Data-Driven Approaches to Crime *and* Traffic Safety (DDACTS)

Operational Guidelines

August 2009

EXECUTIVE SUMMARY

Data-Driven Approaches to Crime *and* Traffic Safety (DDACTS) is a law enforcement operational model supported by a partnership among the Department of Transportation's National Highway Traffic Safety Administration and two agencies of the Department of Justice, the Bureau of Justice Assistance and the National Institute of Justice. DDACTS integrates location-based crime and traffic crash data to establish effective and efficient methods for deploying law enforcement and other resources. Using geo-mapping to identify areas through temporal and spatial analysis, that have high incidences of crime and crashes, DDACTS employs targeted traffic enforcement strategies. By saturation locations with high crime and crash incidences with highly visible traffic enforcement, DDACTS communities play a simultaneous dual role: fighting crime and reducing traffic crashes and traffic violations. Drawing on the deterrent value of highly visible traffic enforcement and the knowledge that crimes often involve the use of motor vehicles, the goal of DDACTS is to reduce the incidence of crime, crashes, and traffic violations in communities across the country.

The model's focus on collaboration with law enforcement, community members, and organizations reinforces the crucial role that partnerships play in reducing social harm and improving quality of life. Building on this collaboration, DDACTS positions traffic enforcement as a logical rationale for a highly visible law enforcement presence in a community.

The DDACTS Model

DDACTS ensures accountability and provides a dynamic, evidence-based problem-solving approach to crime and crashes. This approach, grounded in community-oriented law enforcement, suggests that time- and place-based policing, "…as opposed to [traditional] person-based policing, is more efficient as a focus of law enforcement actions; provides a more stable target for law enforcement activities; has a stronger evidence base; and raises fewer ethical and legal problems."[1] The application of high-visibility traffic enforcement is a proven and effective countermeasure that addresses both crime and crashes whether they occur simultaneously or independently in time and/or location. Furthermore, its reliance on geo-mapping to identify the nexus of crashes and crime provides a scientifically based method for law enforcement to accurately target its efforts.

As leaders of this national initiative to improve the quality of life in local communities, NHTSA, BJA, and NIJ are fortunate to have support from a number of national partners. The following organizations will offer technical assistance and in-kind resources through their local affiliates to support law enforcement agencies that use DDACTS:

- American Probation and Parole Association;
- Federal Highway Administration;
- Federal Motor Carrier Safety Administration;
- Governors Highway Safety Association;
- International Association of Chiefs of Police;

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[1] Weisburd, D. (2008, January). Place-Based Policing, *Ideas in American Policing*, Police Foundation, No. 9.

- National Criminal Justice Association;
- National District Attorneys Association;
- National Liquor Law Enforcement Association;
- National Organization of Black Law Enforcement Executives; and
- National Sheriffs' Association.

A Starting Point for Long-Term Change

Implementation of DDACTS is a starting point for executing long-term change in which law enforcement professionals take a more integrated approach to the deployment of personnel and resources. The following presumptions about the future of law enforcement support the necessity for implementing DDACTS:

- Resources allocated for law enforcement activities are frequently not sufficient to keep pace with the demands placed on agencies to respond to calls for service and threats to public safety.
- Decreasing social harm and improving quality of life for communities continue to be primary missions of law enforcement agencies.
- The need for police executives to provide timely and accurate data to justify expenditures and deployment decisions will only increase as Federal, State, and local officials, along with the public, continue to scrutinize the allocation of tax dollars.
- Technology has and will continue to improve the policies and practices of law enforcement. Existing and emerging technologies, such as wireless computers and license plate readers, along with the application of information technology, have greatly enhanced the effectiveness of law enforcement practices.
- Law enforcement agencies must collaborate and keep pace with other public and private service sectors that are turning to information technology to assess needs, deliver services, and manage costs.
- Community-focused, place-based law enforcement has emerged as an effective strategy for addressing current issues of social harm and concerns for public safety.

Finally, because a shortage of law enforcement resources is likely to continue in the foreseeable future, police executives should continue to explore new strategies to further improve quality of life in communities that suffer from the effects of high crime and crash rates.

Implementing the DDACTS Model

DDACTS relies on seven guiding principles for its implementation. Starting with building community partnerships to establish support for highly visible traffic enforcement and to obtain participation that will aid the development of strategic countermeasures and operational plan, DDACTS is based on local data collection and analysis to identify crime, crash, and traffic-related "Hot Spots." As law enforcement agencies execute these plans, routine information-sharing sessions with stakeholders reinforce the collective ownership of the DDACTS initiative. Finally, monitoring, evaluation, and the analysis of outcome measures provide data-driven feedback for adjustments to internal and external activities. The implementation guide outlines procedures and highlights operational considerations based on best practices in the field for each of the following seven guiding principles.

Partners and Stakeholder Participation—Partnerships among law enforcement agencies and with local stakeholders are essential and provide opportunities and synergies for decreasing social harm and improving the quality of life in a community.

Data Collection—Place-based, current crime, crash, and traffic-related data, coded for type of incident, time of day, and day of week are the building blocks of DDACTS. The collection of crime data may include Part I and Part II crimes. Additional data may include citizen complaints, field interviews, dangerous driving behaviors, and other nontraditional data such as the location of parolees and probationers, individuals with suspended or revoked licenses, and wanted persons.

Data Analysis—The creation of integrated maps that overlay crime, crash, and traffic-related data lets agencies identify problem locations, or "Hot Spots." Additional analysis, through a number of proven Hot Spot evaluation techniques, can distinguish causation factors for each type of data, delineate spatial and temporal factors, and consider environmental influences on crime and crashes.

Strategic Operations—Based on data analysis, agencies are able to identify Hot Spots that focus enforcement activities and countermeasures. Hot Spot analysis guides the realignment of workflow and operational assignments to focus enforcement efforts and increase efficiency.

Information Sharing and Outreach—Built into the model are opportunities to share results, promote community participation, and document accomplishments. Regularly generated progress reports give management the documentation needed to keep officers informed, hold meetings with community members, and report to government administrators and elected officials. Progress reports also provide the basis for ongoing media relations.

Monitoring, Evaluation, and Adjustments—Data collection and analysis procedures allow for the monitoring, evaluating, and adjusting of field and internal operations. They also provide an opportunity to regularly assess crime and crash reduction, cost savings, and other outcome measures that define success.

Outcomes—Goals and objectives that emerge during problem area identification and strategic plan preparation are developed into outcome measures. These measures are used to assess effectiveness relating to reductions in crime, crashes, and traffic violations; cost savings; the use of specific interventions; and personnel deployment.

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INTRODUCTION

Data-Driven Approaches to Crime *and* Traffic Safety (DDACTS) is a law enforcement operational model supported by a partnership between the Department of Transportation's National Highway Traffic Safety Administration and two agencies of the Department of Justice, the Bureau of Justice Assistance and the National Institute of Justice. DDACTS integrates location-based crime and traffic crash data to establish effective and efficient methods for deploying law enforcement and other resources. Using geo-mapping to identify areas, through temporal and spatial analysis that have high incidences of crime and crashes, DDACTS employs targeted traffic enforcement strategies. By saturation locations with high crime and high-crash incidences with stepped-up traffic enforcement, DDACTS communities play a simultaneous dual role: fighting crime and reducing traffic crashes and traffic violations. Drawing on the deterrent value of highly visible traffic enforcement and the knowledge that crimes often involve the use of motor vehicles, the goal of DDACTS is to reduce the incidence of crime, crashes, and traffic violations in communities across the country.

Using the Guide

This guide presents procedures and recommended practices for communities to build an implementation plan that integrates implementing DDACTS through the use of seven guiding principles that characterize comprehensive community law enforcement programs. The principles are (1) partners and stakeholder participation; (2) data collection; (3) data analysis; (4) strategic operations; (5) information sharing and outreach; (6) monitoring, evaluation, and adjustments; and (7) outcomes.

Beginning with an overview of the DDACTS initiative, the guide highlights research demonstrating the crime control and traffic safety benefits derived from strategically directed highly visible traffic enforcement. The overview is followed by a general discussion of the use and availability of geo-mapping technology. The main section presents the guiding principles, implementation considerations, and reference materials.

The DDACTS Model

As leaders of this national initiative to improve the quality of life in local communities, NHTSA, BJA, and NIJ understand the challenges faced by law enforcement executives as they strive to weigh competing demands for police services against the allocation of limited resources. Designed to address this challenge, DDACTS ensures accountability and provides a dynamic, problem-solving approach to crime and crashes. And ultimately, DDACTS aims to improve the quality of life in local communities, diminishing social harm caused by both crime and traffic crashes.

This approach, similar to community- and problem-oriented policing, suggests that place-based policing, "…as opposed to person-based policing, is more efficient as a focus of law enforcement actions; provides a more stable target for law enforcement activities; has a

stronger evidence base; and raises fewer ethical and legal problems."[2] The application of high-visibility traffic enforcement is a proven and effective countermeasure that addresses both crime and crashes whether they occur simultaneously or independently in time or location. Furthermore, its reliance on geo-mapping to identify the nexus of crashes and crime acknowledges the important role that information technology plays in law enforcement and other public safety arenas.

DDACTS builds on more than 20 years of research illustrating the residual crime control and traffic safety benefits resulting from data-driven, strategically directed traffic enforcement. Findings from two studies conducted in Indianapolis,[3] referenced in an article titled "Strategic and Tactical Approaches to Traffic Safety," demonstrate some of the benefits of this approach.

- Highly visible traffic law enforcement can be an effective countermeasure for disrupting organized criminal enterprises, particularly when these groups market drugs and illegal firearms. However, such strategies appear to be far more effective when used in high-crime areas.
- Traffic law enforcement can be an effective tool for increasing law enforcement visibility, thus increasing the perceived risk of apprehension. It is important, however, that there be a marked departure from normal practice. Simply increasing the marginal productivity of officers (e.g., increasing contacts from one to two a day) will probably not suffice to achieve this goal.
- When using a general deterrence approach, it is more effective to significantly increase the level of enforcement activity for a brief period of time and then return to the same operational level at a subsequent time. This will increase the residual benefit of the program.
- Using traffic stops as a countermeasure to interdict narcotics, guns, and contraband can be effective as a general crime control strategy.

Further corroboration for these findings is found in studies conducted in Dayton, Ohio, and Kansas City, Kansas. In Dayton, researchers found that when officers assigned to routine patrol increased the number of traffic contacts made during discretionary time, there was a statistically significant reduction in number of arrests for drugs and weapons. "This [finding] led some observers to suggest that once offenders became aware of heightened police activity in the area, they chose alternative routes for transporting these goods."[4]

In the Kansas City Gun Experiment, officers received special training in how to search automobiles for illegal firearms. "During the six-month experiment, gun seizures increased by 65 percent in the target beat, with no increase in the comparison beat. Moreover, the

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[2] Weisburd, 2008.

[3] McGarrell, E. F., Chernak, S., & Weiss, A. (2002, November). Reducing Gun Violence: Evaluation of the Indianapolis Police Department's Directed Patrol Project. NCJ 188740. Washington, DC: National Institute of Justice.

[4] Weiss, A., & Freels, S. (1996, September). The Effects of Aggressive Policing: The Dayton Traffic Enforcement Experiment, *American Journal of Police 15*(3), 45–64.

target beat experienced a nearly 50-percent reduction in gun crimes, and there was only a slight change in the number of gun crimes in the comparison beat."[5]

The Use and Availability of Mapping Technology[6]

A digital point or dot map is essentially an online version of a traditional wall map on which pins are placed to represent crime and crash events. It is comprised of a series of points (dots representing locations of crime and crash incidents), lines (depicting street networks), and polygons (demarking jurisdictional boundaries or precincts). These types of simple maps were used historically by law enforcement to identify problem areas.

DDACTS extends beyond these simplified maps and seeks to use modern geographic information systems (GIS) to identify areas with disproportionately high incidences of crime and crash incidents. Analysts evaluate these incidences in the context of problem-oriented, **intelligence-led policing**, or geographic theories that seek causes for the identified crimes and crashes and appropriate countermeasures to reduce them.

Geographic technologies have significantly improved the ability of crime and traffic analysts, along with researchers, to understand crime and traffic patterns, as well as patterns of victimization. The use of spatial statistical techniques to identify clusters of crime and crashes provides firm evidence that both are occurring in the same places and at the same times. This identification of Hot Spots allows law enforcement executives to use techniques such as high-visibility enforcement countermeasures to more efficiently affect crime and crashes together.

GIS and spatial analysis technologies are widely available to law enforcement agencies. As county and municipal governments invest in multipurpose GIS systems, use by the agency helps in better understanding of problems. In such instances, learning about and participating in planning and designing GIS applications (and contributing data to them) can help meet the specific mapping needs of law enforcement.

There are many GIS software programs for mapping crime and traffic events. Most major commercial software packages can produce quality results for DDACTS mapping objectives. There are some free spatial statistical software packages available. However, they have limited functionality in data transfer and analytical capability.

Mapping requires a diverse set of skills including highly developed visual-spatial abilities, a facility for data management, and a creative way of thinking about the acquisition and use of various types of data. Along with these skills, mapping requires vigilant attention to data quality. Therefore, law enforcement executives will need to identify staff members who demonstrate an aptitude for analysis and provide them with training and resources develop a mapping system.

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[5] Sherman, L. W., Shaw, J. W., & Rogan, D. P. (1995). *The Kansas City Gun Experiment,* Research in Brief, Washington, DC: National Institute of Justice; NCJ 150855; and Sherman, L. W., & Rogan, D. P. (1995). The Effects of Gun Seizures on Gun Violence: 'Hot Spots' Patrol in Kansas City. *Justice Quarterly 12,* 673–693.

[6] Unless otherwise implied, information presented in this section is attributed to the following article: Markovic, J., Bueermann, J., & Smith, K. (2006, June). Coming to Terms With Geographical Information Systems. *The Police Chief*, *73*(6).

The NIJ Office of Science and Technology's Mapping and Analysis for Public Safety (MAPS) Program offers technical assistance and training in crime mapping and GIS through its Crime Mapping and Analysis Program (CMAP). Training is provided free of charge to State and local public safety agencies at locations across the United States. Course offerings and schedules can be found at: www.ojp.usdoj.gov/nij/training/welcome.htm

The extent to which law enforcement agencies are using crime and crash mapping varies greatly, as do the analytical techniques used, the staff involved in the process, and the manner in which mapping is used for deployment decisions. In spite of this variation, as more law enforcement agencies adopt DDACTS and other data-driven approaches for community law enforcement and problem solving, the need for trained personnel and the importance of mapping will grow steadily. Ultimately, the usefulness of geographic technology rests with the proficiency of the individuals using it and the quality of the data used.

Mapping Technology and DDACTS

To adequately measure the effectiveness of high-visibility enforcement countermeasures, law enforcement executives must be prepared to track crime and crash data from the entire jurisdiction. This allows for comparisons among areas in which high-visibility enforcement is and is not conducted. The information below addresses some basic considerations for using GIS and spatial analysis software technology to implement DDACTS. It includes preliminary details on the use of spatial clustering techniques for identifying and analyzing Hot Spots.

Baseline Data

Since crash frequencies are highly variable from year to year (Nicholson, 1985,[7] 1986[8]), police departments should use three years of data to establish a baseline for crash data. The use of a single year of crash and crime data for identifying high crash and high crime locations may yield misleading results due to variation. Smaller metropolitan areas (populations under 100,000) may wish to use four to five years of data to establish a baseline.

Geographical Units of Analysis

Program analysts should select small geographical units for analysis; the preferred unit being the block group. This will allow for some degree of correlation between crashes and crimes, given they do not occur in the exact same space. Additional geographical units to consider may include traffic zones, police beats, or other administrative units which are larger and will increase the strength of the relationship between crime and crash locations as a result.

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[7] Nicholson, A. J. (1985). The variability of accident counts. *Accident Analysis and Prevention*. *17*(1), 47-56.

[8] Nicholson, A. J. (1986). The randomness of accident counts. *Accident Analysis and Prevention*. *18*(3), 193-198.

There are two reasons for using small geographical units. First, since most crashes occur on roads and most crimes occur either on sidewalks or within a property boundary (parcel), exact locations will rarely coincide. Second, common factors are likely to involve the interaction between the road system and the land uses it traverses.

Analysis of Crimes and Crashes

To be effective, Hot Spot analysis must account for the type of crime or crash, its location, and the time of day it occurred. Knowing whether a Hot Spot has an abundance of DWI crashes, auto thefts, and robberies that occur mostly in the evening, as opposed to other types of crashes and burglaries that occur mostly in the afternoon, will greatly influence the deployment of high-visibility countermeasures.

Spatial Clustering, a.k.a. Hot Spots

Optimally, analysts will use spatial clustering techniques to identify Hot Spots of crashes and crimes that overlap. The analysis begins with a global analysis and then proceeds to Hot Spot identification. The purpose of the global analysis is two-fold. One is to determine if clustering exists at all in the jurisdiction. Two is to determine how much one is more clustered than the other. Analysis of clusters or Hot Spots can then give rise to temporal analysis and the appropriate and efficient deployment of resources.

Appendix D, "**A Framework for Mapping Technology Implementation,**" gives detailed information and suggested procedures on the use of spatial clustering and Hot Spot evaluation techniques.

> For additional information on mapping techniques, see *NIJ Special Report: Mapping Crime: Understanding Hot Spots* listed in the resources section.

The identification of Hot Spots through the use of spatial and temporal analysis techniques is the foundation of DDACTS. These analyses will provide stronger evidence for a concentration of crime and crashes; and provide an objective framework for deployment of resources and strategic high-visibility enforcement actions.

DDACTS also encourages the use of high-visibility enforcement as a countermeasure in Hot Spots where the crime and crash data may not overlap. The use of the model can be equally effective in combating these social harm issues separately.

As the role of crime and crash analyses, Hot Spot identification, and the efficient deployment of scarce public service resources are becoming the benchmarks of 21st century policing, law enforcement managers should understand the theory, processes, and nomenclature of these principles.

A Starting Point for Long-Term Change

Implementation of DDACTS is a starting point for executing long-term change in which law enforcement professionals take a more integrated approach to the deployment of officers

and resources. The following presumptions about the future of law enforcement support the imperative for implementing DDACTS:

- Resources allocated for law enforcement activities are frequently not sufficient to keep pace with the demands placed on agencies to respond to calls for service and threats to public safety.
- Decreasing social harm and improving quality of life for communities continue to be primary missions of law enforcement agencies.
- The need for police executives to provide timely and accurate data to justify expenditures and deployment decisions will only increase as Federal, State, and local officials, along with the public, continue to scrutinize the allocation of tax dollars.
- Technology has and will continue to improve the policies and practices of law enforcement. Existing and emerging technologies, such as wireless computers and license plate readers, along with the application of information technology, are already considered efficient and effective tools for law enforcement.
- Law enforcement agencies must collaborate and keep pace with other public and private service sectors that are turning to information technology to assess needs, deliver services, and manage costs.
- Community-focused, place-based law enforcement has emerged as an effective strategy for addressing current issues of social harm and concerns for public safety.

Finally, because a shortage of law enforcement resources is likely to continue in the foreseeable future, police executives should continue to explore new strategies to further improve quality of life in communities that suffer from the effects of high-crime and crash rates.

IMPLEMENTING DDACTS

In addition to recognizing the efficacy of traffic enforcement as a tool for reducing crime and crashes, DDACTS positions traffic enforcement as a logical rationale for a highly visible law enforcement presence in a community. Its focus on collaboration with community members and organizations reinforces the important role that partnerships play in improving quality of life. Furthermore, by analyzing the confluence of crime and crashes, DDACTS gives law enforcement agencies an opportunity to use effective interventions and to create new strategies for addressing both issues.

As law enforcement agencies execute these plans, routine information-sharing sessions with stakeholders reinforce the collective ownership of the DDACTS initiative. Finally, monitoring, evaluation, and the analysis of outcome measures provide data-driven feedback for adjustments to internal and external activities.

The following sections elaborate on the seven guiding principles. They outline implementation procedures and highlight operational considerations based on best practices in the field. Although the principles are presented sequentially, many of the activities may be undertaken simultaneously.

Guiding Principle I—Partners and Stakeholder Participation

Partnerships among criminal justice agencies and between law enforcement agencies and local stakeholders are essential to DDACTS. Stakeholders may contribute traditional and nontraditional data for mapping purposes, help promote the initiative to the community, and provide important feedback on how the community is reacting to increased traffic enforcement.

As part of DDACTS partnership development activities, law enforcement agencies also will need to reach out to stakeholders and partners. Stakeholders and partners can include any individual or organization that is involved or interested in reducing social harm and improving the quality of life in a particular community, such as:

- Local civic and business organizations such as State Departments of Social Services, Rotary Clubs, Chambers of Commerce;
- Local government agencies such as courts, Offices of the District Attorney, Departments of Corrections, Divisions of Probation and Parole, licensing bureaus, Departments of Transportation, Metropolitan Planning Organizations;
- Law enforcement agencies with concurrent jurisdictions:
  State police, sheriffs' offices, adjacent local and municipal law enforcement agencies;
- Elected officials;
- Crime or crash victims;
- Neighborhood associations;
- Community leaders;
- Urban renewal groups such as "Weed and Seed" organizations;
- Commercial establishments;

- Media; and
- Organizations with an interest in crime reduction and traffic safety issues.

Stakeholder and partner support for highly visible traffic enforcement is vital to the success of a DDACTS initiative. Therefore, it is very important to allow startup time to engage and develop a system for working with stakeholders.

> For additional information on partnerships and stakeholders, see *A Guide to Reducing Crime and Disorder Through Problem-Solving Partnerships* listed in the Resources Section.

Key Element I—Identify and Make Initial Contact With Potential Partners and Stakeholders

Look for traditional as well as nontraditional partners and stakeholders to form associations with them. Focus on local organizations working to reduce crime or improve traffic safety in the identified Hot Spots. Before making any contacts, have a clear idea of the contribution or role each group can make in support of the DDACTS initiative.

Action Items

- Develop a list of partner and stakeholder categories.
- Identify known individuals and organizations for each category.
- Identify the assistance or data that partners or stakeholders might provide.
- Give a DDACTS overview to each potential partner and stakeholder.
- Assign personnel responsible for contacting partners and stakeholders.

Considerations

- Community residents and businesses are a good source of information about where and when crime and traffic safety issues occur.
- Solicit law enforcement staff for input regarding partner and stakeholder participation.

A written description of the DDACTS initiative and the role that partners and stakeholders play can help them make decisions about participating. (Agencies can modify NHTSA's brochure describing the DDACTS initiative for this purpose.)

Key Element II—Develop a Plan for Partner and Stakeholder Participation

Partners and stakeholder groups will make different contributions to the DDACTS initiative, directly and indirectly. In some instances they will lend credibility to the use of highly visible enforcement; in other instances, they might provide access to various populations within a community or provide information about criminal and traffic safety activities. Considerations for plan development include the need to:

- Identify the various roles and contributions that partners and stakeholders can make to the DDACTS initiative;

- Develop organizational structure(s) that define expectations and interactions (e.g., coalition, advisory group, working group);
- Create specific objectives for partner and stakeholder participation;
- Define expectations for the agency's interactions with partners and stakeholders (e.g., number and frequency of meetings, reporting of DDACTS activities);
- Delineate staff responsibilities for interactions with various partner and stakeholder groups (e.g., documentation of meetings, calls, and e-mails); and
- Identify resources for hosting partner and stakeholder participation (e.g., meeting rooms, presentation technology).

Action Items

- Assign responsibility and a timeframe for plan development.
- Assign responsibility for logistical and administrative support.
- Conduct initial and follow-up meetings with partners and stakeholders.
- Designate partners and stakeholders who will provide feedback and public support to achieve consensus for the final plan.
- Distribute the plan.
- Implement the plan.

Considerations

- Allocate sufficient time for partner and stakeholder outreach and the formation of relationships.
- Make sure partner and stakeholder relationships are in place, before starting enforcement activities.
- Invite partners and stakeholders to internal planning sessions, when appropriate.
- Always document interactions with stakeholders.
- Seek opportunities to promote stakeholder support.

Guiding Principle II – Data Collection

Current place-based, traffic and crime data, coded for type of incident, time of day, and day of week are the building blocks of DDACTS. The collection of crime data may include Part I and Part II crimes and code enforcement. Traffic safety data may include crash causation factors and enforcement contacts. Additional data may include citizen complaints, field interviews, dangerous driving behaviors, and other nontraditional data such as parolees and probationers, individuals with suspended or revoked licenses, and wanted persons.

> For additional information on data collection and analysis, see *Problem Analysis in Policing* and *Assessing Responses to Problems: An Introductory Guide for Police Problem-Solvers,* listed in the Resources Section.

Key Element I—Review Current Data Collection and Analysis System

A review of the current system includes assessment of staffing levels and expertise, internal and external data sources, types and format of data used for strategic planning, software and hardware, routine collection and analysis procedures, and reporting protocols. Particular attention should be given to gaps in the data sets, including over and under reporting. The following action items provide an overview of the areas to examine when assessing an agency's data collection and analysis system as a precursor to undertaking a DDACTS initiative.

Action Items

- Identify the need for additional staff or training of current staff to undertake the collection, mapping, and analysis of crime and crash data.
- Examine software programs and hardware systems to identify the best approach for mapping crime and crash data.
- Identify which Hot Spot techniques are going to be used and standardize the input and output parameters to be used for comparison purposes.
- Determine the need to collect additional data and identify the sources from which to obtain it.
- Determine the need to adjust routine collection and analysis procedures.
- Review reporting protocols to identify necessary modifications.

Considerations

- DDACTS requires expertise in crime and traffic data collection and analysis. As law enforcement executives assess personnel resources, they can begin to develop collaborative efforts among officers who investigate crime and those who work traffic.
- Different crime and crash types have different spatial structures. Therefore, Hot Spots will be different as spatial environments change.
- Agencies pursuing implementation of DDACTS, but not currently using information technology for crime and traffic data analysis, can seek technical assistance through Federal, State, and local government agencies to identify systems used in other jurisdictions.
- Assessing the current data collection system provides an opportunity for management to examine external requirements, compatibility with other data systems, and data accessibility.
- Information generated from DDACTS can provide an opportunity to modify and expand reporting protocols and methods for sharing information.

Key Element II—Finalize Selection of Mapping Software

Based on its current software and hardware systems for analyzing crime and crashes, agency analysts can determine the need for additional mapping resources. Agencies without in-house capabilities can examine more traditional approaches for mapping or identify additional resources and partnering opportunities to develop mapping capabilities. At a minimum, a professional geographic information system will be required.

Action Items

- Review potential data categories to determine software mapping requirements.
- Determine whether current software/hardware programs can be adapted to meet an agency's DDACTS data analysis requirements.
- If necessary, purchase new software/hardware or procure free online programs.

Considerations

- Consider seeking technical assistance and funding through Federal, State, and local government agencies that might provide support for data collection, analysis, and mapping tools.
- Consult with agencies that have mapping programs to obtain input regarding free and commercial mapping programs.
- Be aware of the limitations of proprietary off-the-shelf software (e.g., interoperability, transfer limitations, licensing fees).
- Begin building a case for budget allocations in support of mapping hardware and software for future budget cycles.
- Explore the use of shared systems with internal and external partners.

Key Element III—Create a Data Collection Plan and Identify Data Sources

Based on the selection of mapping software, the data collection and analysis team will need to develop a data collection plan. The plan will identify all internal and external data that will be mapped, new data sources, and a timeframe for the initial collection and ongoing updating of data. For comparison purposes, the plan also should include the collection of baseline data from previous years.

Action Items

- Identify the specific types of data to be collected for mapping.
- Incorporate systems to archive data for future use and transparency of the program
- Identify data sources.
- Develop guidelines for data quality control.
- Ensure that data gaps are identified and addressed.
- Identify protocols/data collection procedures that will be followed to obtain the data.
- Identify individuals responsible for data collection.
- Develop a schedule for data collection and updating.

Considerations

- Give all appropriate personnel the opportunity to make recommendations about the types of data the agency will collect and map.
- Obtain input from community stakeholders about nontraditional data that might enhance Hot Spot analysis.
- Consider how community stakeholders will react to the data collection plan. Be prepared to explain the benefits of all information being collected.

Guiding Principle III—Data Analysis

The creation of integrated maps that overlay traffic and crime data enables agencies to identify problem locations and Hot Spots. Additional analyses distinguish causation factors for each type of data, delineate temporal factors, and consider environmental influences on crime and crashes. The conclusions derived from the data analyses will lead to the identification of problem areas and the development of strategic and tactical traffic enforcement countermeasures.

> For additional information on data analysis and Hot Spots, see *Mapping Crime: Understanding Hot Spots,* listed in the Resources Section.

Key Element I—Develop a Clear Process for Data Analysis

Law enforcement agencies should establish a realistic process for data analysis based on the availability of resources to perform the mapping and analysis function. These agencies must ensure that the identified resources include the expertise of qualified traffic and crime analysts. Agencies also should allocate resources to analyze the overall impact of the DDACTS initiative on agency operations.

This quality analysis is used to efficiently and effectively allocate resources. The principal theme in data analysis centers on the premise that crime and traffic safety initiatives should use Hot Spot maps as the most effective guide for law enforcement action, when development of these maps is guided by theory and focused evaluation techniques. With the appropriate Hot Spot theory, maps can communicate vital information to law enforcement officials and community members efficiently and effectively.[9]

Action Items

- Establish parameters for the scope and capacity of the data analysis function.
- Identify which Hot Spot techniques are going to be used and standardize the input and output parameters to be used for comparative purposes.
- Obtain the services of crime and traffic analysts.
- Perform mapping and analysis to identify Hot Spots.
- Perform analysis of causation and temporal factors and environmental influences.
- Perform analyses of nontraditional data.
- Consider the role that displacement and erosion might have on crime reduction and traffic activities.
- Perform baseline analysis with crime and traffic data from the previous year(s).
- Develop a plan for future analyses.

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[9] Eck, J. E., Chainey, S., Cameron, J. G., Leitner, M., & Wilson, R. E. (2005, August). *Mapping Crime: Understanding Hot Spots*, NCJ 209393. Washington, DC: Office of Justice Programs, National Institute of Justice.

Considerations

- The results from all of the data analyses will encourage buy-in for the program from agency personnel. Therefore it is important to build internal mechanisms for regularly informing personnel, stakeholders, and partners of findings from the data analysis.
- Different crime and traffic crash types have different spatial structures and will change as spatial environments change.
- The focus for the mapping should remain on crime and crashes and traffic safety. Mapping violations, citations, and complaints can be included; however, these types of data require close scrutiny before being used, due to potential misinterpretation and privacy issues.
- Many groups will be interested in the results of the data analysis. Be clear about who will have access to what information and how it will be presented.

Key Element II—Develop Reporting Procedures

The findings from the data analysis are an important tool for garnering internal and external support for DDACTS implementation within identified Hot Spots. In addition to encouraging officer buy-in, findings from the data analysis can be used to inform government officials, community members, and the media about progress, challenges, and expectations for crime reduction and traffic safety improvements. Depending on the scope of the analysis, results also can help other agencies with their own strategic planning.

Action Items

- Determine who will have online access to data and who will receive what type of information.
- Consider drawing shared data from external sources when creating reports.
- Examine formats for data output.
- Develop formats for internal report generation.
- Distinguish between internal and external reporting needs.
- Develop a reporting schedule.
- Ensure accuracy and transparency of information prepared for distribution.
- Develop a review process for all information prepared for external use.

Considerations

- Report generation depends on the availability of resources and personnel who perform the mapping and analysis function.
- Make sure that any information prepared for external use includes background and provides context about the DDACTS initiative.
- Consult with appropriate staff regarding reporting formats under consideration.

Guiding Principle IV—Strategic Operations

DDACTS is designed to provide accurate and objective data to identify Hot Spots and an unbiased basis for making strategic and tactical decisions. Based on the objective findings

of the data analysis, agencies identify a mix of highly visible traffic enforcement countermeasures. Data analysis also guides the realignment of workflow and operational assignments to help focus crime and traffic enforcement efforts, thus increasing efficiency. Law enforcement executives must be prepared to take strong leadership roles to successfully integrate DDACTS into routine operations. In these roles they should be prepared to:

- Promote the efficacy of highly visible traffic enforcement as a core operational element for reducing crime and increasing traffic safety;
- Review agency policies, goals, and objectives to ensure that they support the use of traffic enforcement countermeasures;
- Commit time and resources to the implementation of the model;
- Reallocate resources to purchase equipment to support traffic enforcement countermeasures (e.g., speed-measuring devices, portable breath test devices, license plate readers, etc.).
- Demonstrate flexibility and creativity to address officer and community reactions to highly visible traffic enforcement;
- Make adjustments to field and internal procedures, as appropriate;
- Promote teamwork among staff focusing on reducing crime and improving traffic safety; and
- Provide training to ensure staff members have the skills needed to perform new duties required by the model.

> For additional information on strategic operations, see *Traffic Safety Strategies for Law Enforcement: A Planning Guide for Law Enforcement Executives, Administrators and Managers and Police Enforcement Strategies to Prevent Crime in Hot Spot Areas* listed in the Resources Section.

Key Element I—Identify Countermeasures

The types of crimes, crashes, and traffic safety issues identified through the data analyses will dictate the selection of traffic enforcement countermeasures. During this process, agencies may need to consider the procurement of additional equipment, provision of additional training, and the reallocation of personnel necessary for specific traffic enforcement countermeasures. As appropriate, staff should include partners and stakeholders in discussions on countermeasure selection.

Action Items

- Identify all crime and traffic enforcement activities currently underway in the Hot Spots to account for deconfliction issues and resource management.
- Develop a preliminary list of proposed traffic enforcement countermeasures.
- Make projections on the effect that increased traffic enforcement may have on crime reduction and traffic safety; develop interim goals supporting these projections and measures for analyzing them.
- Identify equipment, training, personnel, and other needs associated with the selected countermeasures.

- Obtain input from partners and stakeholders.

Considerations

- Identify the countermeasures needed to address the problems in the Hot Spots.
- Ensure that all discussions on countermeasure identification include staff members who are engaged in implementing the countermeasure identification and implementation.
- Build on the positive experiences of others that have used a mix of enforcement countermeasures.
- Review exemplary programs and consult with other law enforcement executives who have used saturation patrols and other highly visible traffic enforcement strategies to reduce crime and improve traffic safety.
- Examine the benefits of investing in existing and new enforcement technologies.
- Consider and address, when appropriate, objections to specific countermeasures raised by partners and stakeholders.

Key Element II—Develop an Operational Plan

A comprehensive operational plan describes the overall deployment strategy for the Hot Spot and provides the framework for monitoring, evaluating, and adjusting the deployment strategy. An important component of this strategy is staff training activities that address the multiple skill sets associated with crime and traffic enforcement. The operational plan might include the following elements.

- Goals and objectives
- Strategic approach to Hot Spot deployment
    - Traffic enforcement countermeasures
    - Crime reduction countermeasures
    - Frequency and timing of countermeasures
    - Multijurisdictional interaction and enforcement
- Personnel requirements
- Training of staff
- Equipment and other resources
- Operational plan implementation
    - Daily enforcement activities
    - Weekly enforcement activities
    - Officer assignments
    - Reporting activities
    - Internal briefings
    - External briefings
    - Debriefings
    - Scheduling
- Budgeting
- Evaluation

Action Items

- Assign writing responsibilities for plan development.
- Gather information necessary for plan development.
- Develop schedule.
- Identify review process.
- Review and finalize the plan.
- Distribute plan.

Considerations

- Law enforcement executives need to identify goals and objectives that address the impact of DDACTS on overall operations, as well as the impact on reducing crime and improving traffic safety in Hot Spots.
- Operational categories for plan development can include impact on personnel assignments and scheduling, staff performance, expenditures, and accountability.
- Other agencies that have jurisdiction in the Hot Spot should be involved in plan development.
- Incorporate cost-benefit criteria when developing the operational plan.

Key Element III—Implement Plan

A number of factors may influence the best time to start highly visible traffic enforcement activities. In addition to considering these factors, law enforcement executives should take measures to inform staff, partners, and stakeholders, formally and informally, about the timing of plan implementation.

Action Items

- Set up formal meetings and briefings, before plan implementation, to prepare staff for changes.
- Hold a formal briefing for all staff to announce the start of the DDACTS initiative.
- Work with partners, stakeholders, and media to develop appropriate communications to announce the DDACTS initiative.
- Ensure staff members understand the importance of communicating the appropriate message during every enforcement contact.

Considerations

- All staff should be kept informed throughout the implementation of the DDACTS initiative.
- A formal announcement and media outreach addressing the startup of DDACTS traffic enforcement countermeasures is vital to the success of plan implementation.
- Launching the initiative with a formal announcement and media event will demonstrate respect for the community and promote collaboration with partners and stakeholders.

Guiding Principle V—Information Sharing and Outreach

Information sharing and outreach reflects the community-based nature of DDACTS, in which law enforcement agencies not only share progress but also rely upon feedback from community members and other partners and stakeholders. Throughout the communications process, law enforcement agencies should include messages that reinforce the objective nature of DDACTS, which allows law enforcement agencies to use data to identify Hot Spots and provide an unbiased basis for making strategic and tactical decisions. Communicating this information about the model to partners, stakeholders, and citizens will increase understanding and support for the initiative.

> For additional information on information sharing and working with the media, see *Guidelines for Developing a Municipal Speed Enforcement Program* in the Resources Section.

Key Element I—Review Partner and Stakeholder Plan to Identify Tactics for Information Sharing and Outreach

Regularly generated progress reports give management documentation needed to keep staff informed, hold meetings with community members, and report to government administrators and elected officials. Progress reports also provide the basis for ongoing media relations.

Many factors can affect the implementation of DDACTS and law enforcement executives must be prepared to address challenges as well as successes. Therefore, communications strategies and tactics should be based on the goals and objectives identified in the plan for partner and stakeholder participation.

Action Items

- Review partner and stakeholder participation plan to identify their roles in outreach activities.
- Based on roles, identify tactics for sharing and gathering information.
- Identify tools for communicating with partners and stakeholders.
- Assign staff responsibilities for coordinating the preparation of outreach materials and conducting information-sharing sessions.
- Develop a step-by-step guide to assist other agencies in developing and implementing a similar program.

Considerations

- Meet with appropriate staff to develop realistic expectations about the information suitable for sharing with partners and stakeholders and the timing of its availability.
- Identify information milestones and timeframes for information sharing.
- Identify opportunities for partners and stakeholders to participate in internal briefing sessions.
- Do not underestimate partners' and stakeholders' interest in data collection and analysis.

Key Element II—Develop a Plan for Communicating Through Media Outlets

Informing the public regarding traffic enforcement and crime reduction activities and the resulting impact of DDACTS is crucial to the long-term success of the model. Working with the data analysts and designated staff, the agency's public information officer or spokesperson should develop a plan for communicating through media outlets to share information about the DDACTS initiative.

Action Items

- Develop a communications plan for working with the media that includes background information, key events, and milestones that warrant publicity.
- Develop accurate, consistent messages delineating the goals, objectives, elements, and results of the DDACTS initiative.
- Identify general and audience-specific media outlets that reach all designated audiences.

Considerations

- Develop background information for the media that describes DDACTS; emphasizes the deterrent effect of highly visible traffic enforcement; and includes a list of partners, stakeholders, and other supporters of the initiative.
- Be prepared to address traffic safety issues, along with issues pertaining to possible, perceived, or the actual displacement of crime.
- Make sure to communicate successes in crime suppression.
- Include DDACTS information for the general public on the agency's Web site.

Guiding Principle VI—Monitoring, Evaluation and Adjustments

Law enforcement executives should monitor the effectiveness of traffic enforcement countermeasures and their impact on traffic safety and social harm. Regular reviews of impact data on arrests, crashes, and citations allow for adjustments to the mix of traffic enforcement countermeasures and the deployment of officers. In addition, scheduled briefings keep executives aware of officers' performance and concerns.

Law enforcement executives also will have the opportunity to assess the impact that highly visible traffic enforcement has on the performance of other law enforcement activities—non-traffic-related arrests, processing arrested individuals, filing reports, making court appearances. This information will contribute to decisions about the reallocation of resources and the deployment of officers who investigate crime.

> For additional information on monitoring and evaluating, see *Crime Analysis for Problem Solvers in 60 Small Steps* in the Resources Section.

Key Element I—Use Data and Other Information to Make Adjustments to DDACTS Field Operations

The intervals and duration of each traffic enforcement countermeasure may determine the timing of data analysis and reporting. Staff feedback, along with information obtained from partners and stakeholders may be summarized in weekly or monthly reports.

Action Items

- Develop a schedule for reviewing crime and crash incidence data, along with feedback from staff, partners, and stakeholders.
- Meet with data analysts and staff to discuss findings.
- Make appropriate adjustments.

Considerations

- Be aware of displacement and erosion as factors that can contribute to crime reduction; make adjustments to account for each.
- Based on the data analysis, adjust countermeasures in response to increases and decreases in crimes and crashes.
- Examine the need for additional training to create more effective teamwork among staff.
- Compare staff efficiency and focus before and after implementation of DDACTS.
- Maintain contact with appropriate criminal justice officials regarding the effect that increased traffic enforcement has on their processes.

Key Element II—Document and Report Changes

Documenting changes and adjustments to all aspects of DDACTS will increase the potential for long-term success. These changes and adjustments might pertain to:

- Additions or deletions of data sources;
- Changes in mapping techniques;
- Expansion of data analysis;
- Benefits/challenges associated with use of nontraditional data sources;
- Benefits/challenges of working with various partners and stakeholders;
- Equipment purchases;
- Reallocation of resources and staff;
- Staff training;
- Administrative duties; and
- Expenditures and budget reallocations.

Action Items

- Review the operational plan to identify areas for documentation.
- Develop procedures and formats for documenting DDACTS activities and outcomes.
- Assign responsibility for documentation and reporting activities.

Considerations

- Reports should be accurate, transparent, understandable, timely, and thorough.
- Disseminate reports to appropriate staff, partners, and stakeholders.
- Key partners and stakeholders should review final reports prior to general distribution.

Guiding Principle VII—Outcomes

Inherent in the decision to use DDACTS is a commitment to changing attitudes and practices regarding crime reduction and traffic safety improvement. To document this change, law enforcement executives should establish goals and objectives, based on the initial data collection and analysis that address specific outcomes demonstrating how DDACTS works to reduce social harm. They also should consider conducting a cost-benefit analysis to examine how administrative and operational costs associated with implementing DDACTS may impact these outcomes.

Outcome measures or measures of impact that address a reduction in crime and increased traffic safety may include:

- Individual and collective numbers of fatal, injury, and property-damage-only crashes;
- Numbers of Part I and Part II crimes;
- Numbers of enforcement contacts for driving offenses; and
- Numbers and types of arrests.

Administrative outcomes may include the following:

- Labor costs;
- Equipment costs; and
- Overhead and other administrative costs.

Additional outcomes may include:

- Increased cooperation and training among officers specializing in crime suppression and investigation and those specializing in traffic safety and enforcement; and
- Community support for highly visible traffic enforcement.

Action Items

- Identify areas for monitoring and evaluation.
- Develop outcome measures.
- Identify monitoring and evaluation methods.
- Assign responsibility for monitoring and evaluation.

Considerations

- Include staff in the development of outcome measures.
- Look for ways to apply the findings from Hot Spot analysis to deployment decisions in other locations.
- Monitor relationships with partners and stakeholders from the Hot Spot location to obtain insights on ways to improve community relations in other Hot Spots.
- Incorporate cost-benefit criteria when measuring outcomes.

Appendix A

NATIONAL SUPPORT FOR DDACTS

As leaders of this national initiative to improve the quality of life in local communities, NHTSA, BJA, and NIJ are fortunate to have support from a number of national partners. The following organizations will offer technical assistance and in-kind resources through their local affiliates to support law enforcement agencies that undertake DDACTS initiatives:

- American Probation and Parole Association;
- Federal Highway Administration;
- Federal Motor Carrier Safety Administration;
- Governors Highway Safety Association;
- International Association of Chiefs of Police;
- National Criminal Justice Association;
- National District Attorneys Association;
- National Institutes of Justice;
- National Liquor Law Enforcement Association;
- National Organization of Black Law Enforcement Executives; and
- National Sheriffs' Association.

NHTSA, BJA, NIJ, and their partners are prepared to facilitate the provision of technical assistance teams to work with local law enforcement agencies on various aspects of DDACTS. They also will serve as intermediaries for identifying local partnerships and obtaining technical assistance from local affiliates and State agencies.

For additional information and technical assistance, contact:

National Highway Traffic Safety Administration
Enforcement and Justice Services Division
1200 New Jersey Avenue SE.
Washington, DC 20590
202-366-4295

Bureau of Justice Assistance
Office of Justice Programs
810 Seventh Street NW.
Fourth Floor
Washington, DC 20531
202-616-6500

National Institute of Justice
810 Seventh Street NW.
Washington, DC 20531
202-307-2942

Appendix B

RESOURCES

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Stuster, J. (1995, August). *Experimental Evaluation of Municipal Speed Enforcement Programs. Final Report.* Washington, DC: National Highway Traffic Safety Administration.

Weisburd, D. (2008, January). Place-Based Policing. *Ideas in American Policing,* Number 9. Washington, DC: Police Foundation.

Appendix C

GLOSSARY OF SELECTED TERMS

Baseline data – Basic information gathered before a program begins. It is used later to provide a comparison for assessing program impact. Three years of baseline data is recommended, particularly for crash incidence.

Crime*Stat* - A spatial statistics program for the analysis of crime incident locations, funded by grants from the National Institute of Justice (grants 1997-IJ-CX-0040, 1999-IJ-CX-0044, and 2002-IJ-CX-0007). http://www.nedlevine.com/nedlevine17.htm

Data-Driven Approach to Crime *and* Traffic Safety (DDACTS) National Initiative – A joint effort of NHTSA, BJA, NIJ, and partner organizations to encourage law enforcement agencies to implement a business model that uses highly visible traffic enforcement strategies to fight crime and reduce crashes at the local level by using geo-mapping techniques to identify Hot Spot areas, which support enhanced resource allocation. The initiative encourages using the full range of traditional and non-traditional partners to increase effectiveness.

Deconfliction – The process of avoiding conflicts in investigative and operational programs. Often, investigative efforts such as undercover operations create the potential for conflict between agencies which are unknowingly working in close proximity to each other or agencies that may be coordinating an event on the same suspect at the same time. In either case, agencies may interfere with each other's cases, causing investigative efforts to be disrupted or, worse, officers to be unintentionally hurt or killed. Deconfliction databases can prevent these problems. Cite: http://www.riss.net/rissafe.aspx.

Displacement – Displacement of crime refers to changes in crime patterns that occur because offenders adapt their behavior as a result of some change in opportunities for offending. http://www.weedandseed.info/docs/studies_other/displacement-final-report.pdf

Evidence-Based Policing - Evidence-based policing is the use of the best available research on the outcomes of police work to implement guidelines and evaluate agencies, units, and officers. Put more simply, evidence-based policing uses research to guide practice and evaluate practitioners. It uses the best evidence to shape the best practice. http://www.policefoundation.org/pdf/Sherman.pdf

Erosion – A natural decrease in criminal activity and traffic offenses crashes as a result of displacement.

Geo-mapping – The location-based tracking of an event or incident, most often using some type of computerized geographic information system.

Highly visible enforcement – The use of sustained and focused traffic enforcement strategies to fight crime and reduce crashes and traffic violations.

Hot Spot – Crime and traffic data analysis and evaluation dedicated to locating concentrations of crime, crash and traffic safety problems.

Intelligence-Led Policing – Intelligence-led policing is a business model and managerial philosophy where data analysis and crime intelligence are pivotal to an objective, decision-making framework that facilitates crime and problem reduction, disruption and prevention through both strategic management and effective enforcement strategies that target prolific and serious offenders. http://jratcliffe.net/research/ilp.htm

Kernel Density Estimation (KDE) technique – A spatial analysis method that creates a smooth surface of the variation in the density of point events across an area.

Nearest Neighbor Hierarchical Clustering – A spatial analysis method that uses a technique to identify groups of a minimum number of user-defined points. The technique identifies only those points that are closer than expected under spatial randomness.

Nontraditional data – Data not normally used to track criminal or traffic or criminal activity.

Person-based policing – An approach to crime reduction that focuses on individuals who commit crimes or engage in unsafe driving behaviors, as a means for deploying resources.

Place-based policing – An approach to crime and crash reduction that focuses on places where crime and crashes occur, as a means for deploying resources.

Shared system – A system designed for use by more than one agency (e.g., 911 dispatch systems).

Social Harm – An approach to community issues that should encompass physical harm, financial/economic harm, emotional/psychological harm and cultural safety.

Appendix D

A Framework for Mapping Technology Implementation

A general framework should be implemented to identify crash and crime Hot Spots. As the primary focus of DDACTS is to examine the relationship between crashes and crimes, the use of spatial statistical techniques to identify clusters of each is needed to provide firm evidence that both are occurring together in the same places, and at the same times. Through this unique identification of crash and crime Hot Spots, high-visibility enforcement countermeasures can be focused to more efficiently affect crime and crashes together. Spatial statistical techniques can also be applied to identify areas that are Hot Spots of crashes but not of crimes, and areas that are Hot Spots of crimes but not of crashes, so that appropriate countermeasures may be taken.

The following is a general method for locating high concentrations of crimes and crashes:

1. Analyze relatively small geographical areas, but not pinpoint locations. There are two reasons for this. First, exact locations will rarely coincide, due to the fact that most crashes occur on roads whereas most crimes occur off the roads, either on sidewalks or within a property boundary (parcel). Second, common factors are liable to involve the interaction between the road system and the land uses they traverse. The analysis unit, thus, should be as small as possible such as a block group, traffic analysis zone, police beat, or some other administrative unit. The preferred unit would be the block group. This will allow some degree of correlation to be observed between crashes and crimes given they do not happen in the exact same space.

2. Use three years of baseline data to account for high annual variations in crash frequencies (Nicholson, 1985[10], 1986[11]). In fact, it is common (if not required) in crash analysis to require three years of data as a basis for allocating Federal safety funds.

3. First determine if a simple correlation exists between crashes and crimes at a given location. However, a simple correlation may be a poor indicator of coincidence because both crashes and crimes are highly clustered. In most locations, there may be no relationship between the two types of events. But in key locations, the relationship should be very strong.

4. Analyze correlations by time of day. Many Hot Spots are temporally bound. For example, many crashes occur in the afternoon and early evening. Thus, many crash Hot Spots would also have this periodicity. Conversely, DWI crashes tend to occur at night and DWI crash Hot Spots also would occur during this period. For crimes, burglaries occur mostly in the afternoon while auto thefts and robberies occur mostly in the evening. Without analyzing crashes and crimes by time of day, spurious associations may occur.

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[10] Nicholson, A. J. (1985). The variability of accident counts. *Accident Analysis and Prevention.* *17*(1), 47-56.

[11] Nicholson, A. J. (1986). The randomness of accident counts. *Accident Analysis and Prevention.* *18*(3), 193-198.

5. Conduct spatial analyses to determine:

a.   The degree of global spatial autocorrelation. Often, crime is more concentrated than crashes, though both are highly concentrated relative to the population distribution. Crashes tend to correlate with the distribution of employment whereas crimes tend to correlate with the interaction of employment and lower income levels. It must be recognized that there is only some overlap between crime and crashes. DDACTS primary focus is in those locations where there is substantial overlap.

b.   A visualization of the concentration of events using a **Kernel Density Estimation** technique. A fixed bandwidth (standard search distance) should be used to identify clusters of crimes and crashes. This allows for the scale of identified clusters to be consistent for comparative purposes. The distance should be relatively small due to crashes being confined to a street network and will allow for a high-visibility intervention program to be implemented in more precise areas.

Ripley's K in *CrimeStat*[12] can be used to identify the fixed distance to be specified. It should be used for all crime types and crashes and the average distance between a crime type and crashes will become the fixed distance to use. In terms of the mathematical function, a quartic function is commonly used as it is more compact and will consider only those observations that fall within the specified fixed distance for clustering. Given that that the size of the bandwidth will be small, and likely non-normal, it provides a distance decay weighting that falls off systematically in calculating estimates that are more uniform under the kernel.

c.   Independently determine specific Hot Spots for crashes and correlated crime types. There are a number of techniques for identifying these, but it is recommended that the Nearest Neighbor Hierarchical Clustering (NNHC) routine in *CrimeStat* be used. NNHC identifies clusters of incidents that are closer together than random chance. There are two types of geographic outputs from the NNHC technique, which are standard deviational ellipses (SDE) and convex hulls. The convex hulls should be used for comparison between the crime types and crashes as they are more precise as to the true geographic distribution than the SDEs. This should be done by time of day based on the prevalence of a crime type and specific crash types.

Once identified each of the results from the crime and crash incidents should be overlaid and then ranked for priority for the intervention.

d.   Risk-adjusted Hot Spots if data is available. Crime Hot Spots typically occur where the greatest concentration of people occurs, usually in commercial areas (and where employment can be used as a rough estimate of this). Crash Hot Spots tend to occur where traffic volumes are highest. In order to control for the underlying number of persons who could be exposed to

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[12]http://www.icpsr.umich.edu/CRIMESTAT/

these events, it is preferable to analyze the incidents relative to a baseline of exposure. For crashes, the analysis is the number of crashes relative to vehicle miles traveled (usually in terms of 10 million vehicle miles traveled, VMT) while for crimes, the analysis is the number of crimes relative to employment (or population). There are two ways to conduct a risk-adjusted clustering. One is through a dual kernel density interpolation that interpolates crashes or crimes to small grid cells and then also interpolates VMT or employment. The second is to conduct risk analysis through the risk-adjusted nearest neighbor hierarchical clustering routine in *CrimeStat*; this routine conducts an NNHC but relative to the baseline variable, VMT and employment/population respectively.

The identification of Hot Spots of crashes and crime types that overlap using this technique will provide stronger evidence for the coinciding of the two as they will have been adjusted for a factor they are associated with. However, this data can be difficult to obtain and at a scale that allows it to be used.

U.S. Department of Transportation
National Highway Traffic Safety
Administration

www.nhtsa.gov