**Special Report**

# *DEPARTMENT OF PUBLIC SAFETY*
# *SHOTSPOTTER SYSTEM*


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August 2025

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CITY OF PITTSBURGH
OFFICE OF THE CITY CONTROLLER
Controller Rachael Heisler

August 2025

To the Honorable Mayor Ed Gainey and
Honorable Members of Pittsburgh City Council:

The Office of the City Controller is pleased to present this special report of the City's usage of the ShotSpotter system.

## EXECUTIVE SUMMARY

ShotSpotter is an audio-detection system that uses sensors to detect and locate gunfire. The system's usage is authorized via a professional services agreement with SoundThinking, Inc. In December 2014, ShotSpotter was deployed in a three-square-mile area of Police Zone 5 only, but, as of August 2024, ShotSpotter sensors are active in certain locations within all six City police zones. Based on data of ShotSpotter's usage between January 2015 and December 2017, Resolution 193 of 2018 authorized the City to enter into a three-year agreement with ShotSpotter valued at approximately $3.39 million, with subsequent amendments expanding coverage and extending the contract through 2025 at a total cost of approximately $8.48 million. As the current contract period approaches its end, and in light of the significant investment from City funds, this special report was initiated to assess the City's usage of the system as well as its effectiveness and cost-efficiency.

From the perspective of the City's Department of Public Safety, the program supports five primary objectives: Receipt of fast alerts of gunfire and increased capacity to safely and strategically deploy emergency response into gunfire areas, rapidly locate victims and render assistance, locate and arrest suspects, and locate critical evidence before contamination or loss. Therefore, auditors requested historical data of crime and gun-related incidents and performed procedures to determine how well these objectives are supported with and without ShotSpotter.

The data received comprised tracked incidents of City crime, including confirmed and unconfirmed gunfire, from three primary call types: 911 calls, confirmed gunshot wounds, and ShotSpotter alerts. Each call type also logged the results, or disposition, of each incident. In processing and analyzing this data, we documented the following results:

- ShotSpotter alerts tend to be just as productive as 911 calls.

- Following the deployment of ShotSpotter, 911 calls decreased dramatically, a 50% drop from 2014.

- Police response times to possible gunfire is significantly faster via ShotSpotter when compared to 911 calls.

- The department has spent $8.1 million on the ShotSpotter system, which covers just over a third of the City. There are no budgeted positions dedicated solely to ShotSpotter, as alerts are triggered in the ShotSpotter system and filtered through the City's Real Time Crime Center (RTCC). Analysis and tracking of ShotSpotter data is administered by the PBP's Crime Analysis Unit (CAU).

Details of our procedures and results are described and shown in this report. We appreciate the cooperation, patience, and support of the staff we coordinated with during the course of our special report.

Sincerely,

Rachael Heisler
City Controller

# INTRODUCTION

This special report provides an analysis of the ShotSpotter agreements and amendments executed between SoundThinking, Inc. (formerly ShotSpotter, Inc.), referred to herein as the Vendor, and the City of Pittsburgh, along with an evaluation of the system's utilization and effectiveness within City neighborhoods. The ShotSpotter system is intended to provide real-time detection and location alerts and data on gunfire incidents.

This special report's analytical approach is structured around three key perspectives—the Pittsburgh Police Bureau (PBP), neighborhood residents, and the City budget—each addressing specific dimensions of system effectiveness, community impact, and cost-efficiency.

From PBP's perspective, what is ShotSpotter's effect on the accuracy, efficiency, and speed of police responses to gunfire incident reporting and the investigative outcomes of ShotSpotter alerts in comparison with alerts derived from 911 calls? This speaks directly to PBP's usage of the program. From the residents' standpoint, this special report aims to determine whether or not ShotSpotter deployments have correlated with actual reductions in gun violence within neighborhoods receiving coverage. From the City's financial and budgetary perspective, this special report reviews direct costs such as annual subscription fees, implementation, maintenance, training, staffing resources, and indirect expenses associated with system operations. It also reviews contract terms and vendor obligations.

To support these analyses, the auditors reviewed City documentation, including Council resolutions, vendor contracts and amendments, and departmental data records. Preliminary engagements and information requests were conducted with Pittsburgh's Department of Public Safety to acquire critical data such as deployment dates and coverage areas, historical gun violence incidents, response times, and investigative outcomes.

# OBJECTIVES AND METHODOLOGIES

The primary objective of this special report is to evaluate the utilization, effectiveness, and cost-efficiency of the ShotSpotter gunshot detection program, implemented and expanded through agreements between the City of Pittsburgh and SoundThinking, Inc. Specifically, this report encompasses four primary areas of examination:

- First, auditors had to clearly understand the City's intended use and objectives in adopting ShotSpotter technology. To achieve this, auditors reviewed and analyzed relevant publications, official City documentation, and policy statements outlining Pittsburgh Public Safety's goals. Auditors also directly engaged with Public Safety officials to gain clarity on the department's stated intentions and expectations, providing a baseline against which to measure actual outcomes.

- Second, auditors had to determine what City zones have been included within the ShotSpotter coverage areas, as well as the specific operational timelines for each deployment. To fulfill this objective, auditors requested detailed operational records from

Public Safety, including deployment dates, renewal schedules, and any adjustments or modifications made to coverage areas over the life of the contracts.

- The third objective of this special report was to determine whether or not ShotSpotter has effectively achieved its intended outcomes—particularly in improving gun violence detection and reducing response times. To this end, auditors performed a before-and-after comparative analysis of gun violence incidents within ShotSpotter-deployed neighborhoods, examining incident trends, and determining if measurable reductions have occurred post-implementation. Auditors also assessed if ShotSpotter alerts have significantly resulted in more productive outcomes per incident and evaluated the accuracy of ShotSpotter alerts by analyzing how frequently alerts were verified as actual gunfire incidents versus false positives and how these results compared to alerts from 911 calls.

- Finally, the fourth objective was to evaluate ShotSpotter's overall cost-effectiveness and fiscal impact. This involved a review of the program's costs, including, as applicable, subscription fees, ongoing trainings, support expenses, and legal costs.

# SCOPE

The scope of this special report centers around the Contract 52443, its subsequent amendment, and the relevant timeframes associated with the implementation of the ShotSpotter program, primarily 2012 – 2025.

# OVERVIEW

## *UNDERSTANDING SHOTSPOTTER AND THE CITY'S INTENDED USE*

ShotSpotter is an audio-detection technology system, which utilizes a network of acoustic sensors strategically placed in all City zones. These sensors are designed to instantly detect, locate, and classify gunfire incidents, although other gunfire-like sounds (e.g., fireworks) may trigger alerts from the system as well. When sounds resembling gunfire are detected, the system rapidly triangulates the location, providing law enforcement with real-time alerts—typically within seconds—that include critical details such as the geographic coordinates, timestamps, and audio recordings of the event.

The original contract lists a scope of services, which include qualified alerts of gunfire; logged incidents and reporting; sensor networks; configurable alert consoles for call-takers, dispatchers, and mobile; customer support; Detailed Forensic Reports (DFRs); and more. The program also provides access to "expert witness services". Overall, the program parameters indicate an intent to enhance PBP's capacity to monitor gunfire incidents and rapidly and accurately respond to such incidents.

Public Safety confirmed the intention noted above and provided Order # 69-04, an internal police order, which stated five objectives specific to the implementation of the ShotSpotter. **(1)** To be quickly alerted of shots-fired incidents; **(2)** to be able to safely and strategically deploy into the area of the gunfire; **(3)** to rapidly locate victims and initiate assistance, including, as needed, calling for Emergency Medical Services (EMS); **(4)** to locate and arrest possible suspects connected to illegal gunfire; and **(5)** to locate critical evidence before it has been lost or contaminated.

Public Safety also indicated that ShotSpotter is useful in supplementing 911 calls—and has, in fact, quickly become a more prominent tool in the City's response to gun violence. This is because ShotSpotter will, in the majority of cases, detect incidents that have no corresponding 911 calls from citizens, and, in addition, the program allows police to pinpoint more precise origins of the shots, which is often something not easily obtained via citizen calls to 911. Because ShotSpotter alerts are registered faster and with more accuracy than standard 911 calls, PBP and EMS can also react more quickly when gunfire injuries occur. Public Safety also noted that PBP's capacity to reach out to witnesses and gather evidence, such as bullet casings, is also faster with ShotSpotter assistance.

Public Safety also noted that the enhanced awareness of potential gunfire incidents increases the safety of the City's police officers. However, Public Safety noted data trends of 911 calls significantly decreasing year by year following the implementation of ShotSpotter.

## *SHOTSPOTTER DEPLOYMENTS IN CITY NEIGHBORHOODS*

In December 2014, the ShotSpotter program was initially deployed in a limited three-square-mile area of Pittsburgh's Zone 5. The data accrued between January 1, 2015, through December 15, 2017, was used as the basis for assessing possible expansion.

Resolution 193 of 2018 then authorized the expansion of the program to a 15-square-mile area in all six police zones of the City via a three-year agreement with the Vendor. This resolution included an attachment and summary analysis of the data accrued during the initial deployment, noting that 664 gun-related aggravated assaults and 156 gun-related homicides had occurred during that timeframe and that ShotSpotter coverage in just Zone 5 covered only 134 gun-related aggravated assaults and 37 gun-related homicides. Based on this, the analysis proposed an expansion of 15 square miles as a means to cover an estimated 447 gun-related aggravated assaults and 99 gun-related homicides. The total coverage following this expansion would be 18 square miles of the City.

The subsequent agreement of 52443, executed on April 4, 2018, authorized a fee not to exceed approximately $3.39 million for the expanded deployment. Resolution 686 of 2020 would then authorize an increase in the Vendor's fee to not exceed $8.35 million up through the end of 2025, and Resolution 294 of 2024 authorized yet another increase up to $8.48 million. Most recently, deployment of ShotSpotter sensors in Carrick, an expansion within Zone 3, was completed as of August 22, 2024.

### *SHOTSPOTTER PROCESS*

PBP intelligence is managed by two units: Real Time Crime Center (RTCC) and Crime Analysis Unit (CAU). RTCC is a centralized monitoring center that uses technology and data to support police officers in the field by providing real-time information and intelligence. When ShotSpotter alerts are triggered, they ping the RTCC and pop on a map. The alert is transmitted with an audio recording of the sound and an indication of whether it is probable or confirmed gunfire. This allows an analysis of the sound itself and also any cameras in vicinity of the alert coordinates. Police are channeled via the 911 dispatch center to respond.

The CAU tracks and compiles data by each day, every three days, monthly, quarterly, etc. ShotSpotter also provides its own analysis separate from CAU and the 911 center's Computer Aided Dispatch (CAD) (i.e., 911 calls).

While the original ShotSpotter contract indicates that SoundThinking, Inc. will only retain data for two-year periods, CAU maintains a database of historical data regardless, making the restriction of the service moot.

### *PROGRAM COSTS*

As noted above, Public Safety was authorized to spend up to $8.3 million on the implementation, expansion, and usage of ShotSpotter within the City, but auditors also inquired with the department on any additional or indirect costs.

- Public Safety informed auditors that there are no positions dedicated solely to ShotSpotter and that ShotSpotter trainings are handled at the academy level for each duty location. The department is unaware of any ongoing trainings associated with the usage of the program, but there are training modules available on the SoundThinking, Inc. Learning Management System (LMS).

- Public Safety informed auditors that, as far as it is aware, there have not been any legal cases specific to ShotSpotter implementation as of April 2025.

## ANALYSIS

### *CAU DATA*

Auditors requested comprehensive before-and-after data of historical gun violence within Pittsburgh neighborhoods, response-time data for PBP responders, clearance data, and ShotSpotter alert data. CAU provided various datasheets, including "calls for service" (CFS) data for all units between 2013 – 2025 and Uniform Crime Report (UCR) data for 2012 – 2023.

## *CFS*

CFS tracks specific report numbers and information regarding associated call types, locations, dispositions, responding unit(s), and various other metrics.

- The call type will indicate the type of incident, which spans a weighty number of categories from assault to graffiti to gunshots. Most relevant to this report are three specific call types: (1) “Gunshot”, which indicates record of a confirmed gunshot injury; (2) “Shots-FiredorHeard”, which indicates a 911 call from a citizen reporting gunfire; and (3) “ShotSpot”, which indicates an alert from the ShotSpotter system.

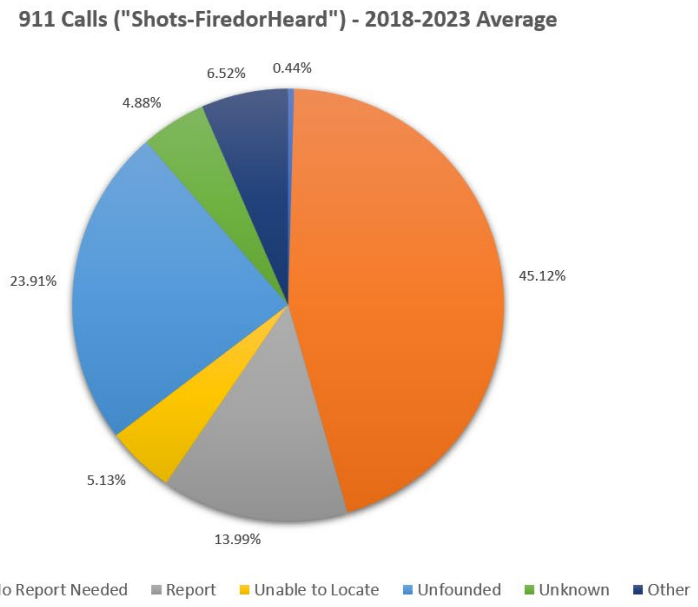
- A host of dispositions are associated with each report number to indicate resolution or lack thereof, as applicable. The dispositions include values like “Arrest”, “Report”, “Cancel”, “Disregard”, “False Alarm”, etc.

The two charts below show a broad ratio of the types of dispositions identified within CFS data; however, due to the substantial number of dispositions listed, the most prevalent were displayed, while the less prevalent dispositions were grouped together. As shown in both charts, the vast majority of dispositions fall within "No Report Needed", although a significant portion of incidents did lead to "Reports". Based on the data and associated reference dictionaries provided to auditors, there were also some dispositions auditors could not clearly identify, which are lumped together in the "Unknown" category.

The first chart shows the distribution of dispositions for 911 calls, and the second chart shows the ratio of dispositions for ShotSpotter alerts. In both charts, the four most common dispositions were for calls that did not require reports, were unfounded, that resulted in a report, and that resulted in arrest.

Chart 1

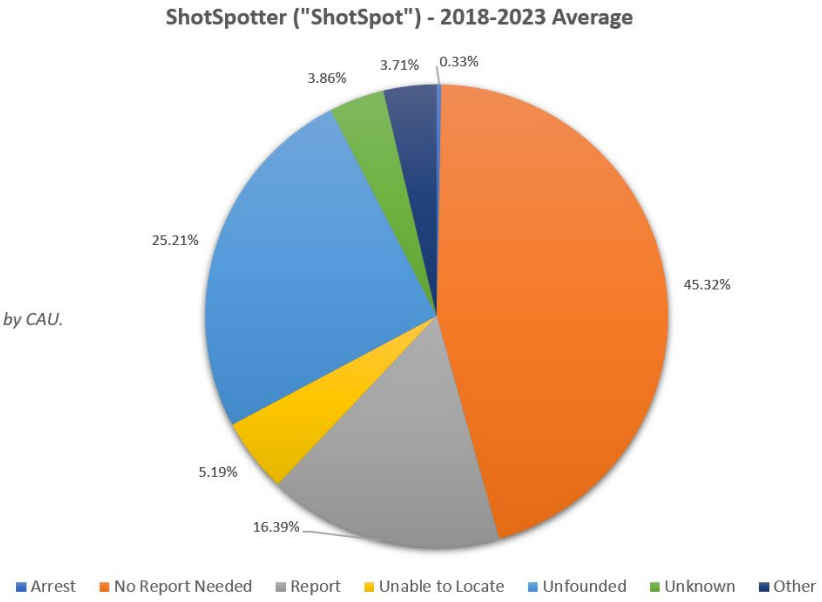
*Source: CFS data provided by CAU.*



As shown in Chart 1 above, 45% of all 911 calls did not require reports and 24% were unfounded, while 14% did result in reports, less than 1% in arrests, and 7% in other categories.

Chart 2

*Source: CFS data provided by CAU.*




As shown in Chart 2 above, 45% of all ShotSpotter alerts did not require reports and 25% were unfounded, while 16% did result in reports, less than 1% in arrests, and 4% in other categories.

### *UCR*

UCR refers to specific categories of high-priority crimes. Within the data provided by CAU, there were 26 UCR categories—among those, for instance, would be arson, assault, murder, etc. Gun-related violence would, of course, be a possible variable within these types of crimes. UCR data also indicated the status of each report number, and four specific status values were evident within the data: (1) adult arrest, (2) juvenile arrest, (3) exceptionally cleared, and (4) not cleared. While the first, second, and fourth statuses are self-explanatory, the third status, and term "exceptionally cleared", refers to cases that were resolved to the furthest degree possible but unable to result in an arrest or formal charge due to circumstances beyond the control of law enforcement.

Being that UCR incidents are prioritized, auditors aggregated CFS and UCR data to determine if report numbers between the datasets correlated and, if so, to what extent. Correlation here could indicate if ShotSpotter contributes meaningfully to the PBP's capacity to clear UCR incidents and/or that ShotSpotter is simply a prevalent component of UCR tracking.

Auditors found that, between 2018 – 2023, approximately 11% of CFS report numbers for gunfire resulting from 911 calls or ShotSpotter alerts correlated to UCR data. Within that population, ShotSpotter alerts comprised nearly 60% of all reports, approximately 40% of adult arrests, approximately 38% of all juvenile arrests, and approximately 76% of all cases cleared

exceptionally. ShotSpotter occurred at relatively proportional rates, a little more than half, of cases not cleared.

The two charts on the following page display the significance of these ratios. Chart 3 provides a visual of the year-by-year correlation of CFS-to-UCR data with 911, ShotSpotter, and all gunfire incidents shown respectively. Chart 4 shows a visual of the ratio between the individual call types (i.e., 911, confirmed gunshot incidents, and ShotSpotter) within UCR data.

Chart 3

**Yearly Ratio of Alerts to UCR incidents**

*Source: UCR and CFS data provided by CAU.*

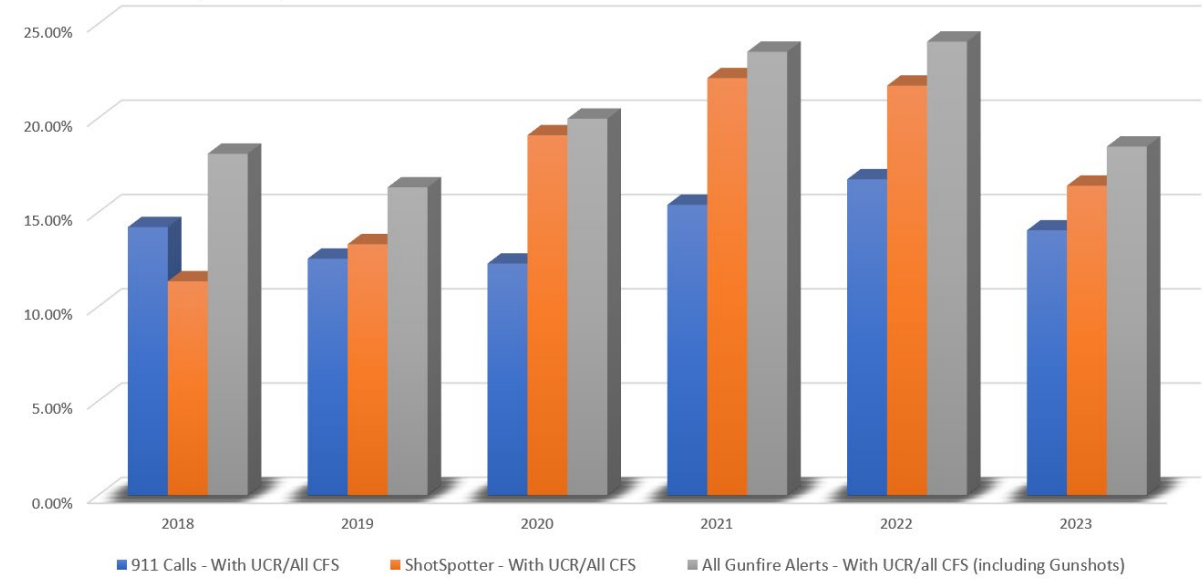
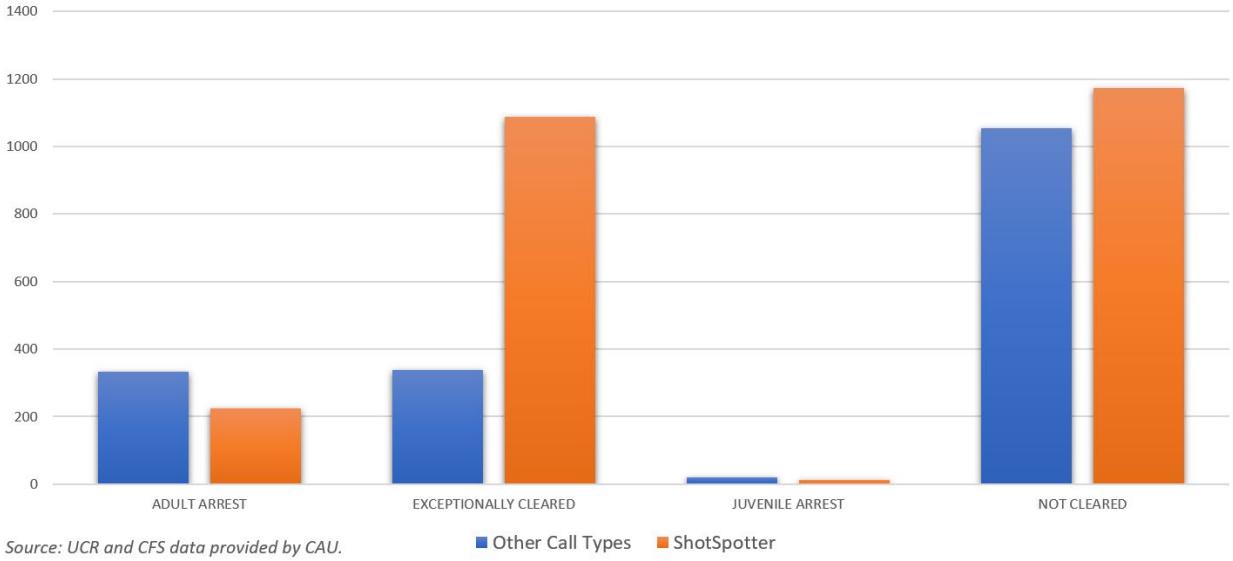



Chart 4

**Ratio of Report Statuses in UCR**




*Source: UCR and CFS data provided by CAU.*

## *PRODUCTIVE VERSUS UNPRODUCTIVE ALERTS*

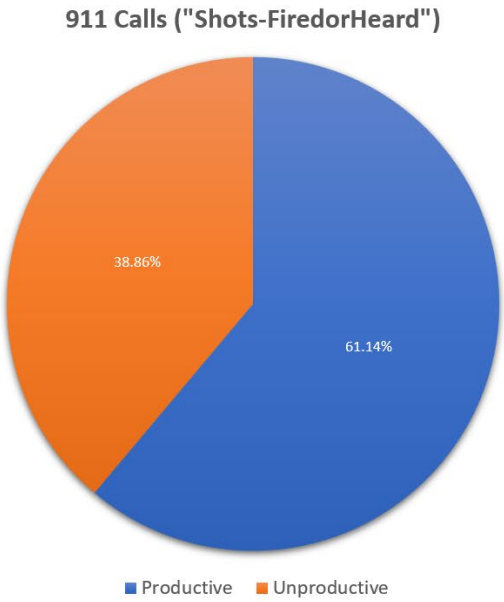
In order to assess the effectiveness of ShotSpotter, auditors had to assess how many alerts from the system led to dispositions indicating productive results—like an arrest, warning, clear designation of result, etc.—and how those results compared to the reports coming from 911.

Using the data described and shown above, auditors aggregated all CFS entries specific to the three categories noted (i.e., "Gunshot", "Shots-FiredorHeard", and "ShotSpot") and identified which disposition categories were "productive" versus "unproductive" within the data. For the purpose of this analysis, auditors defined CFS entries under dispositions like "Arrest" or "Report" as productive while "Cancel" and "False Alarm" were labeled unproductive.

This analysis speaks to the documented results of alerts and the accuracy of their connection to gun-related incidents and not whether or not the investigations of the alerts were productive uses of officer time. Please also note that "Gunshot", by nature of a confirmed gun-related injury, was noted as a productive category in total by auditors. Chart 5 shows the 911 calls categorized as productive and unproductive for the time period of 2018 – 2023.

Chart 5

*Source: CFS data provided by CAU.*

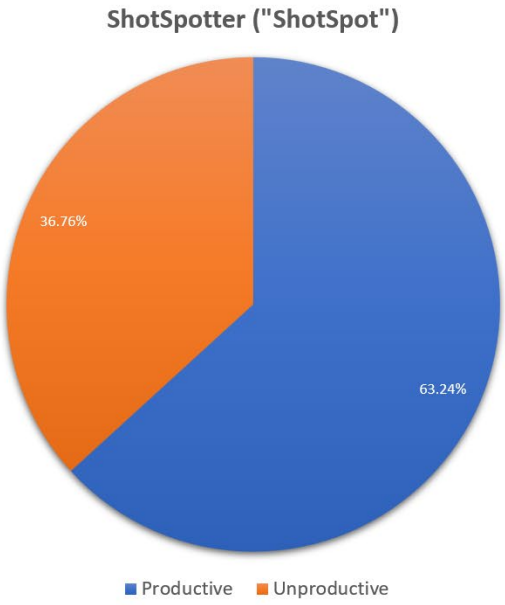



As Chart 5 shows, for gun-related 911 calls between 2018 – 2023, approximately 61% of all report incidents had productive results, while approximately 39% were unproductive. Within productive results, approximately 2% led to arrests, assists, or warnings and 59% led either to a report or clear indication that no report was needed.

Chart 6 shows the ShotSpotter alerts categorized as productive and unproductive for the time period of 2018 – 2023.

Chart 6

*Source: CFS data provided by CAU.*




Regarding alerts from ShotSpotter sensors between 2018 – 2023, the results are not too different from those of 911 calls, although ShotSpotter does come out on top by a narrow margin, as shown in comparing Charts 5 and 6.

With ShotSpotter, 63% of reports were productive and 37% not productive. Within productive results, approximately 1.3% led to arrests, assists, or warnings and 61.7% led either to a report or clear indication that no report was needed.

## *CRIME TRENDS IN ALL ZONES*

CAU also provided overall crime data prior to ShotSpotter deployment. Auditors evaluated this data to observe trends in overall crime prior to the full deployment of ShotSpotter (i.e., between 2012 – 2017).

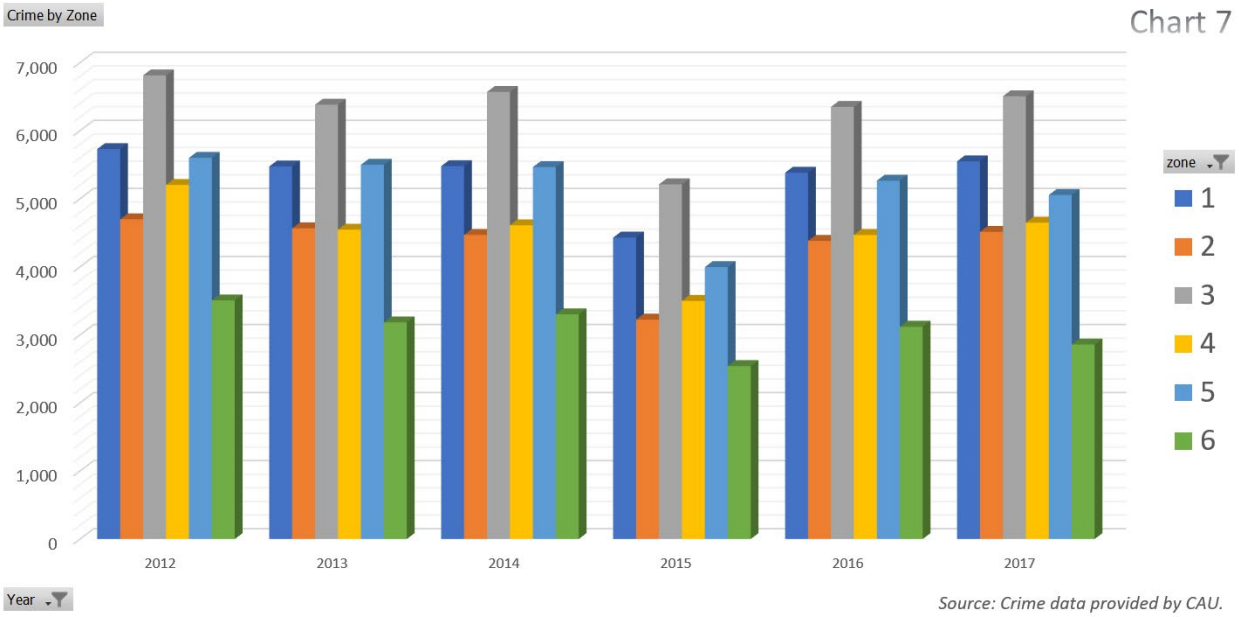
To do so, auditors aggregated crime data from the datasets provided by the CAU, sorted all data by unique incident IDs, and then expressed them by zone and year. The results provided an overview of crime trends within the City's six police zones, the zones that experienced the most crime year by year, and the zones that experienced fluctuations in crime trends over time.

The results indicated that Zones 1, 3, and 5 carried the highest number of overall incidents during the time period examined. Zone 1 carried 19% of all reported crime incidents, Zone 3 carried 22% of all reported crime incidents, and Zone 5 carried 18% of all reported crime incidents. Zone 3 consistently experienced the highest number of crime incidents in each year. Among these three zones was nearly 60% of all crime in the City.

On the other hand, Zones 2 and 6 experienced the lowest numbers of crime in every year with Zone 6 only seeing approximately 11% of all City crime. Incidentally, all zones experienced a

notable drop in crime in 2015; however, crime is present in all zones consistently throughout all years shown.

This is visually depicted in Chart 7.

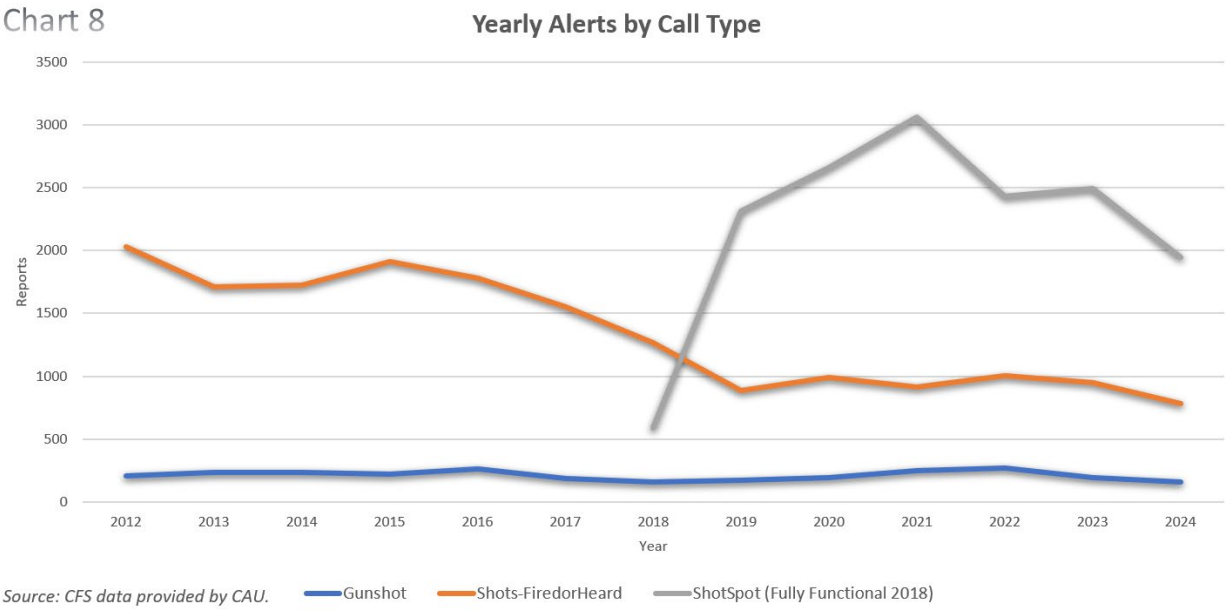



## *GUN-RELATED DATA TRENDS*

Prior to full ShotSpotter implementation in 2018, notification of gunfire was predominantly reported via 911 calls and/or via confirmed gunshot injuries. The earliest data given auditors from 2012 indicates that just over two thousand gunfire alerts were reported to 911 in that year and the trend of 911 reporting did not, on average, fluctuate much more than approximately 9% up through 2017.

Upon the full implementation of ShotSpotter in 2018, the number of 911 calls dropped by 26% from the average trend of reports documented between 2012 – 2018. In 2024, only 780 reports came from 911 calls. On the other hand, alerts from ShotSpotter sensors quickly outstripped those of 911, spiked above three thousand in 2021, and stabilized in the years thereafter.

Chart 8 depicts the trend in numbers for the three relevant CFS categories described in the CAU Data portion of this report above.




Meanwhile, when comparing the trends of confirmed gunshot injuries prior to ShotSpotter and after, no significant change is evident, as shown in the chart above. Between 2012 – 2017, reported gunshot injuries averaged just over two hundred reports; after the implementation of ShotSpotter and up through 2024, the yearly average was two hundred exactly.

## *RESPONSE TIMES*

Order # 69-04 not only delineated the five primary objectives of the ShotSpotter program, it also provided an analysis of ShotSpotter's effect on PBP's response times as of May 2022. Although the summary provided within the order did not indicate the years of the assessment, the primary takeaway was that ShotSpotter contributed to a decrease of 67% in response times.

To determine if the information provided in the memo is accurate and whether or not ShotSpotter has a meaningful effect on the PBP's capacity to receive a report of gunfire and react accordingly, auditors utilized CFS data for 2018 – 2023, as provided by CAU, to calculate response times.

Incidents of Priority Levels 0 and 1 are the most critical, requiring the highest level of response, and gunshots fall within these categories. Using timestamps of report times, dispatch times, and enroute times from CFS data provided by CAU, auditor analysis focused on Priority 1 (P1) incident numbers, both from 911 calls and ShotSpotter. Of note, the standard benchmark for response times is typically measured by the time elapsed between the dispatch and responders arriving on scene; however, this procedure specifically assessed the two following conditions: (1) The amount of time elapsed between the time of the report and dispatch, which would indicate how quickly an incoming report can be routed through dispatch, and (2) the amount of time between the report and the responders being enroute, which would indicate how quickly the PBP is able to get wheels to the ground once a report comes in.

Chart 9 below depicts the differences in response times between 911 and ShotSpotter when looking at the time between the report and dispatch.

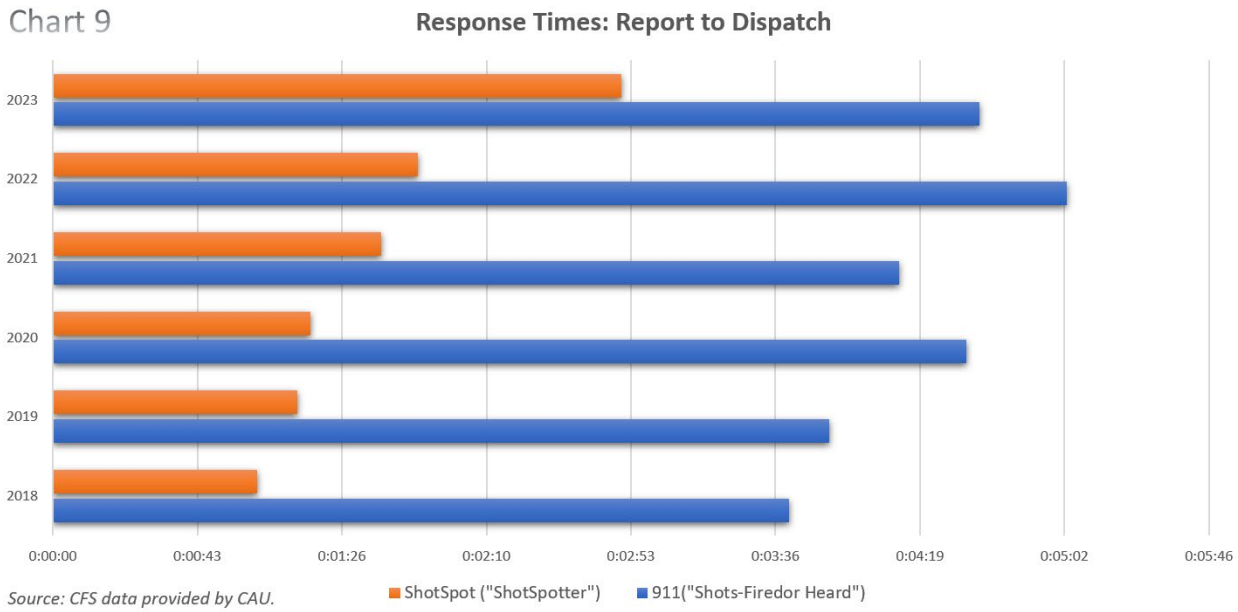
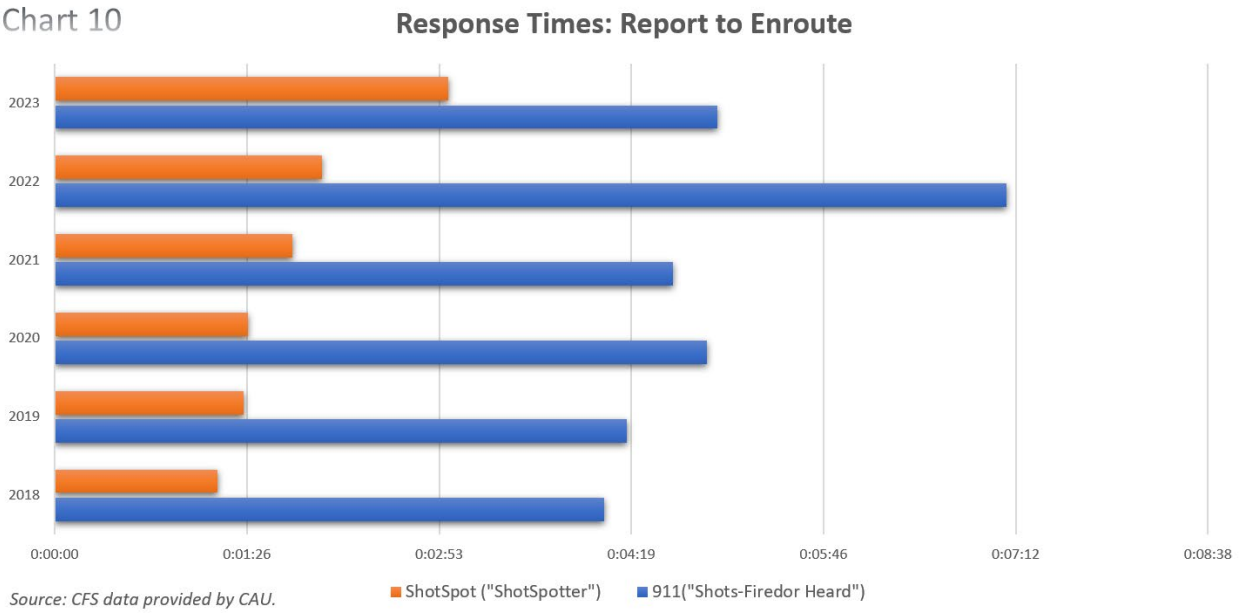



Chart 10 below depicts the differences in response times between 911 and ShotSpotter when looking at the time between the report and enroute.




# RESULTS

- Public Safety's intended uses of ShotSpotter are to receive fast alerts of shots-fired incidents, to enhance the safety and strategy of responder deployments to areas of

gunfire, to rapidly locate victims and render assistance, to rapidly locate and arrest suspects, and to rapidly locate evidence before it has been lost or contaminated. For more information, please review the Understanding ShotSpotter and the City's Intended Use section of this report.

- ShotSpotter was initially deployed in a limited area of Zone 5 and later expanded to a cumulative area spanning 19.25 miles within all six City zones. The first expansion of deployments went live in November and December 2018 and the most recent deployment in Carrick (Zone 3) went live August 2024. For more information, please review the following two sections of this report: ShotSpotter Deployments in City Neighborhoods and Crime Trends in All Zones.

- ShotSpotter alerts led to productive results just as effectively as 911 calls. Of note, ShotSpotter alerts were, on average, more productive by approximately 2% between 2018 – 2023. For more information, please review the Productive versus Unproductive Alerts section of this report.

- As shown in the Gun-Related Data Trends portion of this report, the overall quantity of confirmed gun injuries did not fluctuate too greatly from year to year between 2012 to 2024 but the quantity of 911 alerts of gunfire has dropped significantly each year since 2017, which supports Public Safety's assertion that 911 notifications of gun violence is rapidly decreasing. Of note, the number of 911 reports of gunfire dropped approximately 50% between 2017 and 2024. Therefore, ShotSpotter augments the PBP's detection of gunfire, and, without it, reports would consist of 911 calls only, delayed discoveries, or unreported gunfire incidents.

- The review between report-to-dispatch and report-to-enroute times indicates that ShotSpotter significantly increases the PBP's capacity for responding to gun-related incidents when compared to standard 911 calls. On average, both the report-to-dispatch and report-to-enroute times were approximately 63% faster with ShotSpotter between 2018 – 2023. For more information, please review the Response Times section of this report.

- Since 2018, the City has spent $8.1 million on the ShotSpotter system for coverage of just over a third (i.e., 19.25 miles of coverage) of the City's 58 square miles. The contract includes maintenance of technological infrastructure needed for the sensors, sensor installation and removal, standard support, alert view, orientation and training, and basic reporting. Detailed reports may be requested. Incidentally, there are no dedicated positions retained by the City to monitor ShotSpotter alerts, which are instead monitored in the CAU. For more information, please review the following sections: ShotSpotter Deployments in City Neighborhoods and Program Costs.