
Geographic Information Systems for Small and Medium Law Enforcement Jurisdictions

Geographic Information Systems (GIS) are increasingly recognized within the law enforcement community as an effective new tool for the analysis of crime patterns, the allocation of enforcement resources, and the support of strategic planning by sheriffs or chiefs of police and their staffs. GIS in law enforcement has the potential to prevent crime through better discernment and anticipation of crime patterns as they emerge in a community. GIS also has the potential to elevate law enforcement to a new community leadership role as crime databases are integrated with those databases in local planning, tax, education, transportation, and other agencies.

Nonetheless, actual use of this new tool has proven illusive for the majority of small and even medium law enforcement jurisdictions because of problems associated with software and hardware resources, technical expertise, database management, and other challenges which may be met more easily by large jurisdictions with ample, specialized staffs. This report, based on extensive interviews with crime mapping staff, supervisors, and end-users both within and outside North Carolina, outlines obstacles, opportunities, and action steps relevant to the implementation of GIS in law enforcement agencies of small to medium jurisdictions.

Benefits of GIS

While most jurisdictions implement only some of the possible 21 functions of GIS, all jurisdictions surveyed reported significant benefits from implementation of crime mapping.

Some of the more important functions of GIS are:

- mapping crime locations
- mapping crime hot spots
- detecting patterns of crimes
- integrating interagency data
- allocating resources
- analyzing multivariate patterns

Evidence that GIS works in law enforcement

“Before GIS we had a burglary here. We had a burglary there. But with GIS, with the mapping, with the pinpointing, we really know what’s going on, and that’s good. I think it’s really paid off.”

— C.K. Lamm, crime analyst, Wilson Police Department

In addition to the benefits of GIS within the police department, GIS has helped the criminal justice system in other ways. Geographic Information Systems have communicated evidence more clearly to juries and have helped mobilize communities to aid law enforcement by mapping crime areas.

GIS is different in small and medium cities

Some small and medium jurisdictions, despairing of emulating large-city models, may discount the possibility of implementing a GIS function. But GIS can be implemented effectively in these cities if statewide agencies, which seek to support small to medium jurisdictions, are prepared to provide support quite different from that generally available to larger jurisdictions.

One Offender’s Legacy (1978-1999)

Charlotte-Mecklenburg Police Department

**Geographic Information Systems for
Small and Medium Law Enforcement Jurisdictions**

<i>Size of City</i>	<i>Need Perception</i>	<i>Staff Difference</i>	<i>Organization Difference</i>	<i>Intergovernmental Difference</i>
Small to Medium	Unsure if needed	Existing, part-time	Single officer	Local self-funding
Large	Needed to manage complexity	Pre-trained full-time	GIS unit	Multiple sources of funding

Table 1. Comparison of GIS cities of different sizes.

Table 1 provides an overview of some of the differences between the smaller and larger cities. In general, small to medium jurisdictions require a scale of implementation which can be successfully supported and maintained. The expectations of law enforcement management, the nature of the staffing, and technical support needs must be carefully examined and explained in order for long-term success in these cities.

Start-up strategies

For most North Carolina communities, the main challenge of GIS is simply starting the program. Geographic Information Systems are expensive. A budget must account for software, hardware, training, and technical assistance.

To obtain and maintain GIS, a desirable model is that shown by the City of Wilson, NC, where GIS is funded from a city budget, with each unit (police, public works, etc.) contributing.

Several important considerations for maintaining quality GIS are:

- **Establish interagency cooperation**

Taking advantage of existing geographic data bases is perhaps the most recommended start-up strategy. Smaller cities can benefit from the experience of larger ones in avoiding start-up mistakes, such as underpowering their GIS.

- **Purchase adequate hardware**

“A lot of people don’t realize how processor-demanding GIS are, so they will underpower the hardware and not have it be big enough or powerful enough to do the job.”

— Al Johnson, crime information systems supervisor, Austin, TX Police Department

- **Anticipate database acquisition costs**

Obtaining accurate base maps is essential for implementing crime mapping. Base maps or some other function, such as tax assessment, can be useful. Where base maps are absent, start-up costs can be high.

- **Support data management needs**

Funding must be maintained to keep trained personnel to input the data necessary for sophisticated GIS. Without a high quality database, the GIS software is meaningless.

Planning needs

The effectiveness of GIS in local planning depends upon political support, staffing, systems sharing between agencies, and database cooperation. Investment in human capital to assure the development and retention of experienced GIS analysts is especially important.

Geographic Information Systems for Small and Medium Law Enforcement Jurisdictions

Aspects of planning GIS capabilities include:

- **Developing effective data management**
 - Standards for data collecting, a data dictionary, and data format must be established
 - Data warehousing to hold data from multiple sources must be determined
 - Data filtering for cleaning and geocoding (matching the baseline address database with addresses given by police) must be maintained
- **Creating a suitable organizational culture**

Management must recognize the importance of GIS and support it. Planning involves adapting as community needs and information technology change, and keeping management aware of these changes.
- **Coordinating interagency data**

An early effort at data and software compatibility between departments may prevent costly and frustrating data conversion efforts later which would diminish the efficiency and effectiveness of GIS operations. Forming an interagency group to coordinate the sharing and to recommend standards is suggested and will decrease costs.

Training needs

The effectiveness of GIS in law enforcement ultimately depends on having well - trained analysts. Initial training in GIS software must be combined with broad exposure to applying the software to crime analysis. Training must be ongoing as the techniques of GIS, as used in law enforcement, evolve in new, more sophisticated ways.

"It would be nice if they took this [crime mapping] to the recruit level and used it in the academy so they get some knowledge of what the system is, because we're just learning as we go."

—Lieutenant J.M. Bjurstrom, Durham Police Department

- **Train before GIS implementation**

Because GIS software remains qualitatively more complex and challenging to implement than most existing office tools and crime reporting software, crime analysts need released time in order to attend training schools and conferences so that they can master GIS functions and develop the full capabilities of GIS. Released time and travel expenses must be funded before GIS is installed.

- **Train on networking**

Training cannot be reduced to technical manuals and videotapes. Training should include sponsoring and funding conferences, visiting sites, publishing newsletters, and developing online discussion and self-help lists to promote networking among the community of law enforcement crime mapping staff throughout North Carolina.

- **Train management**

Farsighted leadership will budget for training of the managerial end-users of crime mapping so that these managers can integrate the information from GIS into daily practices throughout the department.

Technical support needs

GIS staff from smaller jurisdictions are apt to be less technically proficient than specialists in large jurisdictions. Consequently, these jurisdictions not only need more technical assistance, but they also need it delivered in a more accessible and less intimidating manner. There is no need to duplicate the substantial resources of the National Institute of Justice Crime Mapping Research Center (<http://www.ojp.usdoj.gov/nij/>), but a simple effort to collect and mount online the technical resources specifically for North Carolina would be useful. For instance, the Winston-Salem Police Department has standard *Arcview* projects which can be adapted for a variety of reports, but at present there is no system for sharing project files among the state's many *Arcview* users in law enforcement.

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Geographic Information Systems for Small and Medium Law Enforcement Jurisdictions

Partnering with local universities and vendors can be useful, but one must initiate the idea of a partnership. One model for a partnership is developing a center at a university that is focused on the use of GIS in the criminal justice area. Centers such as this have been followed in other policy arenas and in law enforcement at UNCC.

Project evaluation

To assess the cost effectiveness of a program, public administrators often seek to quantify the inputs and outputs of a particular program. The most familiar example of quantitative techniques is a cost-benefit analysis. However, the validity of quantitative cost-benefit analysis declines as the effects of programs become more diffuse, long-range, and of human rather than dollar impact, as in the case of crime mapping and analysis.

Plan and monitor for efficiency

John Couchell, the assistant director of the crime analysis unit of the Charlotte-Mecklenburg Police Department provided an excellent example of doing more with less:

“We scheduled a meeting with all 12 of our patrol district captains, turned GIS on, and moved neighborhoods around to balance workloads. GIS enabled us to reduce the number of man-hours to redistrict and reapportion police resources. What took two people six to nine months to accomplish in the past, we did in one day.”

Another salient aspect of the efficiency of GIS is updating police officers when they return to duty. Because officers have to spend time reorienting themselves to the tactical crime situation as it evolved since their last tour, maps generated by GIS can make this transition easier. Although no one is tracking man-hours directly, the quantifiable return on the public's investment in GIS for a crime analysis unit may be found in the saving of time for officers to catch up on events and prepare for their next tour of duty.

Plan and monitor for effectiveness

Gains in effectiveness result when GIS is used to improve the *quality* of a current output or to produce an output not previously available. In

our survey, many police supervisors were convinced that GIS enabled them to target crime better in their districts by providing a visual representation of their areas of responsibility.

“Because of our mapping and our crime analysis, what we thought was the high crime radial turned out to be another area. So we had to increase the manpower in that district, as opposed to the district where we thought we were going to have to increase.”

— Major Billy White, Wilson Police Department

Another area in which GIS is improving the effectiveness of law enforcement is the communication between police departments and the public.

“With mapping you can be honest with the community. You can tell the community, I'm coming into your area, and this is why I'm coming.”

— Captain Beverly Council, Durham Police Department

As technology improves, the effectiveness of crime mapping increases. As more law enforcement officers use laptop computers on patrol, they can be given the capacity to communicate with records management databases and CAD mapping systems as officers perform routine stops.

Design ongoing evaluation program

Program evaluators should focus on changes in law enforcement processes, such as redistricting, assignment of patrol resources or community liaison, with a view toward describing whether GIS technology has created time, personnel or resource savings, or has improved quality without increasing cost. Qualitative process assessment may be based on surveys used in case-study methodology among frontline officers, supervisors and upper management.

Stages of development

While there is no one path to developing an effective crime-mapping function in a small to medium jurisdiction, there are common steps which emerge from a survey of experiences of similar towns and cities. The research findings suggest that communities aspiring

Geographic Information Systems for Small and Medium Law Enforcement Jurisdictions

to implement crime mapping need information on the stages of development that they may anticipate and information on how other jurisdictions have responded to these stages.

Stage 1 - Planning

Involve key leaders in crime-mapping efforts

Where GIS exists in law enforcement agencies, often it is because a member of top management saw its value and mandated its use. Leadership from the top is essential to begin implementing crime mapping because people and political skills are necessary to “sell” GIS to upper law enforcement management and city councils. The involvement of key leadership, determined to implement GIS, sets the stage for these corresponding action steps:

- Strategic planning (defining the mission of GIS in the jurisdiction)
- Organizational design (locating the central office of the crime-mapping function)
- Permanent funding (budgeting and recovering costs from crime-mapping services)

Develop partnerships

Crime mapping is one area where “going it alone” is a difficult prospect. Working with neighboring jurisdictions, GIS vendors, federal and state agencies or colleges and universities can be very beneficial.

“Find out whether or not any other agencies within [your] jurisdiction are using GIS because it’s really important that you try to stay within the same platform. Let’s say Planning or Public Works is using MapInfo, then you may want to seriously consider using MapInfo also.”

— Philip Canter, chief statistician, Baltimore County Police Department

Identify problems to be addressed through crime mapping

The first step in designing a crime-mapping system is surveying existing information sources.

“You’ve got individual officers that have great information, and we very rarely share that information with each other because of shifts and changes. Take your time...and find out what’s really going on and then develop plans to address it.”

— Captain Homer Craig, Winston-Salem Police Department

Although needs assessment in small to medium jurisdictions is undoubtedly less involved than in large cities, a serious needs assessment must consider needs both internal and external to the law enforcement agency. Hardware, software, personnel, budgets and intragovernmental and intergovernmental dimensions must be determined. In undertaking crime mapping, a law enforcement department is establishing a *system*, not just purchasing software.

Conduct a needs analysis

A needs analysis serves as a road map that will guide a jurisdiction to deploy GIS successfully. Deena Bowman-Jamieson, GIS coordinator for the San Diego Police Department, gave this advice:

“The first steps to develop a needs assessment are to look at who your users are, what their requirements are and how they’re going to interact with the data, then identify sources of information, or if the data’s not available, what the costs will be to acquire it.”

A needs analysis will help prevent situations where jurisdictions receive money for software and hardware, but do not use it to its full capability. The best advice to establish a new technology is to build a strategic plan that is open and flexible and allows for changes in the technology.

Establish a leadership board

A leadership body is needed to develop policies and procedures, define areas of responsibility, resolve issues pertaining to data stewardship, address performance problems and provide accountability. The leadership board also sets intermediate milestones and long-term goals.

To be most effective requires working with other agencies in our jurisdiction that have GIS.

Geographic Information Systems for Small and Medium Law Enforcement Jurisdictions

Members of this board must include those who control the finances. A planned funding stream to implement, stabilize and expand the GIS is essential from the onset. Without such strategic leadership, tactical decisions about hardware, software, staffing and crime analysis will founder, leading to demoralization and atrophy of the initial crime-mapping efforts.

Stage 2 - Starting up

Hire staff

Obtaining support for crime mapping is aided by having staff who have a well-deserved reputation for excellence and competence in GIS and crime analysis. This staff must be able to address managerial and technical concerns in law enforcement in order to market to end-users and top management through visits, forums, newsletters, executive briefings, demonstrations, surveys and other outreach opportunities.

Acquire hardware and software

The needed computer power and other technology must be available, appropriate to the task and accessible within the budget. Inadequate investment in hardware has been a common bottleneck and cause of GIS failures. One must have high quality data and trained staff in order for managers to deliver services and respond to new demands quickly.

Form cooperative agreements

All key individuals and units with a stake in the benefits of crime mapping must feel that the reward structure of the system being created encourages collecting and sharing of information even when such efforts are not intrinsically part of what would otherwise be done. Rewards to stakeholders may include better information for strategic decision-making, distribution of the costs of information, and recognition for playing a leadership role. For staff who are stakeholders, rewards may include upgrading job descriptions, providing better career development ladders, and increasing training opportunities.

Stage 3 - Operating GIS

Commit to compatibility

Making the GIS functions compatible with the municipality's existing GIS structure greatly facilitates

implementing crime mapping. The leadership board should give high priority to hiring an experienced GIS coordinator.

Train staff

Managers must commit a substantial investment to training employees. Training should avoid technical jargon which may create a "semantic gap" between the implementers and the organizational rank and file.

Crime-mapping staff may be recruited from various sources, but many are recruited from within, ranging from sworn officers to civilians working for the police departments.

Crime-analysis training in GIS may come from in-house sources, self-directed programs, commercial vendors, and university and community college courses. Commonly cited training sources are the Environmental Systems Research Institute, the Carolina Institute for Community Policing, and the National Institute of Justice Crime Mapping Research Center.

Implement pin mapping

It is important to begin crime mapping by pin mapping feasible targets with a high likelihood of service within the jurisdiction. Pin maps are simple to understand and have proven popular and effective. Early successes with pin mapping build demand for more sophisticated crime-mapping functions.

Stage 4 - Stabilizing the system

Integrate databases

Early in the implementation of GIS, data from other agencies must be integrated with crime mapping. Release data from the Department of Corrections, warrants and summons data, property tax data, demographic information from the Census and alcohol sales information are all databases that can be consolidated with crime data.

Train management and end-users

By involving first-line supervisors and higher officers in the initial planning process, the crucial foundation has been laid for the acceptance and buy-in for new technical tools based on GIS.

Geographic Information Systems for Small and Medium Law Enforcement Jurisdictions

GIS requires constant marketing to superiors. So it would be advantageous to hire someone that has good basic computer knowledge, an extremely good grasp of the business needs of the department and is good at building relationships with management.

Stage 5 - Expanding the system

Assess needs on a continuous basis

Ed Orff, senior crime analyst of the Colorado Springs Police Department, points out that GIS products quickly become popular and customers begin to ask for more products, making some reevaluation necessary. As more products are added to the GIS, flexibility becomes very important in expanding the system.

Most city and county planning agencies are constantly updating their databases, thus making them a rich source of background information. Each jurisdiction should survey either its city or county GIS shops to determine if they should be compatible with these other agencies in order to tap into their databases.

“Tempe got into crime mapping before anyone else did, but they didn’t play along with everyone else in their area, and now they’re left out in the cold.”

— Dan Helms, crime analyst, Las Vegas Metropolitan Police Department

Develop expanded resources

Because projects need a high-level “champion” who appreciates what technology can do and makes the case to the rest of top management, it helps if the GIS unit is highly placed within the organization. GIS responsibilities should be under a single unit rather than split among many. Although the support of key politicians is important, GIS implementers must try to remain politically neutral. To help ease politically difficult decisions, neutral third-party consultants should be used.

Develop broader networks

All affected departments must be kept informed through regularly scheduled formal reports, open meetings, user support groups and, more broadly,

encouragement of a supportive organizational culture. Such an information culture cannot be created overnight, but is associated with how staff approaches problems and knows the GIS options, costs and benefits, as well as the quality of interaction between users and GIS implementers.

Regionalization of GIS

Because GIS constitutes a considerable implementation challenge in terms of resources, training and administrative burden, small jurisdictions may well need to consider some method of pooling crime mapping resources on a regional basis. Shared costs, experience and expertise are several benefits of regionalization of GIS.

An example of the need for regionalization was voiced by Belinda Pridgen, a Durham crime analyst:

“Chapel Hill’s crime rate, for example, went up last year and the chief of police made the comment that Durham was pushing the criminals over there and that could possibly be true.”

- **Economic reasons**

Crime mapping requires a significant investment of time and money. Start-up costs may be prohibitive, but this might be overcome with several jurisdictions sharing resources.

- **Sharing information**

The mobility of crime is an issue, especially in a state like North Carolina that is crisscrossed with interstate highways that can act as high-speed corridors for criminals.

One source to help develop cooperative crime analysis units between cities is the Councils of Government (COG), which are regional government councils that support local jurisdictions. The COG has extensive GIS experience in operating data centers, but they have not yet mobilized on problems facing law enforcement.

Shared costs, experience and expertise are several benefits of regionalization of GIS.

Geographic Information Systems for Small and Medium Law Enforcement Jurisdictions

Another role of the COG would be to settle issues between jurisdictions, as stated by one of the police supervisors in Asheville, NC:

“There’s a lot of competition among a region, and while they may be well intended to try and work together, there are turf issues ... some agencies are better prepared to advance with technology, and there may be a perception that the county agency is holding the city agency back. Some independent regional authority might help to facilitate the development of a regional crime mapping system.”

Some of the possible roles in establishing regional crime analysis units are:

- **Planning and development**

A regional approach to GIS in crime analysis for any size region means that police departments are able to communicate with one another in a common format.

- **Implementation**

A regional crime analysis unit would have standardized hardware, software, and personnel support.

- **Production and output**

A regional approach to crime analysis can facilitate regularly scheduled, standard crime maps and reports for examining crime patterns across the region. Local agencies will still develop maps by special request for emerging local law enforcement issues.

- **Future planning**

Once a regional crime analysis unit is established, updating the various components of the GIS will be necessary and will be more easily funded with several jurisdictions sharing the costs.

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Log on to the Governor’s Crime Commission website <http://www.gcc.state.nc.us> for a copy of the full report “Crime Mapping for Small and Medium Jurisdictions A Report on GIS”.

The latest systemstats and reports include:

- Domestic Violence Shelters and Minorities
- Domestic Violence: Dispositional Outcomes of Protective Orders in the Courts
- A Process and Impact Evaluation of the North Carolina Communities that Care Initiative
- Geographic Information Systems for Small and Medium Law Enforcement Jurisdictions: Strategies and Effective Practices
- Perceptions of Crimes Affecting North Carolina’s Latino Residents: Results from a Qualitative Crime Prevention Needs Assessment (systemstats)
- National and State School Crime Trends (systemstats)
- Disproportionate Minority Overrepresentation in the Juvenile Justice System
- Law Enforcement Tools for Latino Communities
- North Carolina Citizens’ Perception of Crime and Victimization (systemstats)
- Juvenile Day Treatment Centers - Strategies and Effective Practices
- Law Enforcement Domestic Violence Units: Handbooks

Some of these reports can also be found on the Governor’s Crime Commission website listed above.

GIS in law enforcement has the potential to prevent crime through better discernment and anticipation of crime patterns as they emerge in a community.

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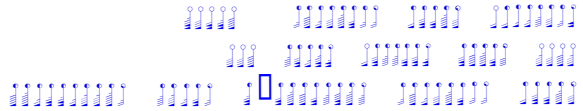
Douglas Yearwood
Analysis Center Director

Navin Puri
Information Systems Planner

James Klopovic
Lead Evaluator

Richard Hayes
Senior Research Analyst

Charlene Coppersmith
Data Analyst
Desktop Publisher



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