts recorded, the number of traffic citations issued, the

After analyzing these data, the crime analysis unit will adjust or redefine hot spot areas as needed to target criminal activity better. Overland Park's crime-analysis-supported enforcement deployment strategies are presented at weekly meetings where appropriate response strategies are developed, discussed, and assigned. It is of great importance that the Crime Analysis Unit's research and recommended deployment opportunities receive high priority during these sessions.

Although long-term statistical analysis of the new deployment techniques may not be possible for another decade, one thing is for certain—the paradigm has shifted and an increasing number of law enforcement agencies across the nation are turning to geographic analysis and advanced technology to make decisions about how best to use police resources to fight problems as they occur. There will be no turning back, and it is essential to apply the necessary resources to make tactical deployment a success.



Figure 1. Captain Bruce Veatch, Operations Commander, directs the department's tactical operations.

number of arrests made, and any other action the officer took that might have had an impact on the problem. The officers will also be able to enter comments pertaining to a particular assignment—including observations made, actions taken, and any recommendations—directly into the deployment application.

Notes

¹ABSTRAT (Accountability Based Strategic Deployment) is Overland Park's version of CompStat. CompStat was founded in 1994 by New York Police Commissioner William Bratton. The primary focus of both programs is to provide timely, accurate, and useful intelligence information to the officers on the street and to follow that information with an accountability process to track success.

Geospatial Technology Helps East Orange Crack Down on Crime

Allison Mayer
East Orange Police Department
East Orange, New Jersey

East Orange, New Jersey, has become a national leader in reducing crime. Its success may come as a surprise—East Orange was named one of the “urban 15” cities in New Jersey that historically account for one-third of the state’s criminal activity. Recent policing strategies reduced criminal incidents from nearly 7,300 serious crimes in 2003 to only 3,200 in 2008, a rate the city had not seen in more than 25 years. The success is due largely to the use of a geographical technology called the Tactical Automatic Vehicle Locator (TAC–AVL).

Like many police departments, East Orange employed a traditional, reactive policing approach when dealing with gang and drug violence and quality-of-life problems. But with the staggering crime statistics observed in 2003, the department knew that it had to revise its strategies. It began to operate proactively rather than reactively and started using policing technologies like TAC–AVL.

TAC–AVL has been a successful and reliable initiative. It is a real-time Geographic Positioning System (GPS) tool that allows commanders to see their crime-prevention plans working at any time of day, at any location in the city. It provides commanders with a real-time map of the city and displays all patrol car locations, which allows commanders to check whether vehicles are at the appropriate place at the appropriate time. It also has a playback feature, which allows officers to learn from their mistakes and compile a series of best practices. TAC–AVL is accessible on all computers at department headquarters and in supervisors’ cars, so that activity in the city can be monitored instantaneously at all times.

Becoming a Proactive Force

In an effort to reduce crime and to police proactively, the East Orange Police Department

reorganized its command structure in 2006. One important change involved the way neighborhoods were patrolled.

In the past, if an incident happened in a police zone,¹ a car in the area would respond and others in neighboring areas would provide backup. This is called “pulling” because deployment “pulled” the backup cars outside their areas of responsibility. This method can create problems because a car responding to a backup call may get a call for service in its own zone. As a result, that vacant zone may have to “pull” another car from a nearby zone, which creates a domino effect—when a car leaves its zone, the area becomes more susceptible to criminal incidents.

In response to this conundrum, East Orange created a set of Impact,² Resource,³ Response⁴ and Conditions⁵ cars. These cars are not assigned to patrol a specific zone; they remain at a home base and respond to backup calls. These units are then “pushed” into the neighborhoods that need them—as backup, or as a first responder to a call while the primary zone car is at another call.

“Pushing” has a number of positive effects:

- It ensures zone integrity.⁶
- It alleviates call “stacking” (i.e., where one car answers call after call).
- It decreases response time.
- It increases officer effectiveness.⁷
- It decreases officer stress and fatigue.

Depending on the shift (i.e., midnight, day, or evening tour) the number of supplemental units can fluctuate based on the typical number of calls for service at that time. Each car responds to certain priorities of calls for service.⁹ With this constant coverage, no zone is ever left vulnerable to an influx of crime because of the absence of patrol units.

TAC–AVL lets dispatchers, commanders, and decision-makers ensure that “pushing” occurs into an area. If an area has no uniformed police support, a nearby supplemental patrol unit can be sent into the zone immediately for coverage. As a result, the response time for calls decreases and the efficiency of the dispatch center increases.



Figure 1. An aerial display in TAC-AVL, which has a zooming feature that shows the location of a patrol car and what type of call it is responding to.

Using TAC-AVL to Enhance Crime Prevention

Commanding officers can use TAC-AVL to ensure that their weekly and daily tactical crime plans are in conjunction with the current crime problem and that they are followed.

For example, a commander may want to increase police presence on the north side of the city because of an influx of car break-ins. From her in-car computer (or mobile data terminal [MDT]), a supervisor can access TAC-AVL to see the following:

- What type of call an officer is on.
- How long the officer has been on the call.
- The result of the call.
- If nearby zones are understaffed.

If nearby zones are understaffed, the commanding officer can send an Impact, Resource, Response, or Conditions car to the area, shaping patrol plan outcomes on the fly.

Discovering Best Practices

Commanding officers can use TAC-AVL's playback feature to discover best practices and learn from their mistakes. TAC-AVL is often used during CompStat meetings to view a specific incident. By selecting a certain call, commanders can see where every AVL-enabled unit throughout the city was at the time of the incident, the officer's response to the problem, and whether a commander should have altered the response efforts.

For instance, if three car break-ins occur in the same neighborhood in 15 minutes, commanders can query the TAC-AVL to find the location of the officer in the corresponding zone. The result could answer why the break-ins happened or raise new questions, such as: Was the officer on another call? Was the Conditions car on the opposite side of the neighborhood? Did these decisions have a negative impact on the entire neighborhood's situation? Was the response taken the best course of action? Questions like these and the answers that come out help shape outcomes and form a series of best practices that officers can replicate.

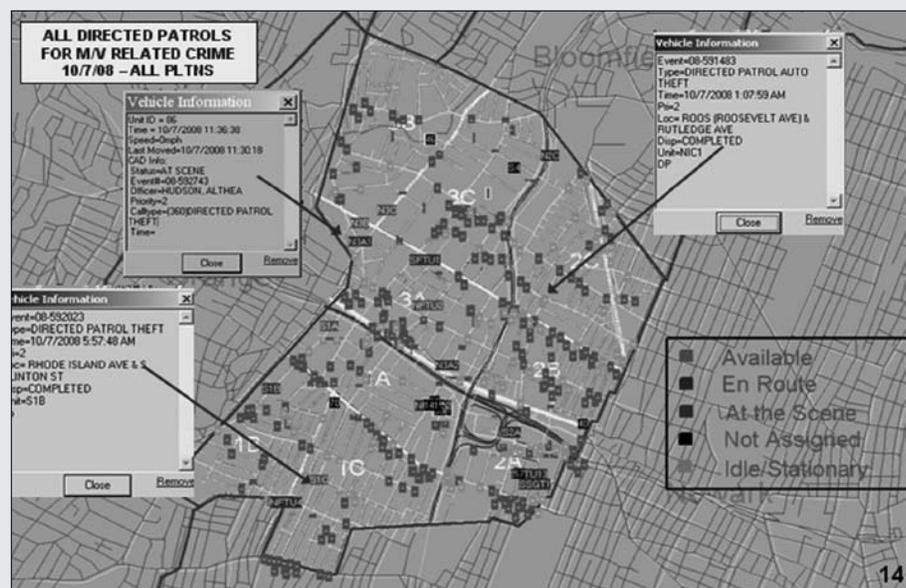


Figure 2. This map displays all directed patrol cars targeting motor vehicle crimes in a single day. By clicking on a patrol car, commanders can view the officers' actions and determine whether the unit is available. The legend on the bottom right indicates the status of all units in service.

A 2-hour playback feature allows officers to view all patrol car activity 2 hours before and after an incident of interest. Activities are color coded so that officers can easily recognize whether they took place before or after the incident under review. If units were not near the crime scene during this time, platoon commanders must review and address the issue. Any outstanding issues must be addressed at daily roll calls, so that officers learn that they must be in crime-prone areas at hot times to prevent crime.

Ultimately, TAC-AVL allows police commanders to monitor patrol cars and make immediate adjustments to their day-to-day strategies based on the situations that arise. If they make mistakes or find they are successful, they can review their decisions and choose whether to incorporate their ideas into future strategies. In East Orange, the use of TAC-AVL has been a prominent factor in reducing the city's crime rates. And commanders are touting the results. "By using TAC-AVL," says Sergeant Chris DeHagara, "I have a quick and effective way of finding out what my officers are doing and where. Gone are the days where I find out what my troops did after their shift. Now I have a real-time tool that tells me everything I need to know at the click of a mouse and allows me to shift resources when needed!"

Notes

¹East Orange has nine police zones (i.e., districts), and one patrol car (zone car) is responsible for each.

²Impact cars perform typical patrol duties such as answering calls for service, conducting crime-prevention-directed patrols, addressing quality-of-life concerns, and addressing traffic issues. They respond only to priority 1, 2, and 3 calls for service.

³Resource cars respond to priority 1 or 2 calls for service when a zone car is unavailable, and back up zone cars in addition to conducting crime-prevention-directed patrols.

⁴Response cars supplement Resource cars when crime or quality-of-life concerns require additional resources. They respond only to priority 1 calls for service when zone cars are unavailable and they back up zone cars.

⁵Officers in Conditions cars perform duties in civilian attire and focus on crime-prevention-directed patrols.

They also respond to priority 1 calls for service when zone cars are unavailable.

⁶Zone integrity is when a police unit (car) remains in its zone of responsibility. This enhances the officer's familiarity with the residents and crime issues within the zone. It also allows officers to maintain responsibility for their zone—officers will not let anything occur in their zone because they are the ones held solely responsible for it.

⁷By having supplemental patrol cars in a police zone, the zone officer has more time for proactive policing.

⁸Impact, Resource, Response, and Conditions cars are referred to as supplemental units.

⁹Calls for service are calls made from a person or agency to police headquarters requesting police response. Priority levels alter based on the level or urgency (i.e., shooting [priority 1] versus an animal-control complaint [a lower level priority]).

Using ESRI's Districting Tool in Policing

Philip Mielke
Redlands Police Department
Redlands, California

Environmental Systems Research Institute's (ESRI) districting tool¹ is a free extension for ESRI's ArcGIS Desktop that allows analysts to create new police districts in a city or region. The redistricting tool initially was designed to help governments draw congressional district lines or create school districts, but has been co-opted to help police departments outline new beats. It helps them draw boundaries and review the outcomes (e.g., predict new workloads and crime rates) for the new districts. The tool provides summary statistics for every boundary selection. It does not automatically create districts from preexisting data; rather, it can be used to aid police communication and make geographic information systems (GIS) a central part of the redistricting process.

Preparing the Data

The ESRI districting tool requires an agency to have GIS data entered as a polygon feature class² with attribute data. These polygons must be smaller than the intended districts. Analysts should use polygons that coincide with naturally occurring boundaries and main thoroughfares.

Police departments must divide a city or region into discrete boundaries to balance service and distribute responsibilities into organizational

branches. This task requires departments to join years of incident data (the point feature class) to the chosen polygon feature class. This helps ensure that a proportional number of incidents is allotted to each geographic region.

The process of joining incident data to polygons in ArcGIS to achieve a count of incidents in each region is the same process that an analyst would use to create a choropleth³ map that depicts different incident counts. To join incident data to a polygon feature class, an analyst should do the following:

1. Right-click the polygon layer, hover over "Joins and Relates," and click "Join."
2. In the following dialog box (Figure 1), select "Join data from another layer based on spatial location."
3. If the project contains the incident data that should be joined to the polygon, use the dropdown menu to choose that layer. If not, load the incident data by selecting the  button. This join will produce a field in the polygon layer with a count of incidents within each polygon.
4. Do not check any summarization boxes.
5. Using join produces a new feature class. Specify where it should be saved.

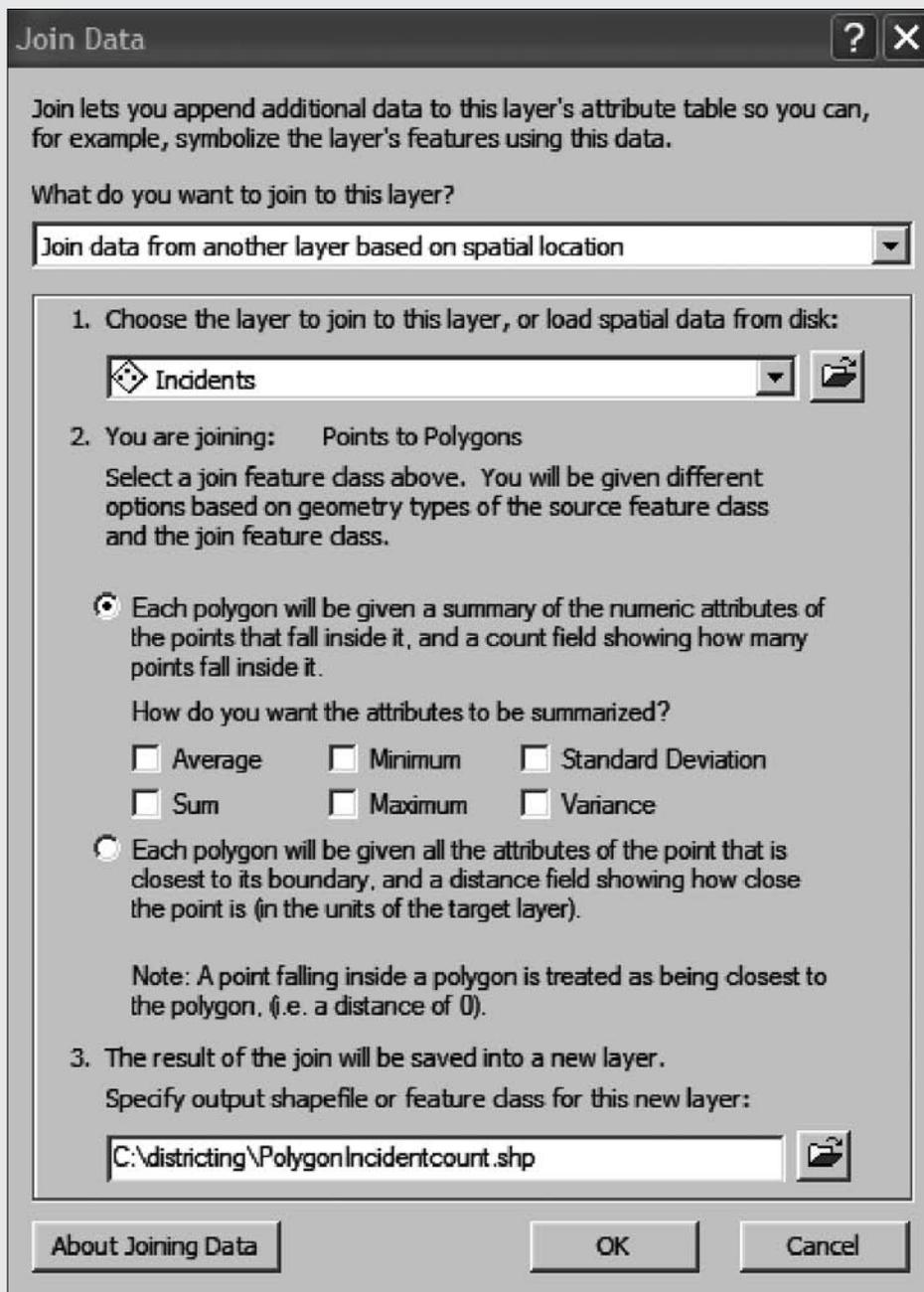


Figure 1. The dialog box for joining spatial data.

Analysts should now see a “Count” field in the resulting polygon that can be used in the districting tool.

Installing the Districting Extension

The districting extension is free and available at www.esri.com.⁴ The download contains a simple executable file that will add the extension to ArcGIS Desktop. A

“help” file and tutorial data are included with the installation.

Analysts should add a toolbar for the districting extension to the project and must turn on the extension. They should follow these instructions:

1. Open ArcMap and select “Tools->Extensions.”
2. Check the box for the extension labeled “Districting.”

3. Add the Districting toolbar by right-clicking empty toolbar space and checking “Districting.”

Creating a New Districting Plan

To create a new districting plan, analysts should do the following:

1. Click “Districting->Districting Admin-> Create New Plan.”
2. Click “Create a New Workspace” and specify a new geodatabase file name.
3. Enter a title for the districting project.
4. Click “Next.”
5. In this wizard screen, check the box that says “Source geography has attribute data” and then click the “Add New” button.
6. Browse to find the polygon file with spatially joined incident data.
7. Select “Count” as the universal field in the attribute data field selection screen. If there is a secondary value to be summed, select that field in the optimal-value field.
8. Click “Next.”
9. Select the number of districts.
10. Click “Next.”
11. Accept the default target optimal value.
12. Click “Next.”
13. An option to automatically calculate the sum and percentage of the universal field to involve other statistical counts by boundary will appear. For the sake of demonstration, leave these unchecked.
14. Select the districting dropdown and select “Start Editing.”

Once a districting plan has been created and the editing process begins, the districting toolbar becomes active and smaller polygons can be grouped into districts. Redistricting should be an iterative process by which decision-makers can gather input and create temporary selections, examining statistical output for each scenario. Although analysts should focus on grouping these polygons, they can examine other pertinent layers (e.g., facilities, aerial photography) if they need them as references.



Figure 2. A districting toolbar.

Assigning Polygons to Districts

Districting can be accomplished by selecting a district from the dropdown list (see Figure 2). Notice that the number of districts prescribed earlier in the wizard is the same number of districts as in the dropdown menu.

Simple selection tools can be used to allot smaller polygon groups to a district. Mousing over the toolbar gives a short description of

each tool, and this tool () selects polygons. Right-clicking on the selection and clicking “Assign Selection” allots the selection to the district number in the dropdown menu. The “Undo Assignment” tool () puts the selection back to where it was. Two buttons on the right bring the charts and statistics windows into view as the analyst assigns polygons to districts (see Figure 3).

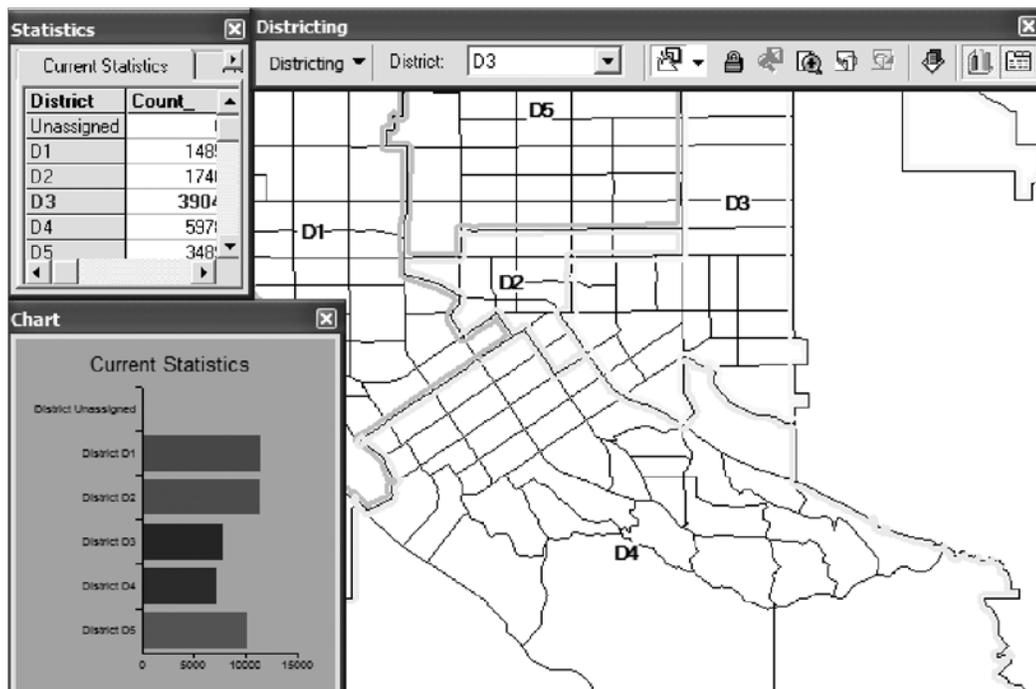


Figure 3. Charts and statistics correspond to district selections.

Advanced Use of the Districting Tool

The districting tool was developed to assist law enforcement agencies with demographics analysis. Agencies, however, should recognize that other data fields can help them make decisions about district boundaries. The “Create Report” button () gives a breakdown of all attribute data fields supported in the new district plan.

Analysts should examine which other data fields can be joined to the polygon and consider what statistical breakdowns are required for the command staff to

make decisions. For example, if parolees are a focus, consider joining their home addresses to the smaller polygon list. Or, if some incidents require officers to remain on scene for a longer period, the agency may wish to district on the basis of time spent in the field rather than on raw incident numbers.

Ultimately, analysts must interpret and explain data and map the real world on the basis of the information available to them. Decision-makers rely on analysts to help them find the appropriate focus in a pool of otherwise overwhelming data. The ESRI districting tool allows the analyst to become a liaison between

the system and police administration by modeling the effects of districting decisions.

Notes

¹For more information, see www.esri.com/software/arcgis/extensions/districting/index.html.

²The representation of a geographic feature. When referring to geographic features, feature classes include point, line, area, and surface.

³A choropleth map is a descriptive map that indicates through some form of shading or pattern the relative size of a particular phenomenon within a defined geographical area.

⁴To download the districting extension, go to www.esri.com/software/arcgis/extensions/districting/index.html.

Police Chief Magazine Focuses on Crime Mapping and Analysis

Christopher Bruce

President, International Association of Crime Analysts
Danvers, Massachusetts

The September 2008 issue of *Police Chief* magazine contains several articles meant to educate police executives about the power of crime mapping and analysis.

In “Making Smarter Decisions: Connecting Crime Analysis with City Officials,” Carl Peed, Ronald Wilson, and Nicole Scalisi discuss applications of crime mapping and analysis beyond the organizational limitations of a police department. Crime analysis, they argue, can help build partnerships with communities, interpret threats and opportunities in urban development, inform municipal planning, and develop municipal policy. They suggest that crime analysts can be invaluable resources for helping local neighborhoods respond to crime and public disorder.

In “Closing the Gap between Analysis and Response,” Christopher Bruce and Neil Ouellette target a complaint common

among mappers and analysts—that no one uses their work. Bruce and Ouellette demonstrate how police agencies can make better use of crime analysis by giving their analysts proper resources and training, getting them out of their offices to connect with the community, and involving them in crime response and planning. They also suggest that agencies should establish formal tactic- and strategy-development processes like CompStat. “Analysts can do great work for an agency,” the authors conclude. “It should not be allowed to go to waste.”

“Finding Out What You Don’t Know: Tips on Using Crime Analysts,” by Kevin Paletta and Stacy Belledin, covers how a mid-sized police agency can use crime analysis. The article offers tips on proper administration of a crime analysis unit. The authors describe the importance of integrating analysis into the agency’s mission

and training programs, keeping analysts free from administrative tasks, and exposing them to the department’s daily operations.

Finally, in “Beyond Arrest: Using Crime Analysis to Prevent Crime,” Police Chief Tom Casady summarizes the significant technological advancements in crime analysis and mapping during the last 2 decades and asks whether police have taken advantage of the available technologies. Casady argues that practice has not caught up with technology. He encourages police to move away from traditional arrest-based approaches to crime reduction and embrace long-term problem solving. “Crime analysts (and their supervisors),” he writes, “need to recognize that crime-prevention efforts can be much more effective than investigative strategies.”

The articles are available online at www.policechiefmagazine.org.

Austin Redistricting Increases Efficiency, Reduces Crime

When the Austin (Texas) Police Department changed its district boundaries, it saw immediate results—officers could respond to crime faster and still maintain a constant presence in high-crime areas.

Each of Austin's nine districts has a standard set of four subdistricts, which helps equalize commander workload. The new strategy gives commanders more flexibility to move officers within the district, ensuring that each district area is patrolled at all times and shortening response times. Austin also uses "district representatives" who handle nonemergency calls and sustain community partnerships.

Austin's changes have given law enforcement time to increase its focus on crime control and community improvement. Increased patrols and interactions with neighborhood organizations have helped officers target and reduce crime.

For more information, see www.impactnews.com/northwest-austin/local-news/1273-redistricting-improves-police-response-time.

UCrime.com Works to Make Colleges Safer

When university students are worried about crime on campus, UCrime.com can give them fast answers.

The web site provides maps of crime committed on college campuses across the nation since April 21, 2008. Crimes are reported to the system by on-campus voluntary reporters. UCrime.com allows students to sign up for automated alerts by e-mail or cell phone that notify them when a crime is reported within a certain radius of a given address.

Find out more at www.ucrime.com.

Charlotte's Redistricting Creates Positive Results

Six weeks after redistricting, the Charlotte-Mecklenburg (North Carolina) Police Department's geographic information system-based redistricting was already improving police response times and effectiveness.

City police reported that it had improved response times to both emergency and nonemergency calls. Certain divisions were better able to focus on specific crime problems, such as traffic violations and illegal gun seizure—one division increased its illegal gun seizures by 500 percent.

Additionally, police have been able to focus more readily on neighborhood partnerships, including safe community forums, and reductions in street-level crimes.

For more information about the department, see www.charmeck.org.

San Bernardino Redraws District Boundaries

In an effort to save money and increase efficiency, the San Bernardino (California) Police Department redrew district boundaries.

The department's new strategic efforts cut \$2.9 million from the city budget. It eliminated its central district and divided the city into two districts. The department also closed six underused community service offices. And officers' workloads will change—officers now have smaller beats and more shifts.

The department hopes that these changes will decrease response times and lower the number of crimes.

SAVE THE DATE

June 15–17, 2009
Marriott Crystal Gateway
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Who Should Attend?

- Policymakers responsible for shaping public safety or social services
- Practitioners in criminal justice
- Researchers interested in criminal justice
- Students interested in criminal justice issues

To Register: www.ojp.usdoj.gov/nij

The NIJ Conference 2009

“It’s an evolution of our community policing model,” Police Chief Michael Bildt told the *San Bernardino Sun*, “and I believe by approaching a community’s crime problem through the beat plan and using technology to deploy where hot spots are, we can be more effective in delivering quality police service to the community.”

For more information, see: www.sbsun.com/ci_10899973.

Arlington Police Department Adds Fourth District, Balances Workload

When shifts in the west district of Arlington, Texas, became overwhelming, the police department decided to add a fourth district to balance the workload.

Officers in Arlington’s west district received high numbers of calls for service. The district was handling about 40 percent of the city’s workload, causing major inefficiencies.

When officers cannot handle a call for service on their beat, a dispatcher sends a nearby officer. These backup calls can send them far away from their regular assignments and take up time that could be spent monitoring for crimes or getting in touch with community members.

With the addition of a fourth district, Arlington will go back to equal workload divisions. A new office in south Arlington will provide residents with more law enforcement presence and a greater sense of safety. And officers will be equipped to respond quickly to calls for service, while maintaining a strong presence in their beat.

For more information, see: www.star-telegram.com/235/story/1033271.html.



Crime Prevention Research Review

#2

Police Enforcement Strategies to Prevent Crime in Hot Spot Areas is the second in the Crime Prevention Research Review series produced by the COPS Office. Summarizing the findings of rigorous academic studies evaluating such strategies, the report shows that focusing efforts on places with high crime and calls for service can help prevent crime in those locations. Fewer calls for service and other reductions in crime and disorder measures were noted in most studies. Displacement of crime resulting from enforcement efforts was not prevalent in studies that measured displacement. The publication is available online at www.cops.usdoj.gov/RIC/ResourceDetail.aspx?RID=456, or can be ordered by calling the COPS Office Response Center at 800.421.6770.

NIJ's MAPS Projects

The MAPS program engages in intramural research on crime, geography, and public safety. Two current projects are described below.

The Geography and Crime Project: Understanding Place and Its Influence on Crime

Ronald E. Wilson

Mapping and Analysis for Public Safety Program and Data Resources
National Institute of Justice

Geography can be applied to most social science research questions, helping researchers better understand human activity. Several crime theories—including defensible space, situational crime prevention, routine activity theory, and crime pattern theory—have used geographic principles as a means to understand how crime occurs and how to prevent it. NIJ's Geography and Crime project will use geographic principles to analyze the impact of ecology, economics, and demographics on crime trends at the local and regional levels, looking at eight different regions in the United States.

The Geography and Crime Project applies the theory of social disorganization to local and regional crime trends. Social disorganization theory says that social disorganization can influence behavior. Related research uses geography to examine spatial distribution and can be applied to settlement patterns (i.e., where people choose to live). The theory was later extended to examine the interactions and interrelationships between adjacent neighborhoods. While the theory helps provide a contextual understanding of why crime occurs where it does, crime analysts also consider the context of the local environment.

Researchers apply geographic theory in two types of crime analysis:

1. They analyze crime using spatial statistics, which provide an analysis of the spatial

characteristics of the crime incidents, including how incidents are related to each other and distributed across space.

2. They analyze the incidents and the characteristics of the environments in which crime occurs. The results show what factors are related to crime.

The Geography and Crime Project will use this second type of analysis, examining eight metropolitan regions across the U.S. Researchers will analyze the geographic characteristics of ecology, economics, demographics, and their relationships to crime. The project will also examine historical conditions of these geographic characteristics and determine how they have influenced crime and led to the current conditions in each region.

Additionally, researchers will assess metropolitan events that may have influenced crime in each area. They will ask the following questions:

- Do regional economic and business trends affect crime at the local level?
- Do local socioeconomic factors affect regional crime trends?
- If yes, then to what scale do the observed effects permeate?

NIJ predicts the project may help state and local governments create more informed public policy decisions.

A Multigeographic Analysis of Hot Spot Techniques

Ronald E. Wilson

Mapping and Analysis for Public Safety Program and Data Resources
National Institute of Justice

This project provides a comprehensive analysis of three families of hot spot techniques. It will determine which statistical techniques best predict future clusters of crime. Researchers will use data sets from multiple jurisdictions across the United States and assess changes in urban geography from metropolitan area to metropolitan area.

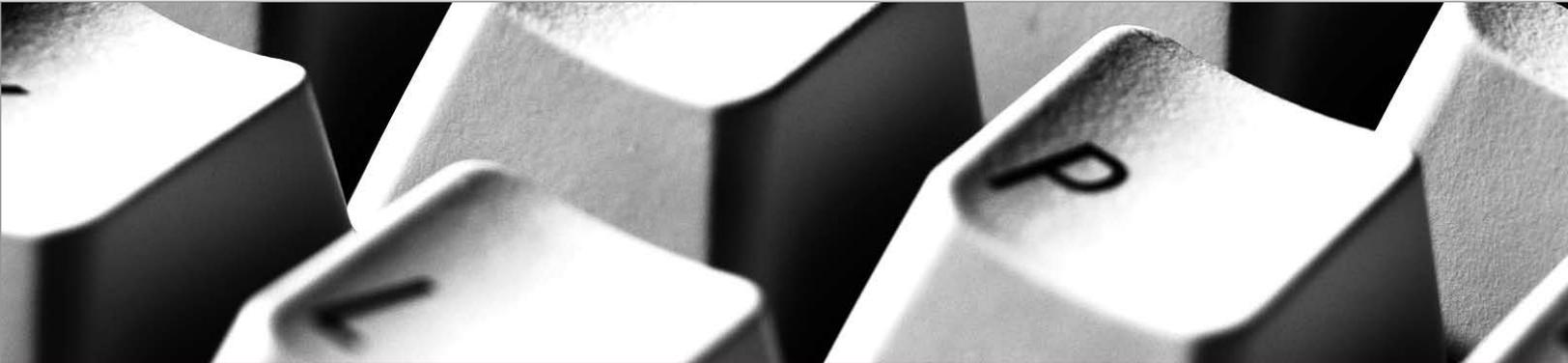
The research determines the accuracy of the statistical techniques. Each technique is used to analyze four different measures of crime as it relates to geography. These measures include the following:

1. The Prediction Accuracy Index (PAI), which provides a ratio of incidents in each geographic area.
2. A repeatability index (RI), which provides the ratio of the PAI over 2 years.
3. The percentage of all incidents captured by the hot spots.
4. A Gini-type coefficient that graphs the cumulative percentage of the cases (X axis) against the cumulative percentage of the study area (Y axis).

Analysis will determine which techniques perform best within each family and

which performs best overall. Additionally, researchers will perform an Analysis of Variance (ANOVA) on the PAI, RI, and the percentage of all incidents captured to determine if the unique geographies matter or do not.

The results from the PAIs will help determine whether the techniques accurately predict hot spots. Overall study results will improve the accuracy of geographic modeling and clarify which factors influence whether a location becomes a crime hot spot.



COPS Grant Information at your fingertips

The COPS Office Response Center provides information on the following:

- COPS Grants
- Grant Applications
- Grant Management
- COPS Online, passwords, financial status reports, etc.
- Community policing training available from the Regional Community Policing Institutes
- COPS Publications
- Contacts for your state Grant Program Specialist or Staff Accountant.

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Fax: 202.616.8594

E-mail: askcopsrc@usdoj.gov

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Washington, DC 20530

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After-hours voice mail—call returned next business day

Information available 24 hours a day at www.cops.usdoj.gov

Ask us for materials to address a specific problem in your community.



Geography and Public Safety Events

Dealing with crime problems in a local law enforcement agency sometimes means reaching out to other local agencies to come up with a solution. The events listed here are good opportunities to learn what mapping professionals and those in related areas are doing, get new ideas, and present your work.

2009 CA/HI/NV Regional User Group (CAHINVRUG) Conference

February 3–5, 2009
in Sacramento, California
www.esri.com/events/cahinvrug/index.html

2009 Indiana GIS Conference

February 17–18, 2009
in Bloomington, Indiana
www.in.gov/igic/conference/index.html

2009 ESRI Federal User Conference (FedUC) February 18–20, 2009

in Washington, D.C.
www.esri.com/events/feduc/index.html

2009 North Carolina GIS Conference

February 19–20, 2009
in Raleigh, North Carolina
www.cgia.state.nc.us/Default.aspx?alias=www.cgia.state.nc.us/nggis2009

2009 National States Geographic Information Council (NSGIC) Midyear Conference

February 22–25, 2009
in Annapolis, Maryland
www.nsgic.org/events/future.cfm

NEMA 2009 Mid-Year Conference and 35th Anniversary Celebration

March 6–10, 2009
in Alexandria, Virginia
www.nemaweb.org/?2068

Association of American Geographers (AAG) 2009 Annual Meeting

March 22–27, 2009
in Las Vegas, Nevada
www.aag.org/annualmeetings/2009/index.htm

California GIS Conference 2009

April 6–9, 2009
in Sacramento, California
<http://calgis.org/>

2009 Southeast Regional User Group (SERUG) Conference

April 27–29, 2009
in Jacksonville, Florida
www.esri.com/events/serug/index.html

Pennsylvania GIS Conference 2009

May 19–20, 2009
in Grantville, Pennsylvania
www.pagisconference.org/

GEOTEC Event 2009

June 1–4, 2009 in Vancouver, British Columbia, Canada
www.geoplace.com/ME2/dirmod.asp?sid=F1E958ECB4E84C1C97324D4851580DDB&type=gen&mod=Core+Pages&gid=104ED2C8722E405C96D6F83446767961

Tenth Crime Mapping Research Conference

August 2009
in New Orleans, Louisiana
www.ojp.usdoj.gov/nij/maps/

2009 National States Geographic Information Council (NSGIC) Annual Conference

October 4–8, 2009 in Cleveland, Ohio
www.nsgic.org/events/future.cfm

GEOINT 2009

October 18–21, 2009
in San Antonio, Texas
www.geoint2008.com/

2009 Applied Geography Conference

October 28–30, 2009
in Baton Rouge, Louisiana
appliedgeog.binghamton.edu/



**Mapping and Mapping and Analysis for Public Safety Program:
A Call for Presentations and Workshops**

The Tenth Crime Mapping Research Conference

Conference Dates: Wednesday, August 19–Saturday, August 22, 2009

Sheraton Hotel, New Orleans, Louisiana

Submissions Due: Friday, January 30, 2009, before 7:00 p.m., e.s.t.

Solving Problems with Geography and Technology

Solutions to crime and public safety problems involve a combination of research, practice, technology, and policy. Law enforcement agencies now often use geography to help solve crime problems.

Advancements in geographic technologies have helped law enforcement agencies understand crime more completely, deploy public safety resources better, and examine criminal justice policies critically. Geographic research leads to better practice and technological advances. Research provides a theoretical foundation. Practice applies technology to put theories into operation. Research and practical demonstrations help focus policy decisions.

The Crime Mapping Research Conference is about understanding crime and public safety and their effect on communities. It presents a range of research findings, practical applications, technology demonstrations, and results that can shape future policies.

Presentations and workshops for the 10th Conference will highlight geographic principles in research, geographic applications in practice, technology demonstrations, and solutions to crime and public safety problems that can lead to new policies.

For information about submitting a presentation, go to: www.ojp.usdoj.gov/nij/events/events/maps/welcome.htm.

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