

## **Case Study**

### **Tempe, Arizona, Police Department**

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#### **Introduction**

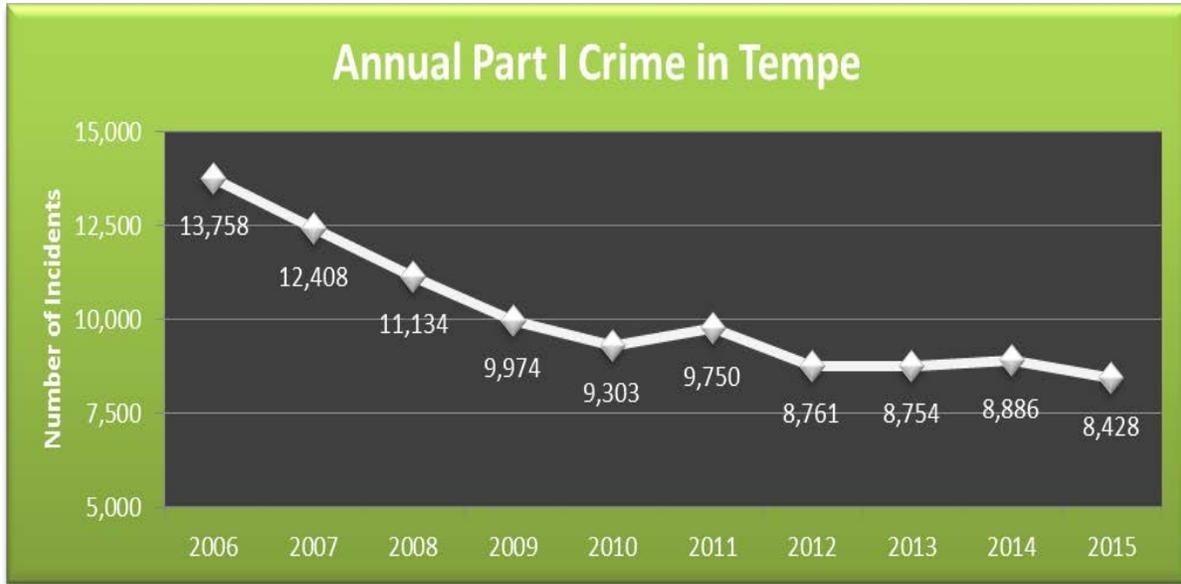
The Tempe, Arizona, Police Department (TPD) applied for the BJA/IIR Crime Analysis Capability Project Grant (aka Crime Analysis Capacity Building Grant) with the intent to build on its 25 years of crime analysis experience. Over the years, TPD has adopted community policing, problem-oriented policing ([www.popcenter.org](http://www.popcenter.org)), evidence-based policing (Sherman, 1995), intelligence-led policing (Ratcliffe, 2017), and stratified policing (Santos and Santos, 2015) into its day-to-day approach to fighting crime and addressing community disorder.

In an attempt to synthesize these similar models of policing, TPD applied for and received a Nationwide Crime Analysis Capacity Project Award to improve its capacity, share lessons learned, and offer its expertise to other departments across the United States and around the world. Following key components of intelligence-led policing, TPD partnered with several subject-matter experts (SMEs) to improve its crime analysis capacity in three critical areas:

1. Improve capacity to identify and track prolific offenders.
2. Develop a set of crime analysis metrics (CAMetrics) to regularly evaluate crime statistics and predictive analytics as part of its crime suppression meetings (CSMs) and its actionable decision-making process (CompStat-like).
3. Improve capacity for geospatial and temporal analysis (i.e., Enterprise GIS) and develop location-based dashboards as related to the goals above, allowing TPD to monitor criminal/call-for-service events and target hot spots on a recurring 28-day cycle.

#### **Agency Background**

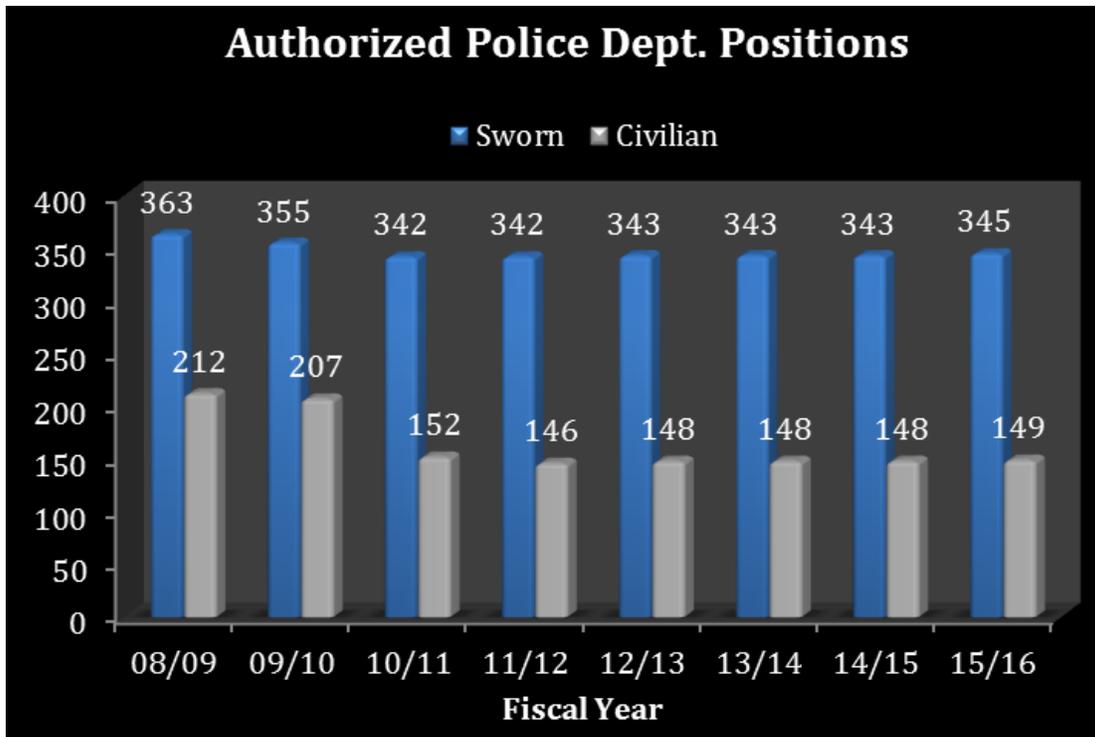
The city of Tempe is located centrally within Maricopa County, Arizona, the fourth most populous county in the United States. The city has a population of more than 175,000 residents and experiences a daytime population increase to almost 245,000. In addition, the city is home to Arizona State University (ASU), the largest public university in the country. Tempe's crime rate is higher than that of its neighboring cities, and with the sweeping daily population increase and the presence of ASU, TPD experiences unique challenges when addressing crime and quality-of-life issues. As a university town, Tempe experiences unique issues with a youthful population, loud parties, underage drinking, shoplifting, sexual assaults, fights, various larceny-theft issues, traffic, and college sporting events. In spite of these pressing issues, the city of Tempe has been successful at driving down and maintaining a relatively low crime rate.



The Uniform Crime Index (UCR) rate per 100,000 for the entire United States was 2,961.6 in 2014.<sup>1</sup> The 2015 crime rate for Arizona was 3,374.8 crimes per 100,000 population based on an estimated population of 6,758,251. Tempe experienced a higher UCR Index crime rate of 4,899.9 per 100,000 by comparison, as a result of special events and a 40 percent increase in daytime population.

Year	Violent Crime				Property Crime				Total
	Homicide	Rape	Robbery	Aggravated Assault	Burglary	Larceny	Motor Vehicle Theft	Arson	
2014	5	103	193	498	1,177	6,406	461	43	8,886
2015	7	101	182	430	1,108	6,175	359	66	8,428
% change	40%	-2%	-6%	-14%	-6%	-4%	-22%	53%	-5.2%

<sup>1</sup> Most recent data available from the FBI.



TPD’s F/Y 15/16 operating budget was \$81.7 million, of which 79 percent was allotted to personnel services. The department’s budget currently has an authorized strength of 494 employees, comprising 70 percent sworn personnel and 30 percent civilians. These personnel numbers remained relatively stable after the City’s budget reduction process, which took place during the nation’s economic downturn.

### Crime Analysis

TPD has an extensive tradition of building crime analysis capacity that began officially in 1989. TPD was the first department in Arizona to hire a full-time crime analyst, and over the past 27 years—since 1990—has continued to build its capacity to conduct tactical, strategic, and administrative crime analysis. In 2007, TPD created two crime analysis centers as outlined below.

The Crime and Intelligence Center (CIC) is made up of two tactical analysts, four investigative assistants, and one working supervisor. This unit focuses specifically on crime series, intelligence gathering, investigative support, and the targeting of serious offenders within the community. In addition, these analysts work with local and federal partners such as the FBI, DEA, ATF, HIDTA, EPIC, U.S. Secret Service, U.S. postal investigators, and local and state fusion centers. The Strategic Planning, Analysis and Research Center (SPARC) is made up of two strategic analysts and one working supervisor. SPARC focuses on strategic assessments, crime and operational statistics, deployment modeling, applied research, and the department’s commitment to keep Tempe residents aware of crime and safety issues within its jurisdiction. SPARC currently produces the department’s annual report, facilitates the yearly strategic planning process, and analyzes citizen-generated calls for service to develop and publish an efficient patrol schedule. In

addition to these efforts, SPARC reviews UCR statistics to inform the public about crime and delivers crime statistics to Arizona State University and other universities and colleges that conduct business in Tempe to meet Clery Act federal reporting requirements.

TPD has incorporated ATAC, ATAC-RAIDS, Raids Online, and ATAC Workstation as the primary analytical tools for its analysts. TPD shares data with neighboring jurisdictions through ATAC-RAIDS and COPLINK and uses Raids Online to release crime maps and statistics to the public. Versadex Records Management System is used to collect and store calls for service, street-check, crime, arrest, and case management data utilizing various ODBC connections. Data is pulled directly from Versadex to feed other operational systems including, but not limited to, Corona Solutions (Discover and Deploy), ATAC products, and TPD's internal statistical application (SPSS). Versadex data and ArcGIS are used to perform spatial analyses of crime, call-for-service, and arrest data. Shapefiles are recreated many times and utilize geographic data that was antiquated at best. The City of Tempe currently has an Enterprise License Agreement with ESRI, which allows it to install as many copies of ArcGIS and relevant extensions as needed to realize its geospatial and temporal crime analysis goals. The Crime Analysis Capacity Building Grant has been applied to improving TPD's spatial analysis capability.

## Tempe Logic Model: Crime Analysis Capacity Building Grant

Shown below is the logic model outlining the resources, activities, and outputs, as well as the short, intermediate, and long-term outcomes, of the grant project.

Resources	Activities	Outputs	Short-Term Outcomes	Intermediate Outcomes	Long-Term Outcomes
<p>\$300,000 cash; Full police RMS (Versadex); 26 years of crime analysis agency experience; robust local and international Crime Analysis Association; Arizona State University GIS department; experienced city IT/GIS department staff; crime data; arrest data; knowledge of project and agency personnel; research on what is effective for offender-focused strategies; academic experience in criminology, public administration, GIS, and policing.</p>	Build prolific offender database	Reports on top offenders, maps related to activity space	Generate top offender lists for various types of intervention	Use activity space analysis to resolve crime patterns; interrupt repeat offender activity	<p>Reduce crime in hot spots; reduce crime committed by repeat offenders; more rapid intervention in crime patterns; improve efficiency and effectiveness of police operations; conduct pre-/post-assessments; and improve clearance rates</p>
	Develop a protocol to identify repeat victims and target hotspots (prototype scenarios)	Reports on repeat victims and produce profiles of hot spots	Produce analytical reports that support targeted interventions for people and places	Create protocols for action plans for patrol and other operational units	
	Create a set of crime analysis metrics using 28-day crime cycles and effectiveness benchmarks	Develop a catalog of innovative measures for crime reduction and police performance	Develop the models and formulas for these measures; provide a list of potential metrics and performance measures for professional review	Produce better measures of social harm, crime stats by demographics, police activity, improved comparative measures, and measures of change	
	Build a CA-server, an enterprise GIS server, and several dashboards/location-based applications for delivery of above information	SQL server data warehouse, GIS SDE spatial server, and client interface that fully serve the other activities of the project	Stand up the hardware and software	Integrate data connections and data entry into crime analysis processes and products	
	Develop the Crime Analysis Toolkit	Provide a mechanism to offer applications, processes, procedures, and policies for enhancing crime analysis	Collect protocols, data dictionaries, database structures, checklists, and step-by-step procedures for achieving activities 1-4 above	Create and disseminate the toolkit	

## Scope of the Project

TPD has an extensive history in obtaining grants and serving as a demonstration site for police improvement. Many analysts and supervisors have served on the boards of the International Association of Crime Analysts (IACA), the Arizona Association of Crime Analysts (AACCA), and the International Association of Law Enforcement Planners (IALEP). As a mid-sized agency with a history grounded in community and problem-oriented policing and a strong commitment to ILP, the department is confident that agencies of all sizes will gain knowledge on capacity building from its experience.

### Crime Analysis Implementation Plan

TPD's primary purpose over the next few years is to create an effect similar to "Money Ball" and sabermetrics, which it calls CAMetrics. In the same fashion that Billy Beane changed Major League Baseball, TPD hopes to change the essence of police work. CAMetrics is the concept and practice of collecting and monitoring innovative statistics that measure criminality, victimology, police performance, and community demographics, all of which build predictive capability. At the core of this initiative is the collection of calls for service and criminal event data related to offenders, victims and locations—the primary elements of the Crime Triangle.

### Known Offender Database and Portfolio System

SMEs identified the crucial characteristics of serious repeat offenders and used current best practices in weighting data elements to prioritize which offenders are prolific. This database contains offender characteristics, modus operandi elements, and the activity space of prolific offenders (including, but not limited to, registered sex offenders, probationers, parolees, and Arizona Department of Corrections releases). Analysts will eventually use this system to collect information about offenders' crime(s) of choice, their preferred criminal methods of operation, and elements of their crime patterns, as well as the activity space in which they live, work, and play. This prolific offender portfolio system also will be used to overlay known crime patterns and offender activity space to identify investigative leads within crime hot spots.

### Crime Analysis and Police Performance Measures Recommendations

This segment of the project called for TPD to create a set of performance measures similar to sabermetrics that allowed the department to more accurately measure community crime and call-for-service activity, changing neighborhood demographics, and departmental productivity indicators. The development of a CAMetrics system is threefold. Step one required SMEs to establish appropriate and innovative metrics. These metrics go beyond traditional police measures such as crime rates, response times, and clearance rates, to include new measures of crime and police performance. Such measures included crime rates at the census-block level, neighborhood-level demographics, and gang activity. These metrics will be used to measure the effectiveness of patrol and investigative efforts and to refine future initiatives. TPD hopes to provide measures that help normalize police-related activity and create comparative measures over time. Other measures of police satisfaction, use of force, proactive police contacts, traffic stops, demographics, and fear of crime are examples of data elements that will be included in the catalog.

The second step is to establish a protocol for tracking the metrics on a 28-day cycle. A dimension of this step includes tracking by occurred date rather than reported date (also an element of UCR). Incorporating these changes resolves statistical anomalies found in tracking month to month and eliminates problems associated with delayed reporting. The metrics tracking system (i.e., catalog) will include each of the metrics designed in step one. A critical part of this step is to collect three to five years of data so that a historical perspective may be visualized. Comparing the 13 28-day cycles over three to five years illustrates variation in crime and its seasonality, key elements of predictive analytics.

The third step of the metrics system is to incorporate location-based dashboards. These dashboards will include the measures developed in step one, allowing officers and managers to monitor these measures over time and place. They will include the production of crime and call-for-service hot spots to help direct officers to high-incident locations and provide prolific offender and repeat victimization data relevant to their locations (pulled from the respective offender and victim databases as they go into production).

#### Enterprise Crime Analysis Server (CA-Server)

An Enterprise GIS crime analysis server was created to store each of the data elements incorporated above and to utilize geospatial data and dashboards. The CA-server hosts a database that tracks key pieces of information about prolific offenders, repeat victims, criminal events, and calls for service. It stores data on which calls turn into crime reports, which reports turn into ongoing investigations versus early case closures, which investigations turn into arrests, which arrests are forwarded for prosecution, and which cases are filed for court or plea-bargained. Understanding the relationship between different phases of the process is a significant element of study. Process mapping and outcomes can be stored in the system so the CAMetrics can be reviewed and continuously improved.

The CA-server hosts historical data used to create operational dashboards, performance metrics (i.e., rates and ratios discussed above), and location-based offender and victim profiles. The CA-server allows TPD to display geographic and temporal hotspots, offender and victim activity spaces, and comparative statistics. Patrol and investigative supervisors and managers can use the dashboards to deliver crime-reduction strategies and monitor neighborhood level results. Ultimately, TPD will determine whether implemented strategies were effective in the target areas. The dashboards allow the department to measure the short-term effects of its efforts, while the 28-day crime cycles allow TPD to measure long-term effects within hot spots and across the city. Using the dashboards to monitor CAMetrics provides ongoing performance measures at the department, police zone/district, and squad levels.

Finally, the CA-server helps track temporal/spatial hot spots to enhance TPD officers' ability to be in the right place at the right time, looking for the most prolific offenders and most likely criminal events. Using the CA-server, TPD hopes to develop a protocol for predictive policing and measuring successes. TPD continues to fund ongoing software and maintenance costs associated with the software, ESRI's Enterprise GIS, and the dashboard solution. Much of this cost is already included in the City's operating budget.

## Successes and Challenges

A number of success and challenges resulted from this project. The achievements include the following:

1. Developing a protocol to extract data from the Versadex Records Management System. TPD is now able to pull data that includes calls for service, street checks (i.e., field cards), general offense reports, and arrest bookings. TPD also was able to create SSIS packets to pull the data on regular intervals.
2. Pulling all of TPD's property tables and related information from separate property tables (i.e., articles, alcohol, bicycles, boats, drugs, firearms, jewelry, motors, securities, and vehicles) into a single property table so TPD can query property from a single query.
3. Creating spatial data in SDE layers relatively real time so TPD can map crime, calls for service, arrest, and street checks directly from the crime analysis data warehouse.
4. Creating a prolific offender database by calculating their weighted score helps TPD prioritize serious offenders and export their known activity space for crime series spatial correlation (forthcoming). This offender database will be the protocol for creating the repeat-victim score in the future.
5. Electronically connecting Tableau to TPD's SQL server so the department can create several workbooks and dashboards to assess historical trends. Tableau allows TPD to seamlessly look at temporal data, including the creation of 28-day crime cycles used for CSMs (CompStat-like meetings), and to effortlessly export crime, CFS, street-check, and arrest data from data visualizations (i.e., directly from graphs, charts, and tables) and send them to ArcGIS for spatial analysis. TPD is in the process of collecting five years of data for predictive analytics and statistically significant increases or decreases in crime and CFS over time.
6. The greatest gain came as part of this automation: reducing the time needed to respond to statistical requests from 4 to 6 hours to under 2 hours, many responses now requiring only 15 to 20 minutes. The automation has streamlined TPD's data analysis process.
7. As TPD works on adhering to the results of the President's Task Force on 21st Century Policing, particularly the Pillars—building trust and legitimacy, technology and social media, and community policing and crime reduction—work on the crime analysis metrics is proving both challenging and resourceful. While the department has developed only a handful of measures to assess crime, fear, officer performance, spatial distribution of crime, and calls so far, and has just begun to deliver public-facing dashboards or open data portals regarding police activity, it is hoped that these measures will be put to the test and used to assess efficiency and effectiveness, as well as to keep the public informed. By sharing them with the greater crime analysis community via the CAMetrics Catalog and the toolkit, TPD hopes that other analysts will refine and add metrics to this set of robust measures. It is hoped that this catalog will be published and accessible from the BJA Crime Analysis On-Demand website and on the IACA website to reach as many departments and analysts as possible.

This project provided several challenges, some of which were internal organizational changes that occurred in the midst of the implementation. SPARC's supervisor was promoted to City Hall, and both SPARC analysts took employment outside the unit during this project. One lesson learned

was how to deal with such adversity— to hire and train new staff while introducing new systems. On one level, it was easier, since the new analysts were fresh and open to change. On the contrary, the new analysts were not as familiar with TPD datasets and protocols as their predecessors, so the department faced a learning curve as time progressed. Another challenge was working with the City’s IT staff members, who were new to Tableau and Tableau server. This application became the backbone for TPD’s dashboards, and, at times, experienced delays as IT staff members upgraded the software and installed virtual servers. The big lesson learned here was collaboration and taking it steady as it goes. The final challenge was the realization that this was a hefty, robust project; implementing all of the features was going to be impossible as a result of the above issues. What came out of the efforts included the development of an infrastructure that utilized open applications such as ArcGIS, Tableau, SQL server, and Microsoft Office to leverage a systemic approach on which TPD can continue to grow its capacity.

### **Conclusions and Implications for Policing**

In the end, this was an extremely bold endeavor. Getting the appropriate SMEs and selecting COTS solutions provided TPD with tried-and-true applications, best practices, and the ability to synthesize datasets and leverage analytic experience. It is TPD’s hope that other agencies and analysts from across the country will not only learn from this department’s experience but take advantage of the tools and techniques incorporated into the toolkit.

### **References**

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Santos R. G. and Santos, R. B. (2015). Evidence-based policing, “What works,” and Stratified policing, “How to make it work.” *Translational Criminology*, 8, 20–22.

Sherman, L. (1995). *Evidence-Based Policing*. Washington, DC: Police Foundation.