

**The Bill Blackwood
Law Enforcement Management Institute of Texas**

**GIS: The Solution for Real-Time Crime Mapping And
Crime Predicting in a Police Agency**

**A Leadership White Paper
Submitted in Partial Fulfillment
Required for Graduation from the
Leadership Command College**

**By
Robert L. Steele**

**Texas Tech Police Department
Lubbock, Texas
February 2018**

ABSTRACT

The purpose of this research is to reveal the clear advantages of agencies using a geographical information system (GIS) to predict crime patterns, hotspots, and accumulate spatial data for several functions. Creating a workable software suite that is capable of multiple applications is a sound strategy in affording the software, training the personnel necessary to use the program, and producing a positive outcome for everyone involved. Agencies should examine the different application advantages of a GIS system and integrate a system into their department that is right for them.

Finding the right software suite is paramount. Police agencies have moved to a policy of transparency. The data delivered by a GIS system delivers the transparency sought by numerous local governments in gaining public support for their crime prevention efforts. Other agencies within a city can benefit from the data mined as well. When sharing the software, the overall cost can be shared over several budgets creating a partnership that benefits everyone.

The research clearly shows that the technology is available at a reasonable cost, it is effective at accurately predicting activity, and can be used to build public trust. Agencies do have several counter points that could slow down the implementation of the software. However, agencies without the GIS are severely disadvantaged in the growing criminal elements. Training staff, training administrators, and educating the public is a positive plan for developing a tool that will pay for itself in manpower allocation while lowering criminal activity.

TABLE OF CONTENTS

	Page
Abstract	
Introduction	1
Position	2
Counter Position	6
Recommendation	9
References	13

INTRODUCTION

Geographical information systems (GIS) have been in use since the early 1960s. Dueker (1987) stated that “a GIS allows the operator to capture, manage, manipulate, analyze, and query spatially referenced data for solving complex planning and management problems” (p. 383). In the policing world, the process of having a visual aid to determine criminal activity is not a new concept. Ratchiffe (2004) reveals that “for at least 100 years’ police officers have stuck pins into paper maps displayed on walls, where each pin represented a crime location. In some places this practice continues” (p. 67). Another, older method was inserting data into a spreadsheet and creating an elaborate algorithm to interpret the data entered. Further, the strategy of community policing is a concept that is becoming a standard in some agencies. The idea is to put the patrol officers in direct contact with the community to gain trust and information from the people they serve with the purpose of deterring criminal activity. Although this would appear to get the job done, that approach seems to lack detailed information, takes an enormous number of personnel hours to maintain, and leaves the department open to inaccurate or missed information. In the law enforcement environment, “GIS systems offer an avenue to more easily accomplish this goal, and as the literature suggests, officer intuition is not always the most reliable technique” (White, 2007, p. 21).

Today, GIS offers law enforcement agencies a more accurate and up to date look at crime trends in their jurisdictions. The amount of different software companies available that provide this service is growing yearly. With this growth comes advancements in the data entry process, the cost involved in maintaining the system, and the increased number of users that can use the system. Agencies can tailor the

systems by size, functionality, and user access. A stand-alone system offers a more secure system while the networking option allows for greater availability of information throughout the agency and to the community they serve.

When looking at all the challenges law enforcement agencies face daily, the implementation of a GIS system offers agencies another strategic tool in their arsenal to combat the criminal activity within their communities. Agencies should examine the different application advantages of a GIS system and integrate a system into their department that is right for them. The challenge is determining which system is right for their agency and properly implementing a system that will be user friendly and offer accurate information for the proper allocation of resources to address increased criminal activity in a geographical area. Further, finding the right software and implementation strategy is key in controlling cost and ensuring a successful initiative. Brudney and Brown (1992) claimed that “GIS supporters argue that the technology can enhance organizational performance at a fraction of the cost that would be incurred without the system” (p. 88).

POSITION

GIS, when implemented correctly, can be an enormous time saving tool for an agency. The value is in identifying the application. Finding the right type of software that meets all the requirements makes for an easier transition into the digital world. GIS discloses to users a map of an area that provides valuable information with specific data. The algorithm of topology and spatial data identifies trends and displays information to decision makers for adjustments. (Brudney & Brown, 1992).

Imagine being able to gather information that would normally take days to compile in a media format that gives a visual snapshot into current statistical data. Law Enforcement agencies would no longer need to assign personnel to compile data and present it in a fashion that is less than accurate. Being able to quickly assess a situation and make good decisions based on accurate model forecasting will increase the effectiveness of the resources available.

Understanding that the agency itself can use GIS for forecasting and predicting criminal activity, it can additionally be a valuable tool for transparency within the department. An example of this would be cross-referencing specific crimes with a mechanism that could allow citizens to anonymously provide general information to law enforcement about crime trends occurring within the community. Web design could integrate this function and create leads into cases that might go cold as time passes. This would give the citizens an outlet to help without feeling like they are under the microscope. Further, it creates that sense of transparency that the agency is being truthful and honest with its citizens regarding criminal activity without giving up the specifics of a crime, names associated, or placing a case at risk of not being solved due to too much information being available. Carefully setting up this type system reaps its own rewards due to the information flow going both ways. Herchenrader and Myhill-Jones (2015) stated that “the public map allows citizens to query recent occurrences as well as historical occurrences. When querying occurrences, the precise locations of crimes are generalized to approximate locations to avoid data misinterpretation and to protect privacy” (p.140). In the community policing model, this is the goal. The cyber policing model will do the same thing but on a much larger scale.

GIS in today's marketplace is vast as far as functionality options. GIS offers insight into the crime prevention efforts by predicting hot spots. These hot spots are crucial in taking a pro-active position on stopping crimes before they happen. Groff and LaVigne (2002) summarized that applications examine what has already occurred. The data that is gathered are useful in identifying trends. Police agencies can use this empirical data to introduce crime prevention solutions. Providing more of a police presence, video surveillance, and strengthening security measures are just a few of the ways the data is utilized in a proactive manner.

Another positive option is sharing the GIS system with other departments. The public works department could use it to map existing infrastructure and plan for expansion or repair projects. The grounds-maintenance department could employ a real-time schedule of maintenance, expansion projects, and customer use plans. Emergency management could use the system to plan for emergency protocols in the event of a natural disaster, event, or environmental issue. Brudney and Brown (1992) stated that "other common applications of GIS, especially at the local level, include emergency services, tax assessment, zoning, and renewable resources management" (p.85). The functionality of the GIS is only limited to the willingness and time involved in maintaining the database accurately and inclusively.

A department that implements a GIS must be willing to make the commitment to provide not only monetary resources but personnel resources as well. The amount of time that goes into the database to ensure that reports are accurate and timely is enormous. Elwood and Leitner (1998) surmised that "concerns about the ability to use and maintain the technology and database, however, varied among individual members

of the groups. Some members were quite apprehensive, while others were more optimistic about incorporating GIS into their work successfully” (p.85). Departments must make a strategic plan and identify how involved its members are going to be in the daily updating of the system. The commitment is paramount if the system is going to be a successful part of crime prevention tactics. The information gained is invaluable.

Craglia, Haining, and Wiles (2002) suggest that “GIS is an ideal way to analyze the distribution of problems in local areas so that initiatives can be targeted as effectively as possible in spite the fact that agencies may operate with different and non-coterminous geographical boundaries” (p. 713). This system needs to be easy to use and the training time needs to be one that is seamless to schedule. Once all the variables are identified and addressed, a sound decision can be made as to what type of system to purchase and to use. The benefits gained will be more than the agency can fathom until the practical application is observed and implemented.

The reports generated by the system should be easy to read, and the variables should be easy to change to get the information requested by the user. An example would be the data entry from a records management system (RMS). In most cases, the data is extracted from the RMS and transferred into the GIS for spatial data analysis. Police agencies often obtain this information from extracting data from their computer aided dispatch (CAD) consoles and export specific information to the GIS software. What data is extracted and transferred makes a big difference as to what reports can be generated.

How this works exactly can illustrated using an offender methodology. If the same offender carries out a series of offenses, the relationship of offenses will begin to

have similarities. Using fields in the GIS software to correlate similar groupings can be extracted to create a profile. In this process, using what we know can help predict future occurrences and possibly targets of concern (Harries & LeBeau, 2007).

Knowing what exactly the agency wants the system to do is crucial. Development of sound operating practices that are consistent throughout the agency is needed to ensure the quality of the results produced. The software system that is chosen should be one that is upgradable and can expand as the needs of the department increase. Although this is not always a predictable point, finding a software company with a proven track record would be a good idea. Visiting with other agencies of a similar size and exploring what they use is a great way to determine what software would be ideal for a department. Finding a proven system and seeing it in action gives departments a real sense of what it looks like and how it is used. This action also helps promote the need for the solution and shows value in acquiring the technology for the agencies community.

COUNTER POSITION

Brown (1996) states that “recent research suggests that the primary obstacles to GIS success fall into three camps: technological limitations, organizational hurdles, and financial constraints” (p.195). With the increasing demand for other resources within city or county organizations, finding the money within a budget to afford and successfully implement a GIS programs is not always feasible. When one considers the initial set-up cost, the expense of training personnel to use the software, and the end benefit, some do not believe it justifies the overall cost. In smaller communities, it is argued that it is not needed because there is not as much criminal activity to track.

Police departments are often needing additional resources for new vehicles, in-car video equipment, weapons, uniforms, training, and numerous other line items that are tangible and practical. Further, competing demands from other departments with their own needs make the pool of resources a limited one. For many communities, prioritizing the needs of the city is paramount, and spending money on GIS is simply not an option.

Although this point is valid, it is important to remember the end goal, which is to lower the crime rate and to predict crime patterns to become more proactive. It can be a challenge to be able to afford to purchase the system. Finding the right GIS software and storage solutions for the needs of the department is imperative. Having too much functionality can make the system complicated and impractical. However, the cost to implement GIS on a smaller scale has become more affordable as technologies increase yearly. A few years ago, implementing a GIS system in a medium-size organization would have cost so much that local budgets could not support the software. In today's market, the cost has been significantly reduced, and the enhancements to the software have increased due to the development and enhancements from other manufactures. The competition factor has streamlined the software and created a sense of value to an economical dilemma that is easier to forecast in local budgets.

Having a discussion to incorporate the GIS system, not only in the police department, but also in other departments that could benefit from its diversity, would go a long way in justifying the cost. White (2007) believes that "some might argue that we do not have crime like the 'big city,' so we do not need to adopt technology" (p. 21)?

When one considers the wealth of information contained in a computer aided dispatch (CAD) records management system (RMS) that is simply sitting there, the need for GIS is clear. Grants are available to smaller departments that could reduce the initial set-up cost to a manageable amount. The challenge of management is to define the role GIS is to play in each organization and to show the benefits of implementation. To do that, the administration is going to have to buy into the concept and take a proactive approach to figuring out the right fit.

Another point the administration has as to why not to implement such a complex program is lack of resources. Police departments especially seem to always be working on a limited budget when it comes to staffing. Often, there are several shared tasks, within a department, where more employees are expected to accomplish more work with less funding. The demands of implementing a GIS system could further constrain an already squeezed budget and staff. The amount of training involved is another issue. As complex as GIS is, the training cost could be staggering. When requiring a specialized skill set to work with the GIS software, the potential turnover of personnel is another real issue that needs consideration.

Once an agency has templates that are incorporated, anyone with basic computer skills can successfully retrieve useful data from the system (Burnett, 2007). The key to overcoming the staffing issues or the resource issues is simplicity and delegation. As stated previously, CAD RMS is often where most of the data set originates. Tasking a communications operator to provide the data is a real option that is attainable. Another option is training multiple positions. Since turnover plagues most agencies, having that built-in cross training is essential for GIS success. If an agency

trains one or two people on the complete system of GIS, they can come back and train others on the functionality side. During most trainings with companies on software use, the company will go in depth and train their personnel on every aspect of the software. Not all users need to be that versed in the system. Having staff train others is another way to lower training costs while creating the buy-in needed from the staff. In addition, for smaller applications, the complexity of the software used is increasingly becoming more user friendly. Most available software suites work off a Windows based platform that most users are already familiar with. Simplifying the software is simplifying the process. It is doing more with less. Creating a buy-in and the result realized are all attainable through following a set plan and implementing the plan without hesitation.

RECOMMENDATION

GIS implementation is certainly not a new issue facing agencies. Countless articles and studies have been completed on the useful bi-product of implementing a successful GIS system (Burnet, 2007; Ratcliffe, 2004; Brundey & Brown, 1992). Some agencies received grants to move forward. Others began to phase in the system through strategic planning and sharing of software with other departments to share the expense. Although the decision to move forward and how is different for everyone, the decision to move forward should be implemented.

The studies mentioned above also show that when GIS is implemented correctly, it is an enormous time-saving tool. Looking back at the way law enforcement used to track crime statistics, the information was incomplete, untimely, and it required many resources to gather data. GIS streamlines the information quickly and provides real-time data that can be used to allocate the resources necessary to be more effective.

Further, it gives the viewer a snapshot of a total issue. Before GIS, one might have had a spreadsheet full of spatial data that was cumbersome and hard to read. Converting the data into a GIS mapping model gives a visual perspective on the issues. It also can predict criminal activity when all the information over several years is available. This is useful because planning can be utilized to take a preventative measure in areas that consistently have recurring criminal activity due to weather, the time of year, the time of day, or to special festivals or events that happen on a recurring basis. Getting ahead of the problem is an important purpose of implementing a successful GIS system.

Creating a buy-in atmosphere must come from the very top down to the bottom. If everyone is not committed to the plan, it has the potential to fail. Part of the buy-in is coming up with a strategic plan for implementation, identifying all the departments that could benefit from the GIS system, and getting them to buy support and implement the concept. Another significant portion is identifying the right software needs for the size of the department, figuring out how it will be managed, and deciding who is responsible for ensuring that everything entered is correct and entered timely. Seeing the results of all the hard work and time invested in preparing for the GIS system is the benefit.

Budget issues are always going to be an obstacle to overcome. The police department will always need new equipment, vehicles, uniforms, and other items of daily use to do their jobs effectively. GIS is an additional tool to make the department a success. Looking at GIS as a staple item in the department is a good way to get the buy-in from the staff. Once in place, the benefits gained from the information gathered and shared will pay itself forward. First line officers will feel empowered to get detailed

information about the areas they patrol, and they will focus their efforts on hot spots to reduce crime.

Early identification of what is working and what is not working is important. Although the data and the information might be there, without proper training in its use, GIS might as well be just another computer software program that produces minimal results. Taking specific individuals within the department to produce crime maps and hot spot forecasting could go a long way in ensuring the success of the system. Assigning this task to the communication operators or perhaps the crime prevention staff member would be a wise course of action.

Environmental Systems Resources Institute's (ERSI) is a software company that has been involved with GIS mapping since its inception. ARCGIS is the name of their flagship software that is cutting edge technology in the GIS environment. They can tailor a GIS system to the needs of a department and do it with a very competitive cost factor. During their company's history, they have successfully converted all the spatial data from previous versions of the software into their newest version. This, coupled with their longevity as a leading company in GIS mapping, makes them an excellent choice for all departments looking for a reliable product with ease of use and a sustainable database for successful crime mapping and predicting. They have a top-notch training team that is there for the user. Furthermore, "ESRI products are currently more widely used by active crime analysts" (Bilchler & Balchak, 2007, p. 39).

After reviewing all the evidence into the GIS crime mapping software, it is evident that purchasing and training personnel to use the program will result in spatial data that could be used to deter or minimize criminal activity. Agencies should examine the

different application advantages of a GIS system and integrate a system into their department that is right for them. Budgeting this revolutionary solution to crime trends will go a long way to ensuring a prepared and safe community.

REFERENCES

- Bilcher, G., & Balchak, S. (2007). Address matching bias: Ignorance is not bliss. *Policing: An international Journal of Police Strategies & management*, 30(1), 32-60. doi:10.1108/13639510710725613
- Brown, M. M. (1996). An empirical assessment of the hurdles to geographical information system success in local government. *State & Local Government Review*, 28(3), 193-204. Retrieved from <http://jstor.org/stable/4355160>
- Brudney, J. L., & Brown, M. M. (1992). Do geographic information systems meet public managers' expectations? *State & Local Government Review*, 24(2), 84-90. Retrieved from <http://www.jstor.org/stable/4355038>
- Burnett, E. (2007). Crime analysis reporting and mapping for small agencies: A low-cost and simplified approach. *FBI Law Enforcement Bulletin*, 76(10), 15-22. Retrieved from <https://www.ncjrs.gov/App/publications/abstract.aspx?ID=242076>
- Craglia, M., Haining, R., & Wiles, P. (2000). A Comparative evaluation of approaches to urban crime pattern analysis. *Urban Studies*, 37(4), 711-729. doi:10.1080/00420980050003982
- Dueker, K. J. (1987). Geographic information systems and computer-aided mapping. *American Planning Association Journal*, 53(3), 383-390. doi:10.1080/01944368708976457
- Elwood, S., & Leitner, H. (1998). GIS and community-based planning: Exploring the diversity of neighborhood perspectives and needs. *Cartography and Geographic Information Systems*, 25(2), 77-88. doi:10.1559/152304098782594553

Groff, E. R., & La Vigne, N. G. (2002). *Forecasting the future of predictive crime mapping*. Retrieved from

http://www.popcenter.org/library/crimeprevention/volume_13/03-Groff.pdf

Harries, K., & LeBeau, J. (2007). Issues in the geographic profiling of crime: Review and commentary. *Police Practice and Research, 8*(4), 321-333.

doi:10.1080/15614260701615029

Herchenrader, T., & Myhill-Jones, S. (2014). GIS supporting intelligence-led policing.

Police Practice and Research, 16(2), 136-147.

doi:10.1080/15614263.2014.972622

Ratcliffe, J. H. (2004). Crime mapping and the training needs of law enforcement.

European Journal on Criminal Policy and Research, 10(1), 65-83.

White, J. W. (2007). *A case for enhancing crime analysis for police agencies through Geographical Information Systems (GIS)*. Huntsville, Texas: The Bill Blackwood Law Enforcement Management Institute of Texas.