

DESIGNING AN EFFECTIVE LAW ENFORCEMENT DATA DASHBOARD

Functional and Technical Requirements

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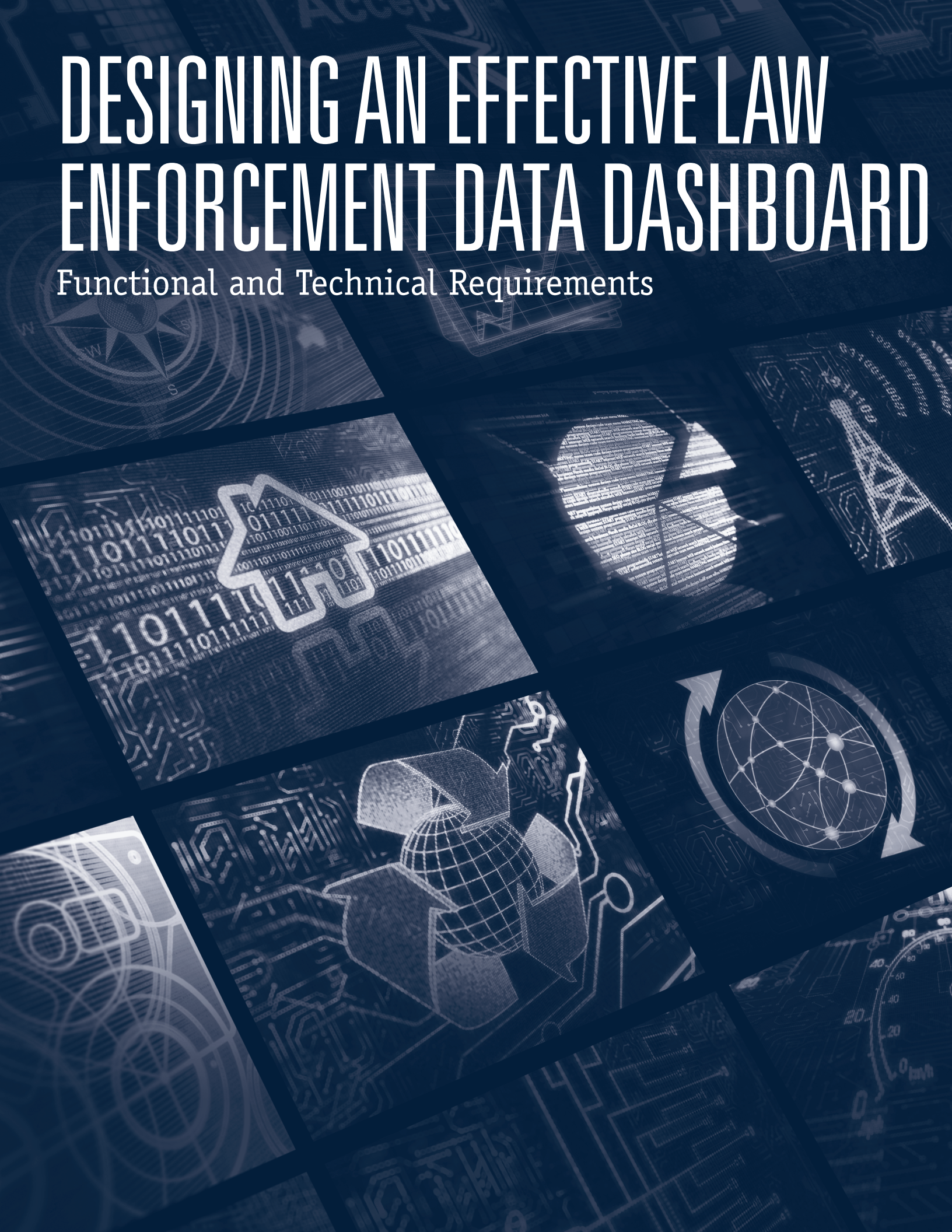



COPS

Community Oriented Policing Services
U.S. Department of Justice

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This project was supported, in whole or in part, by cooperative agreement 2019-CK-WX-K018 awarded to SEARCH, Group, Inc. by the U.S. Department of Justice, Office of Community Oriented Policing Services. The opinions contained herein are those of the author(s) or contributor(s) and do not necessarily represent the official position or policies of the U.S. Department of Justice. References to specific individuals, agencies, companies, products, or services should not be considered an endorsement by the author(s), the contributor(s), or the U.S. Department of Justice. Rather, the references are illustrations to supplement discussion of the issues.

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Recommended citation:

Jacobson, Michael, Diane Lacy, Dave McClure, Mark Perbix. 2023. *Functional and Technical Requirements*. Designing an Effective Law Enforcement Data Dashboard. Washington, DC: Office of Community Oriented Policing Services.

Published 2023

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Acknowledgments

This document was prepared by SEARCH, Group Inc., in collaboration with the Police Executive Research Forum (PERF) and the U.S. Department of Justice, Office of Community Oriented Policing Services (COPS Office). The project team included SEARCH staff Michael Jacobson, Information Sharing Specialist; Diane Lacy, Information Sharing Specialist; and Mark Perbix, Programs Director; PERF staff Dave McClure, Senior Principal; and COPS Office staff George Fachner, Program Manager.



Letter from the Director of the COPS Office

Colleagues:

Policing, like so many other fields, is increasingly data-driven. Timely, accurate data, in useable formats, are necessary to law enforcement agencies seeking effective answers to policing challenges.

Data are in high demand outside the agency as well. The public wants to know how much crime is occurring in their neighborhoods, what agencies are doing to address it, the budgetary costs of these efforts, and how well they are succeeding—and law enforcement agencies want to provide these data, to create greater transparency and foster community trust. One method for making data more accessible is through a data dashboard.

Data dashboards, when implemented well, can provide much of this information, at a glance, to the people who require it. An effective, well-designed dashboard can enhance internal operations and fight informational silos while also informing the public about what is happening in their communities.

This series of three publications, *Getting It Right and Why it Matters*, *Developing a Concept of Operations Document*, and *Functional and Technical Requirements*, draws together best practices for conceptualizing, designing, and implementing a data dashboard, both for law enforcement agencies developing their own product and those using an external vendor.

The COPS Office's resources and technical assistance consistently support law enforcement agencies in developing a "what works" approach to working collectively with their communities to solve modern policing challenges. Data dashboards can be a powerful tool for increasing public transparency. We hope these three publications will help agencies use their own data to improve performance metrics, agency response, and community trust, and to enhance safety in their communities.

Sincerely,



Hugh T. Clements, Jr.

Director

Office of Community Oriented Policing Services

Letter from the Executive Director of PERF

Dear colleagues,

Police departments have more data than ever before, and a growing number have created dashboards to help them make better, data-driven decisions. But there are many possible approaches to designing a data dashboard, and a number of pitfalls to avoid. A dashboard that is ineffective—one that’s easy for end users to misread or misinterpret, for example—is worse than none at all.

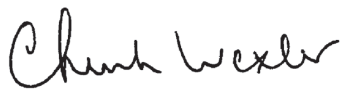
The most effective dashboards often seem simple in their design and presentation, but a lot of hard work goes into making something that is easy for users to operate. These three reports are designed to help departments design data dashboards that are useful and meet a department’s unique needs. *Getting it Right* gives examples from the field about following an organized approach to developing data dashboards. *Developing a Concept of Operations* focuses on creating a shared understanding across users of the capabilities a data dashboard should provide. *Technical Functional Requirements* looks at the technical side of developing and implementing data dashboards.

I would like to thank the staff of the National Consortium for Justice Information and Statistics (also called SEARCH) and the U.S. Department of Justice’s Office of Community Oriented Policing Services (COPS Office) for their collaborative efforts on the three reports. I would also like to thank the project advisory board (see appendix B) for their expertise, which assisted in molding and completing this work.

Finally, I would like to thank PERF staff members Dave McClure, Senior Principal and Kevin Morison, Chief Program Officer, for their work on this project.

I hope you will find these reports useful.

Sincerely,



Chuck Wexler

Executive Director

Police Executive Research Forum

Letter from the Executive Director of SEARCH

Dear colleagues,

Law enforcement agencies are implementing data dashboards to communicate valuable information, support data-driven decision-making, and provide information to the public.

SEARCH is pleased to provide the law enforcement and public safety communities with three educational documents on how to develop effective data dashboards: (1) *Getting It Right and Why it Matters*, (2) *Developing a Concept of Operations Document*, and (3) *Functional and Technical Requirements*.

The effective use of data is more important than ever for promoting transparency and accountability, and data dashboards are often the best way to do this. They provide timely information “at a glance” about important topics of interest to the many different audiences interested in law enforcement and public safety activities, both internal and external.

The goal of these three guides is to cover the lifecycle of the data dashboard development process from inception—providing the justification and benefits of developing a dashboard—through design and requirements. Using these documents as guides, any agency should be able to develop their own data dashboards or prepare an effective Request for Proposal (RFP) to acquire a dashboard product from a vendor or service provider.

Sincerely,



David J. Roberts
SEARCH Executive Director

About This Product Suite

The **Law Enforcement Data Dashboard Project** is a collaboration between SEARCH Group, Inc. (SEARCH), the Police Executive Research Forum (PERF), and the Office of Community Oriented Policing Services (COPS Office) to produce user-friendly guidance and tools to help law enforcement agencies successfully plan, design, implement, and sustain effective information dashboards within their ecosystems.

This report is part 3 of a three-product suite, *Designing an Effective Law Enforcement Dashboard*, which is intended to educate law enforcement and public safety executives, thought leaders, dashboard designers, project managers, and other integral stakeholders in the development process from project inception to technical design and development. Each product is based on extensive research and consultation with law enforcement leaders and subject matter experts in law enforcement, data science, information systems, project management, and technology innovation. Throughout each publication, the reader will find helpful tips with examples of real-world operational dashboards that are helping law enforcement agencies manage, analyze, and display actionable information in a user-friendly interface.

Three themes cut across all three products:

1. **Purpose.** Think methodically about the specific issue you intend to address by developing a dashboard.
2. **Collaboration.** Engage with key stakeholders, data owners, and end users throughout the design and development process to ensure the purpose envisioned for the dashboard matches the reality of what is possible.
3. **Communication.** Dashboards tell a story about high-value information to an end user. The organization or unit behind the dashboard is communicating its values in what it measures, tracks, and reports through its dashboard.

Beyond these three themes, each product focuses on a different aspect of dashboard creation and a different audience:

- *Getting it Right and Why it Matters: An Introduction*

Audience: Law enforcement executives, thought leaders/influencers, end users, community members, all stakeholders

Purpose: This guide serves as a primer on the promise and perils of dashboard inception, design, and development. It offers key insights from law enforcement leaders, designers, and technology innovators with extensive knowledge and expertise on the topic. Individuals who want to learn about what a dashboard is, how it can be leveraged as a powerful tool and resource in law enforcement, and pitfalls to avoid should read this guide.

- *Developing a Concept of Operations*

Audience: Project managers, agency stakeholders, end users, IT staff

Purpose: This guide provides a roadmap for developing a concept of operations (ConOps) document for a law enforcement dashboard. The purpose of a ConOps is to ensure that all stakeholders share a common vision and understanding of the capabilities a data dashboard can and should provide. This document includes helpful checklists, templates, and a complete example dashboard that readers can modify to suit their own purposes. Individuals who are charged with designing and implementing a law enforcement dashboard or writing a ConOps should read this guide. Individuals with approval authority or otherwise significant stake in the end product should also read this guide.

- *Developing Technical and Functional Requirements*

Audience: Project managers, IT staff

Purpose: This guide provides a roadmap for developing the technical and functional capabilities of a law enforcement dashboard system. It can be used to procure, develop, and implement a dashboard solution. Like *Developing a Concept of Operations*, it includes helpful checklists, templates, and instruction that readers should adapt to suit their agency-specific needs.

Introduction

Law enforcement agencies rely on technology and information systems to effectively and efficiently fulfill their mission to reduce crime in their communities. The key computer applications and data systems these agencies use to collect and manage data are frequently not connected with one another and often require multiple logins to gather information users need on a day-to-day basis. While these systems can be comprehensive and reliable tools, they do not provide a single, unified view of critical information to inform agency decision-making.

Law enforcement agencies (LEA) rely on computer-aided dispatch (CAD) systems and records management systems (RMS) as the primary computer applications used to track and manage detailed information about the agencies' activities. Agencies may also have applications for their crime lab, internal affairs, shot location detection, automatic license plate reading, or other specialized or internally developed data systems, as well as access to external data sources.¹ Often, agencies need to combine and analyze data from these disparate systems to provide actionable information for agency decision-makers.

Data dashboards are useful solutions to aggregate data from disparate systems that LEAs can then analyze to identify and visualize a comprehensive set of important performance indicators. Dashboards can

- allow users to visualize data collected from multiple law enforcement databases;
- provide a holistic view of agency operations and performance;
- help communicate findings to and answer questions and concerns from policy makers, news media, and the public.

Law enforcement agencies can select from a robust marketplace of dashboard applications. Selecting a dashboard system requires a comprehensive understanding of what is required and expected of a dashboard tool. Agencies can document these requirements in a *functional and technical requirements document*. The law enforcement community has followed this approach in the past, developing functional standards documents for CAD² and RMS³ systems to help agencies define their specific requirements and inform the acquisition process.

1. Other systems, such as traffic cameras, regional agency data sharing, booking, property and evidence, crash reporting, pawn data, civil process, protection orders, permits, and fleet management may or may not be included as RMS modules.

2. Law Enforcement Information Technology Standards Council, *Standard Functional Specifications for Law Enforcement Computer Aided Dispatch (CAD) Systems* (Washington, DC: Bureau of Justice Assistance, n.d.), https://bja.ojp.gov/sites/g/files/xyckuh186/files/media/document/leitsc_law_enforcement_cad_systems.pdf.

3. Law Enforcement Information Technology Standards Council, *Standard Functional Specifications for Law Enforcement Records Management Systems (RMS), Version II* (Washington, DC: Bureau of Justice Assistance, n.d.), <https://www.theiacp.org/sites/default/files/all/k-m/LawEnforcementRMSv2.pdf>.

This publication serves as a similar resource for LEAs choosing to implement a data dashboard system.

It is intended to guide LEA staff in how to gather the detailed requirements for their dashboard system and to develop the functional and technical specifications the agency will use to procure, develop, and implement it. This document

- identifies and describes the range of capabilities dashboards can provide;
- explains how dashboards contribute to data sharing;
- describes how dashboards provide access to and visually present information to support informed decision-making;
- identifies and defines the key factors an agency needs to successfully define, develop, and deploy a dashboard system.

Stakeholders who are involved in the dashboard procurement process can use this publication to help determine which capabilities and requirements apply to their organization. Agencies can also use it to evaluate their current capabilities and future needs as input into an acquisition process.

This publication organizes dashboard guidance into six sections:

- **Using Law Enforcement Dashboards.** A review of dashboards used by law enforcement and the importance of user perspectives
- **Dashboards and Performance Measures.** The importance of using key performance measurements in dashboards
- **Dashboard Design Best Practices.** Guidance for designing a dashboard system
- **Dashboard Business Requirements Process.** Guidance in gathering requirements for a dashboard system
- **Functional Requirements.** Use cases applicable to law enforcement dashboards
- **Technical Requirements.** Nonfunctional capabilities needed to implement and manage a dashboard system

1. Using Law Enforcement Dashboards

Law enforcement agencies use data so they can better understand the problems they face and improve their ability to respond effectively. Data come from many sources, with the analytical results generated from each data source often presented as reports, tables, spreadsheets, charts, and graphs. While there are numerous ways to aggregate and analyze data, this report focuses on the use of a particular type of data analysis and visualization tool called a *data dashboard*.

A dashboard is a **data analysis tool that displays select performance measures that are important to a given audience in a manner that is easy to use and understand—typically as graphic visualizations**. By representing data through visual elements like charts, graphs, and maps, data visualizations simplify complex data and provide an accessible way to understand trends, outliers, and patterns in data. Dashboards enable users to make decisions that are more informed; align activities with agency strategies and objectives; quickly identify data trends, outliers, or anomalies; and make comparisons. Dashboards, in essence, provide readily understandable information about key performance measures important to the agency.

Effective dashboards enable agencies to be proactive and “information agile” by immediately delivering information that the agency can use to help assess, enhance, and optimize its resources.

Audience perspectives

A law enforcement agency can use dashboards to support different agency users’ needs in different ways, aggregating data from multiple systems and customizing the presentation of those data and the analytical capabilities offered. Law enforcement dashboards are generally designed for the use of any or all of four audiences, each with a different perspective: (1) senior leadership, (2) operations management, (3) tactical and analytical staff, and (4) the public. In some cases, perspectives designed for one of these audiences can meet the needs of multiple user groups:⁴

- **Strategic perspective.** Strategic dashboards include high-level measures of performance that allow decision-makers to monitor the function and success of the agency. They are generally associated with key performance indicators (KPI) and measurements that reflect longer timelines and support long-term strategic and policy decisions.

4. Kunal Shah, *Designing Dashboards for Multiple Target Audiences*, virtual presentation (SAS Institute: Proceedings of the SAS Global Forum, June 16, 2020), 3, <https://www.sas.com/content/dam/SAS/support/en/sas-global-forum-proceedings/2020/4323-2020.pdf>.

- **Operational perspective.** Operational dashboards serve an audience responsible for activities that have a shorter timeline and require more immediate decisions. They may be associated with KPIs and measures that support more tactical decisions. They may monitor operations in real time and alert users when KPIs fall outside of performance objectives. Operational dashboards provide users with the information they need to identify and respond to problems.
- **Tactical perspective.** Tactical dashboards serve agency staff and crime analysts who require an emphasis on analysis and monitoring. These dashboards support deeper interactions with the data, such as working with multiple data sets and searching for patterns, relationships, and trends by various factors (e.g., time, location, person, circumstances). Tactical dashboard analyses can inform command staff decision-making.
- **Public-facing perspective.** Public dashboards present data that reflect community concerns, public safety incident awareness, and curated law enforcement statistics. Legal, security, and individual privacy concerns affect the detail of data available on public-facing dashboards.

What Are Key Performance Indicators (KPI)?

Key performance indicators (KPI) are the critical indicators of progress toward a law enforcement agency's goals and objectives. KPIs provide a measure for strategic and operational improvement, create an analytical basis for decision-making, and help focus attention on what matters most.

Other measures and metrics may go into determining and measuring KPIs, such as the following:

- **Key performance metrics.** A metric is a specific measurement or calculation associated with a KPI, meaning it contributes to the KPI but is not a KPI itself. Metrics are repeated measures that are applied as references for assessing variance, as compared to a defined target. A baseline is a point-in-time measure of a known state or performance level that an agency uses as a reference for subsequent measurements. Metric data are intermediary data, key for lagging and leading trends and patterns analysis.
- **Key performance measures.** A measure is a quantifiable expression of performance collected during the execution of tactics toward an intended outcome. Measures contribute to performance metrics. Measures can be either lagging or leading.
- **Lagging/Leading indicators.** Lagging indicators show how successful the agency was at achieving results in the past. Leading indicators predict likely future performance based on lagging indicators.

Source: "What is a Key Performance Indicator (KPI)?," KPI.org, accessed June 27, 2022, <https://kpi.org/KPI-Basics>.

Table 1 compares these perspectives in more detail.

Table 1. High-level characteristics of dashboard perspectives

Characteristic of perspective	Strategic	Operational	Tactical	Public-facing
Audience	Senior leadership	Command staff	Agency staff and crime analysts	Public
Usage	Long-term decision support; monitors long-term KPIs and performance measurements	Mid-term decision support; monitors shorter-term KPIs and performance measurements	Predictive statistics, trends, and pattern analysis	Informs the community on policing activities and selected performance data
Time frame of data	Historical trends (quarterly or annual)	Point in time snapshots (weekly, monthly, or cumulative)	Multi-year datasets	Comparative data statistics
Example dashboard content	Visualizations for crime rates, arrest rates, clearance rates, and officer complaints over time	Visualizations of officer activity and behavior, patterns of behavior, and training received	Visualizations for specific crime types such as stolen vehicles by time and location	Visualizations showing crime rates, response times, and police use of force statistics

Data privacy and dashboards

Data dashboards should be tailored to the needs of the intended audience. When designing a dashboard to serve multiple audiences, agencies should be mindful of data privacy requirements.

Agencies should consider completing a privacy impact assessment (PIA) to ensure that personally identifiable information (PII) is appropriately secured. A PIA is used to determine the risks and effects of collecting, maintaining, and disseminating PII in electronic information systems and to examine and evaluate protections and alternative processes for handling PII to mitigate potential privacy risks. Law enforcement agencies are familiar with the Federal Bureau of Investigation (FBI) Criminal Justice Information Services (CJIS) Security Policy⁵ that outlines standards for protecting criminal justice information—and PII—from collection through dissemination.

5. *Criminal Justice Information Services (CJIS) Security Policy version 5.9* (Washington, DC: Federal Bureau of Investigation, 2020), https://www.fbi.gov/file-repository/cjis_security_policy_v5-9_20200601.pdf/view.

Open Police Data and Public Data

In 2015 the White House launched the Police Data Initiative to encourage law enforcement agencies to release data to the public. While this initiative helped to bolster public trust, it also created concerns that this public data could compromise victims' safety if the data released could be traced back to individuals. Federal Trade Commission Chief Technologist Lorrie Cranor has written about potential issues with reidentifying individuals based on data associated with public safety incidents in a February 15, 2020 blog post, "Open Police Data Re-identification Risks," at <https://digital.gov/2016/05/17/open-police-data-re-identification-risks/>.

The FBI website "Department of Justice/FBI Privacy Impact Assessments (PIAs)" provides links to PIAs that can be used as templates: <https://www.fbi.gov/services/information-management/foipa/privacy-impact-assessments>.

Through the COPS Office, SEARCH has produced two resource documents on this topic that can also be used as guides to completing a PIA: *The Guide to Conducting Privacy Impact Assessments for State, Local, and Tribal Information Sharing Initiatives*⁶, which includes a Privacy Impact Assessment Template, and *The Law Enforcement Tech Guide for Information Technology Security – How to Assess Risk and Establish Effective Policies*.⁷

6. SEARCH, *Guide to Conducting Privacy Impact Assessments for State, Local, and Tribal Information Sharing Initiatives* (Washington, DC: Bureau of Justice Assistance, n.d.), <http://www.search.org/files/pdf/PIAGuide.pdf>.

7. "IT Security Self- and Risk-Assessment Tool," SEARCH, accessed June 27, 2022, <https://www.search.org/resources/it-security-self-and-risk-assessment-tool/>.

2. Dashboards and Performance Measures

Producing dashboards that contain meaningful metrics in a readily understandable format like a graph, timeline, or other visualization is an effective way to convey information to users.⁸ While tables of data may be appropriate in some instances, visualizations are often more informative than simply displaying numbers. Visualizations can display data as counts or percentages, with filtering and drill-down capabilities—for example, allowing a user to sort the number of calls for service by the type of call or the number of incident reports by crime type. Geographic data can be displayed as interactive maps. Timeline visualizations show comparative data by week, month, or year. Seattle’s SeaStat Crime Dashboard (figure 1 on page 8) illustrates some of these features in its “Citywide Shootings & Shots Fired” dashboard.

Law enforcement agencies rely on data to make informed decisions and assess their progress toward agency goals and objectives. This assessment depends on correctly identifying both metrics for success and the data necessary to calculate those metrics. These quantitative performance measures are known as key performance indicators, or KPIs. Crime and arrest clearance rates are the most traditional performance measures and are widely used. Community-oriented policing strategies, in which agencies and their community partners use collaborative problem-solving techniques, call for their own performance measures, such as community satisfaction with policing efforts,⁹ residents’ sense of safety, and trust between law enforcement and their communities.¹⁰

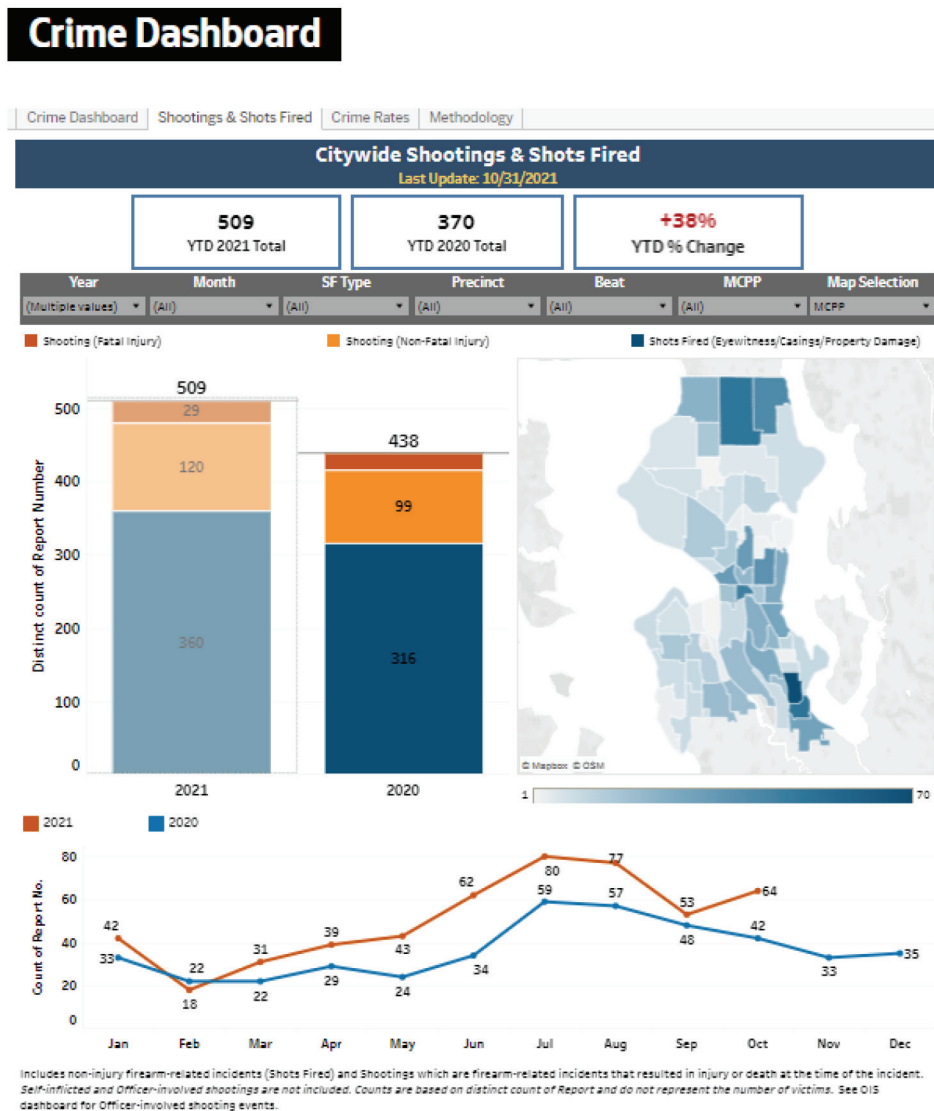
Performance management at many levels throughout a law enforcement agency relies on accurate and precise KPIs. Defining strategic agency objectives and building operational and tactical plans for their implementation requires a comprehensive understanding of current operations. Planning and implementing programs aligned with those strategic objectives requires continuous monitoring and measurement to ensure those programs are implemented effectively, operate efficiently, and provide a measurable return on investment of time and resources. Evaluating whether operational and strategic goals have been met calls for integrating a performance management framework into the agency’s organizational structure.

8. Dashboards and KPI reference sources include “KPI Dashboard – Definition, Benefits & Examples,” Sisense, accessed June 27, 2022, <https://www.sisense.com/glossary/kpi-dashboard/>; Thomas Gonzales, “Dashboard Design: Key Performance Indicators and Metrics,” July 22, 2019 <https://towardsdatascience.com/dashboard-design-key-performance-indicators-and-metrics-2b13745f5b2f>; and “KPIs, Dashboards, and Operational Metrics: A Guidelines,” Klipfolio, “accessed June 27, 2022, <https://www.klipfolio.com/resources/articles/kpi-dashboard-operational-metrics-top-10-guidelines>.

9. Susan Shah, Jim Burch, and S. Rebecca Neusteter, eds, *Leveraging CompStat to Include Community Measures in Police Performance Management*, Perspectives from the Field (New York: Vera Institute of Justice, 2018), 16–17.

10. President’s Task Force on 21st Century Policing, *Final Report of The President’s Task Force on 21st Century Policing* (Washington, DC: Office of Community-Oriented Policing Services, 2015), 23–24, https://www.cops.usdoj.gov/pdf/taskforce/taskforce_finalreport.pdf.

Figure 1. Seattle SeaStat Crime Dashboard



The COPS Office publication *The Law Enforcement Tech Guide for Creating Performance Measures that Work* provides specific guidance for law enforcement agencies on defining, implementing, and managing KPIs.¹¹

11. David J. Roberts, *Law Enforcement Tech Guide for Creating Performance Measures That Work: A Guide for Executives and Managers* (Washington, D.C.: U.S. Department of Justice Office of Community Oriented Policing Services, 2007), <https://cops.usdoj.gov/RIC/ric.php?page=detail&id=COPS-P120>.

Law enforcement key performance measures

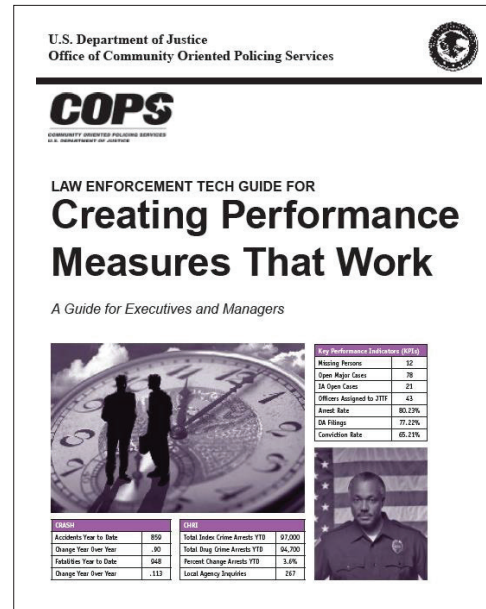
The U.S. Department of Justice (DOJ) identified four high-level policing KPIs in the mid-1970s: (1) crime rate, (2) arrest rate, (3) clearance rate, and (4) response times. The DOJ expanded these measures during the 1980s and 1990s to include public safety, use of resources, and—when law enforcement began adopting community- and problem-oriented policing strategies—community satisfaction measures.¹²

Crime rate

The crime rate is the most often discussed KPI in policing. It is the ratio of the number of crimes in an area to the population per 1,000 people per year. For example, Washington, D.C., had a population of 705,749 in 2019; the violent crime rate in that year was 10.49 per 1,000 people and the property crime rate was 54.16 per 1,000 people.¹³

Arrest rate

The arrest rate is the number of arrests made by law enforcement agencies per 100,000 population. An arrest rate is calculated by dividing the number of reported arrests in an area by its population; the result is multiplied by 100,000. For example, the arrest rate for the United States in 2016 was 3,298.5 arrests per 100,000 inhabitants.¹⁴



12. Geoffrey Alpert and Mark Moore, "Measuring Police Performance in the New Paradigm of Policing," in *Community Policing: Contemporary Readings*, Geoffrey P. Alpert and Alex Piquero, eds. NCJ-181382 (Washington, DC: U.S. Department of Justice, Bureau of Justice Assistance, 1998) 109, <https://www.ojp.gov/ncjrs/virtual-library/abstracts/measuring-police-performance-new-paradigm-policing-community>.

13. The FBI Uniform Crime Reporting (UCR) Program defines violent crime as offenses that involve force or threat of force, broken down into four offenses: (1) murder and non-negligent manslaughter, (2) rape, (3) robbery, and (4) aggravated assault. FBI, "Crime Data Explorer," accessed July 7, 2022, <https://crime-data-explorer.app.cloud.gov/pages/explorer/crime/crime-trend>.

14. FBI, *Crime in the United States 2016* (Washington, DC: Federal Bureau of Investigation, 2017), <https://ucr.fbi.gov/crime-in-the-u.s/2016/crime-in-the-u.s.-2016/topic-pages/persons-arrested>.

Clearance rate

Like the crime rate, the clearance rate is a well-established and institutionalized KPI. Also known as *resolution rate* or *solve rate*, this KPI is the number of offenses resolved as a percentage of the total number of offenses reported.¹⁵ For example, New York City had a clearance rate of 86.2 percent for homicide and 69.0 percent for aggravated assault in 2019.¹⁶

Response times

When someone calls 911 to report a crime in progress, they expect a timely response by police. Calls for service are generally classified by priority. A first priority call is a “serious incident” or an emergency call that requires an immediate response because there may be an immediate threat to life or a substantial risk of major property loss or damage. A second priority call does not require an immediate response, but there exists a likelihood that an officer’s investigation will lead to the apprehension of a suspect based on suspect information or physical evidence. A third priority call is a request for service where the officer’s primary function will be fact-finding, reporting, or rendering assistance. Response times are measured in minutes, from the receipt of the call to the arrival of the first officer on scene and can be broken down by priority.

Public safety

People want to be safe in their homes, schools, and workplaces; in public venues, such as malls, parks, sports, and entertainment venues; and when they travel. Various metrics are factored into measuring public safety. The most common measures include core metrics of arrest rate and response times to calls for service, alongside other metrics such as rates of home burglary, crimes against businesses, and crimes against people and property.

Public trust in police is often measured indirectly or by proxies. Trust is eroded by police use of force and by violence against marginalized or vulnerable communities, which police have a responsibility to protect.¹⁷ Hence, use of force and number or proportion of crimes having a bias motivation can be used

15. FBI, *Crime in the United States 2018*, “Clearances,” (Washington, DC: Federal Bureau of Investigation, 2019), <https://ucr.fbi.gov/crime-in-the-u.s/2018/crime-in-the-u.s.-2018/topic-pages/clearances>.

16. New York City Police Department, “2019 Clearance Report,” accessed July 15, 2022, <https://www1.nyc.gov/site/nypd/stats/reports-analysis/clearance.page>.

17. President’s Task Force on 21st Century Policing, *Final Report* (see note 10).

as metrics for trust, alongside complaints against officers and number of police traffic stops.¹⁸ Another approach to the public safety KPI is used by the Cambridge Harm Index Consensus—harm-focused measurements that define crime metrics in terms of harm to victims.¹⁹

The Cambridge Harm Index Consensus

The Cambridge Harm Index Consensus proposes assigning a weight to the harm caused by each crime rather than counting all crimes as equal. This index produces an annual measure, the Crime Harm Index (CHI), leveraging existing systems of data collection and reporting. The CHI includes only crimes reported to the police by victims and does not include police-initiated crimes, such as those arising from traffic stops or “stop and frisk” activities. Proponents of this measure believe it is a closer indicator of public safety than traditional metrics such as overall crime rate.

Source: Lawrence W. Sherman and Cambridge University Associates, “How to Count Crime: The Cambridge Harm Index Consensus,” *Cambridge Journal of Evidence-Based Policing* 4, 1–14 (2020), <https://link.springer.com/article/10.1007/s41887-020-00043-2>.

Use of resources

Community members hold police accountable not only for their performance but also for their use of budgetary and other resources. Core measures such as crimes reported versus crimes cleared by arrest and response times to calls for service are factored into measuring effective, efficient, and fair use of resources. Additional measures included as KPIs include the percentage of total police staff on active patrol, the average and total street time per police officer, distribution of crime duty officers by area, and average time to complete a crime report. Adding these measures to internal dashboards as well as to public-facing ones can provide command staff with additional data to help with resource allocation.²⁰

18. Shah, Susan, Jim Burch, and S. Rebecca Neusteter, eds. 2018. *Leveraging CompStat to Include Community Measures in Police Performance Management*. Perspectives from the Field. New York, NY: Vera Institute of Justice. 23–35.

19. Lawrence W. Sherman and Cambridge University Associates, “How to Count Crime: The Cambridge Harm Index Consensus,” *Cambridge Journal of Evidence-Based Policing* 4, 1–14 (2020), <https://link.springer.com/article/10.1007/s41887-020-00043-2>; J. H. Ratcliffe, *Harm-focused Policing* (Arlington, VA: National Policing Institute, 2015), <https://www.policinginstitute.org/publication/harm-focused-policing/>.

20. Mark H. Moore and Anthony Braga, *The ‘Bottom Line’ of Policing: What Citizens Should Value (and Measure!) in Police Performance* (Washington, DC: Police Executive Research Forum, 2003), [https://www.policeforum.org/assets/docs/Free Online Documents/Police Evaluation/the bottom line of policing 2003.pdf](https://www.policeforum.org/assets/docs/Free%20Online%20Documents/Police%20Evaluation/the%20bottom%20line%20of%20policing%202003.pdf).

Community satisfaction

Community-oriented policing (COP) encourages positive, non-enforcement contact and ongoing collaborative problem solving between police officers and the public. COP goals are to build public trust and enhance police legitimacy in the public eye. COP performance measures seek to quantify the extent to which police affect the quality of life in the communities they serve, as well as the problems they solve. One tool that agencies use to determine the success of a COP program is the DOJ Community Survey on Public Safety, which assesses the following:²¹

- Community involvement
- Safety
- Procedural justice
- Performance
- Contact and satisfaction

“The National Academy of Sciences found that a single, positive, non-enforcement related encounter enhanced the legitimacy of police officers and increased [the public’s] willingness to cooperate. The positive effects were continued toward police 21 days after the initial encounter.”

— Kyle Peyton, Michael Sierra-Arévalo, and David G. Rand, “A Field Experiment on Community Policing and Police Legitimacy,” *Proceedings of the National Academy of Sciences of the United States of America* 116 (40), 2019.

Other, more recent police reform initiatives and strategic plans provide further insight into newer goals and measures adopted by law enforcement agencies to encourage collaborative planning with health, education, social services, and other first responders. In 2015, the President’s Task Force on 21st Century Policing published its final report, which identified recommendations and action items that promote effective crime reduction by building public trust and advancing community policing.²² These initiatives, studies, and publications increasingly guide LEAs’ efforts to develop their strategic plans, goals, objectives, and performance measures.

21. *Community Survey on Public Safety and Law Enforcement* (Washington, DC: COPS Office, 2014), <https://cops.usdoj.gov/RIC/ric.php?page=detail&id=COPS-W0743>.

22. President’s Task Force on 21st Century Policing, *Final Report* (see note 10).

CompStat as a Performance Evaluation Tool

CompStat (short for either “comparative statistics” or “computer statistics”) is a performance management system developed by the New York Police Department in the early 1990s in response to rising citywide violent crime and increased concern for public safety. The goal was to reorient policing practices to reduce and prevent crime instead of merely responding to crimes after they are committed. The earliest version of CompStat was a basic computerized statistical tracking system, which focused on core law enforcement performance metrics. Through the years, it has evolved into a framework of measures that focus on identifying problems and developing solutions; LEAs still consider it transformative to modern policing missions.*

Developed in 2016, CompStat360 (CS360) is the next generation of CompStat. Taking a proactive and problem-solving approach, CS360 provides law enforcement with the tools to integrate community needs and feedback with a traditional CompStat data-driven crime monitoring process. CS360 provides police departments with enhanced data views and dimensions of analysis to measure accountability, police and community collaboration, organizational effectiveness, integration of non-command staff perspectives, and transparency. It extends the measures into a wider set of indicators that focus on emerging areas of concern, such as domestic violence, the opioid epidemic, mental health, and the COVID-19 pandemic.†

Nearly two-thirds of the nation’s largest police departments and many smaller agencies currently rely upon a CompStat-like program to highlight crime problems, deploy resources, and track progress. These programs’ measures can serve as the basis for dashboard visualizations.‡

* Police Executive Research Forum, *COMPSTAT: Its Origins, Evolution, and Future in Law Enforcement Agencies* (Washington, DC: Bureau of Justice Assistance, n.d.), <https://bja.ojp.gov/sites/g/files/xyckuh186/files/Publications/PERF-Compstat.pdf>.

† CompStat360, home page, accessed July 28, 2022, <https://www.compstat360.org>.

‡ David Weisburd, *The Growth of CompStat in American Policing* (Washington, DC: Police Foundation, 2004).

3. Dashboard Design Best Practices

The purpose of a dashboard is to provide the right information to the right audience. Dashboards should provide the user with actionable information that is timely, accurate, and easy to understand. Dashboards should be interactive, allowing the user to quickly visualize performance data to identify trends and patterns. PERF surveyed multiple agencies using dashboards and identified several additional best practices and design recommendations that LEAs should consider as they explore dashboard development. These best practices can be considered through two lenses: Process and Results. In other words, designers can approach the task by asking what they should *do*, or what the final dashboard should *be*.

From a Process perspective, there are three overarching best practices for designers to follow:

1. Define your audience.
 - ▲ Dashboard designers should clearly understand the context of the dashboard to ensure it supports the information objectives of the intended audience. While an executive needs a dashboard that aggregates key performance metrics to support decision-making about the agency, an operational manager needs a dashboard that highlights specific key metrics to identify performance gaps in their areas of responsibility.
2. Identify KPIs.
 - ▲ Dashboard designers should choose the KPIs they present based on the perspective of the intended audience and the goals they want to reach. It is not enough to present measures of current performance: Dashboards should show these measures in comparison to KPI target goals. For example, a property crime unit may have a targeted goal to reduce its community's burglary crime rate by 2 percent a year. A dashboard could show the trending of the measure compared to the targeted rate to monitor how the unit is progressing towards this goal.
3. Use interactive elements purposefully.
 - ▲ Data drill-downs and filtering are essential capabilities of dashboards. For example, consider Seattle's CAD Events tab, shown in figure 2 on page 16. Clicking on a CAD event category, such as Traffic, in the 2021 CAD Events by Group drill-down will display the data for just that group. Using the precinct filter in the top navigation bar enables the user to further filter events by precinct (figure 3 on page 17).

From a Results perspective, a data dashboard should follow five basic rules:

1. Data dashboards should be user-specific. Designers need to understand the intended audience's needs and requirements and then design the dashboard using visualization and presentation techniques that align with the user's technical abilities, subject matter knowledge, and authorized access to the data.
2. Data dashboards should be simple and self-evident. Effective dashboards should use a simple design that is quick and easy for users to scan and understand without requiring additional context, background information, or training.
3. Data dashboards should be purpose-specific. Dashboards should focus on answering specific questions on a specific topic. It is generally better to make two separate dashboards that serve two different purposes than it is to try to serve both purposes at the same time in a single dashboard.
4. Data dashboards should provide the user with basic navigation capabilities. Users should have the ability to filter and view subsets of the data presented in the visualizations.
5. Data dashboards should focus on providing answers to recurring questions. A dashboard is a dynamic means of communication. LEAs should regularly update their data so the dashboard presents current information to the end user. As a tool, data dashboards are not well suited to answering one-time questions.

These best practices provide two approaches to the same basic principles:

That the most effective dashboards

1. Are easy to interpret and visually appealing;
2. Answer a user's questions;
3. Do not overwhelm the user with too much detail.

Design Considerations for Dashboard Developers

The dashboard presentation is the application's user interface, and developers should consider these additional guidelines for user interface design:

- Design fields with user-friendly business names.
- Document business rules associated with data fields.
- Associate fields with screens, tables, charts, graphs, and presentations.
- Create conditional navigation, i.e., filtering.
- Create field-level help content, e.g., "hover hints."
- Create on-demand training content.

Figure 2. Drill-down into traffic events

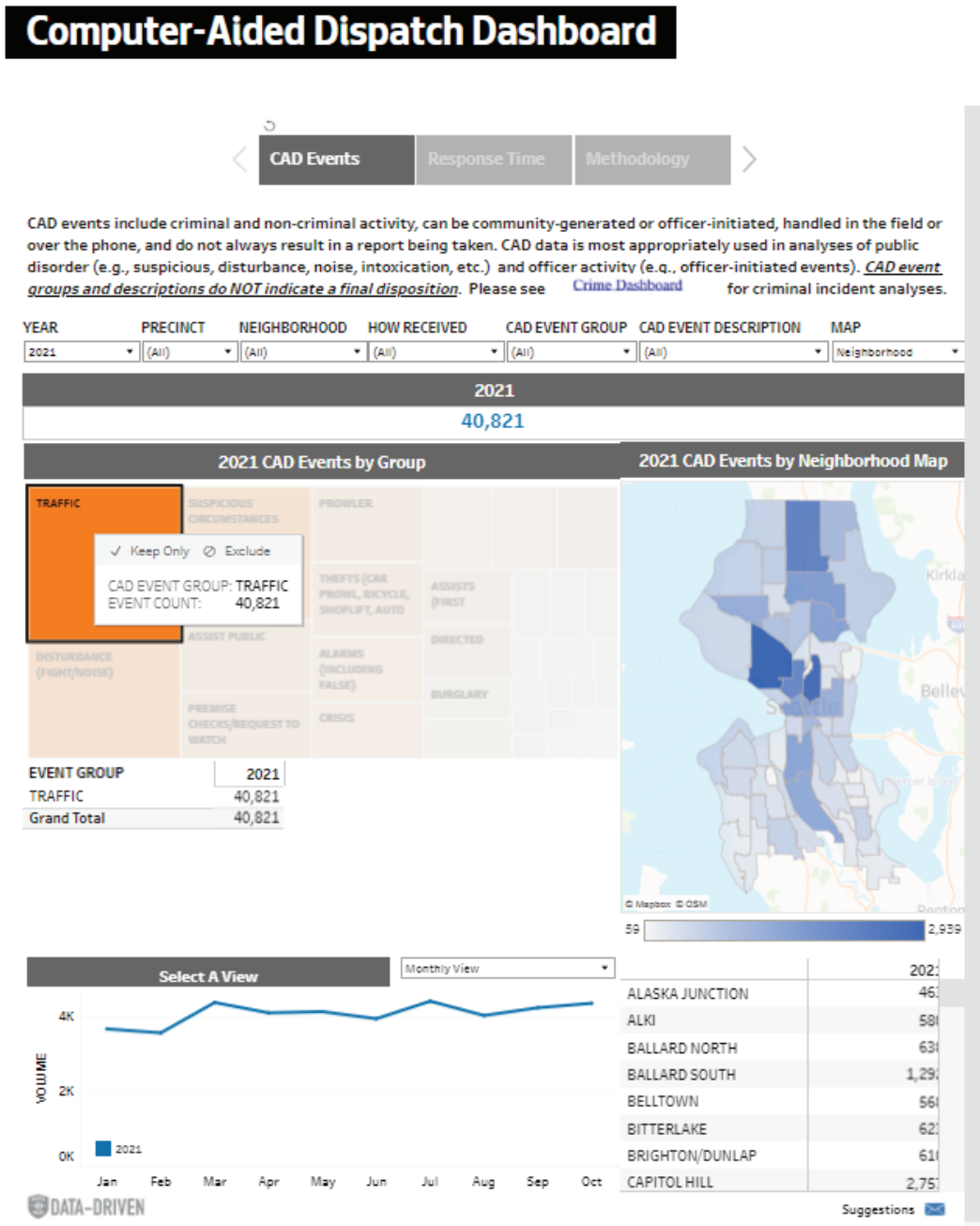


Figure 3. Filtering all events by precinct

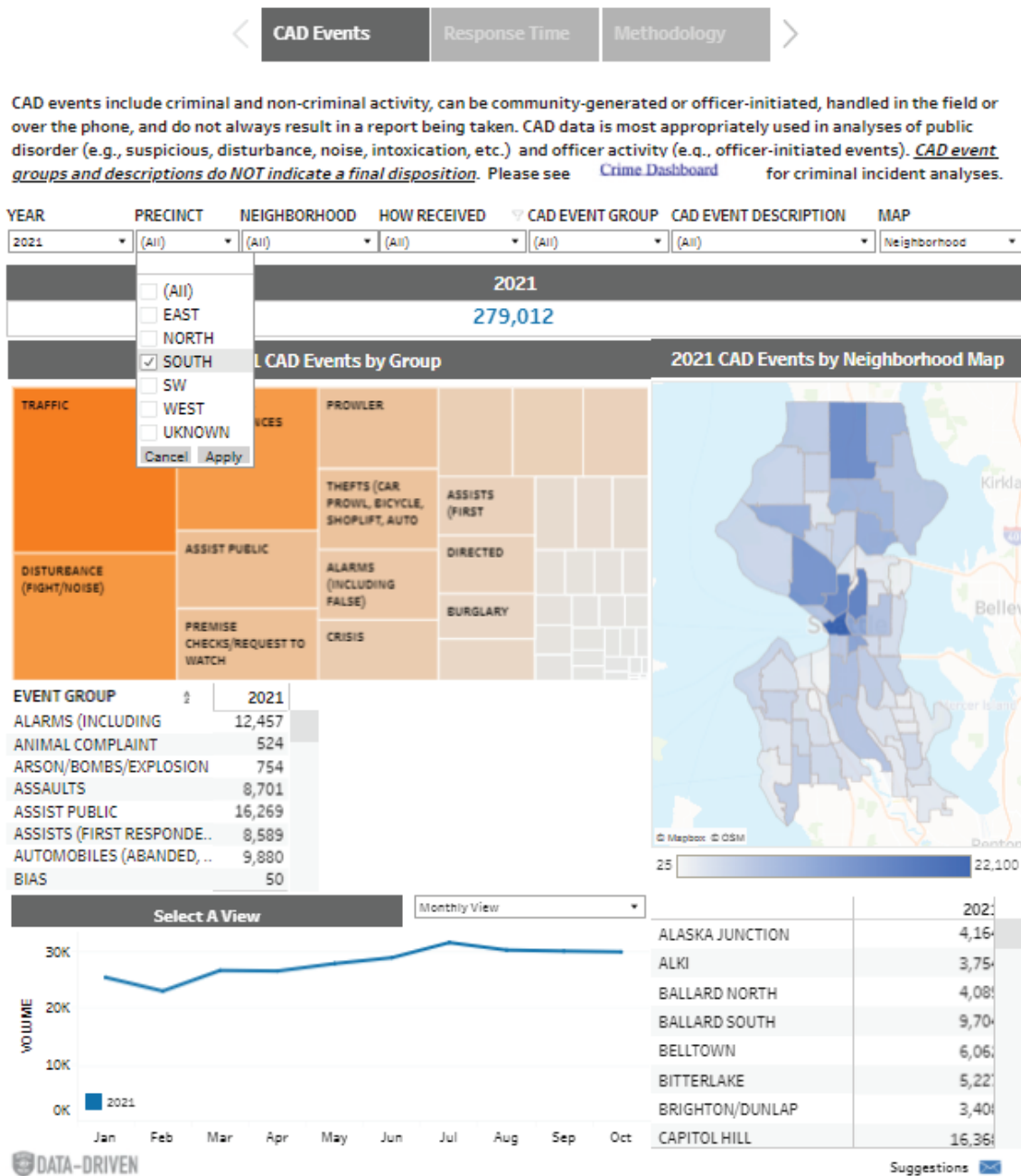
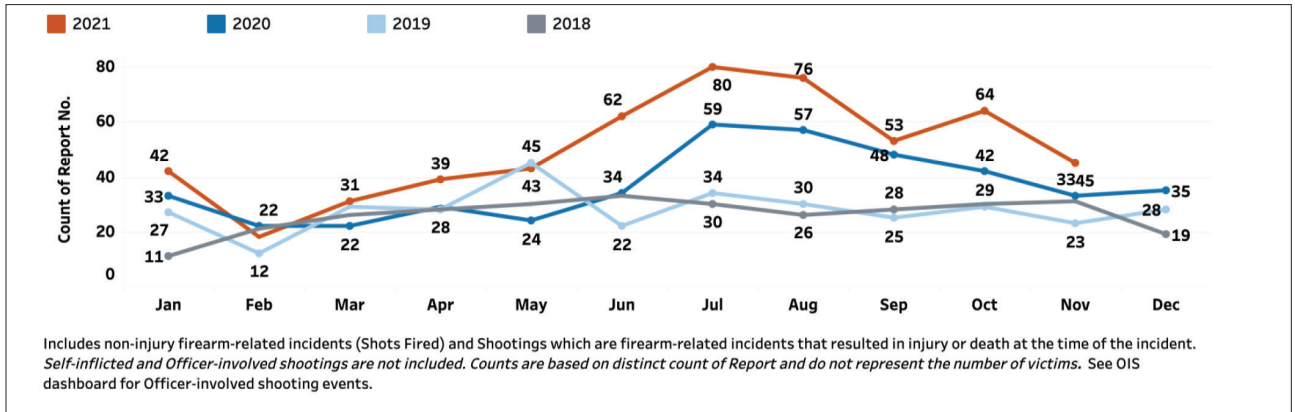


Chart types

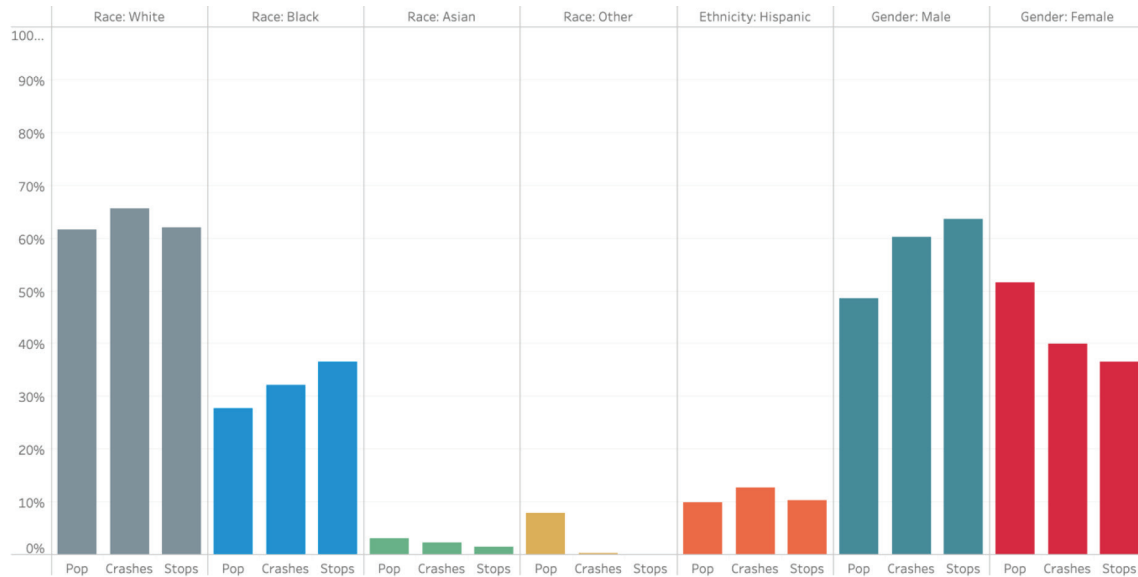
Line charts (figure 4) present a single or multiple sets of data points on an X/Y axis. LEAs use line charts to display patterns of change across a continuum or date range. They are compact, clear, and precise. Line charts are common, familiar to most people, and easy to understand.

Figure 4. Line chart example



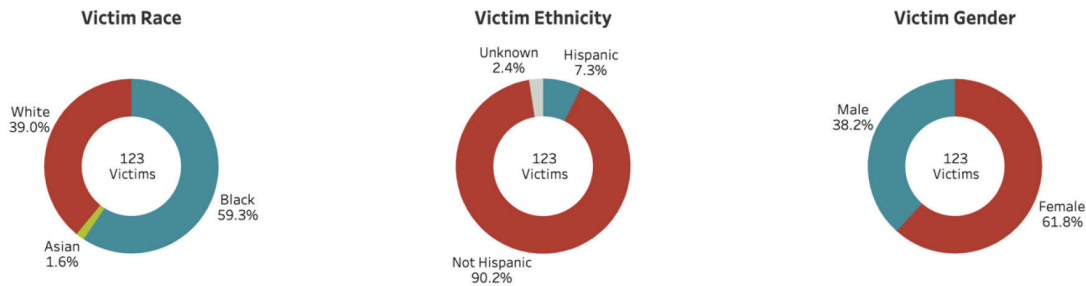
Bar charts (figure 5) show scaled comparisons in the same category. They are easy to understand, clear, and compact. Bars are plotted on a common baseline to allow for easy comparison of values.

Figure 5. Bar chart example



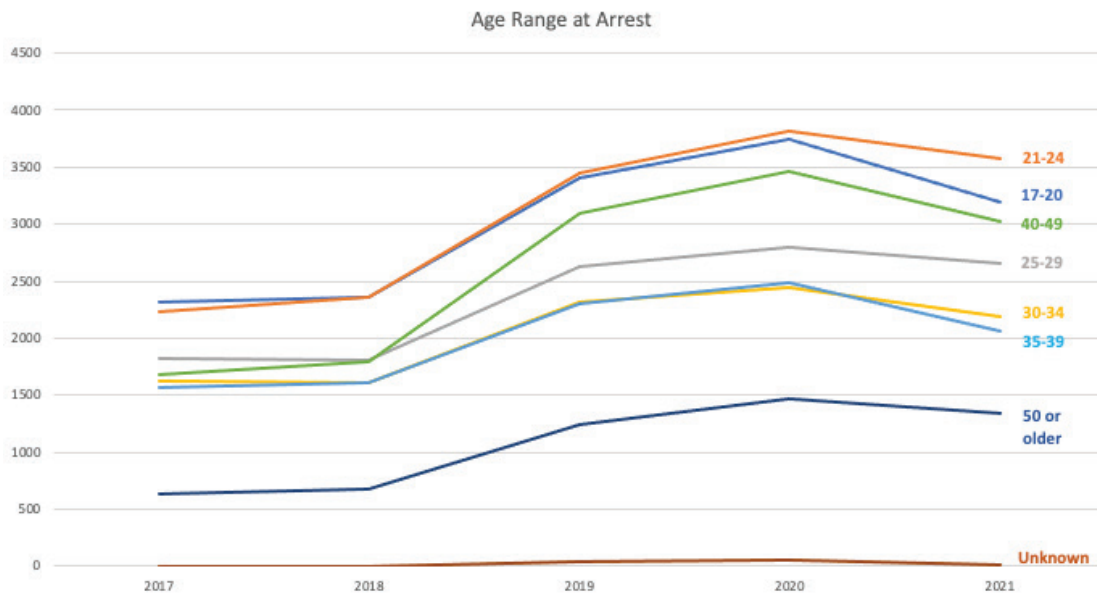
Ring and pie charts (figure 6) convey the relative percentage of the components of a given measure but have the disadvantage of not representing the scale of the measure itself. Ring and pie charts containing small slices or many slices can be difficult to read and understand. This chart type is best used to illustrate specific proportions of a total broken down by percentage or count.

Figure 6. Ring chart example



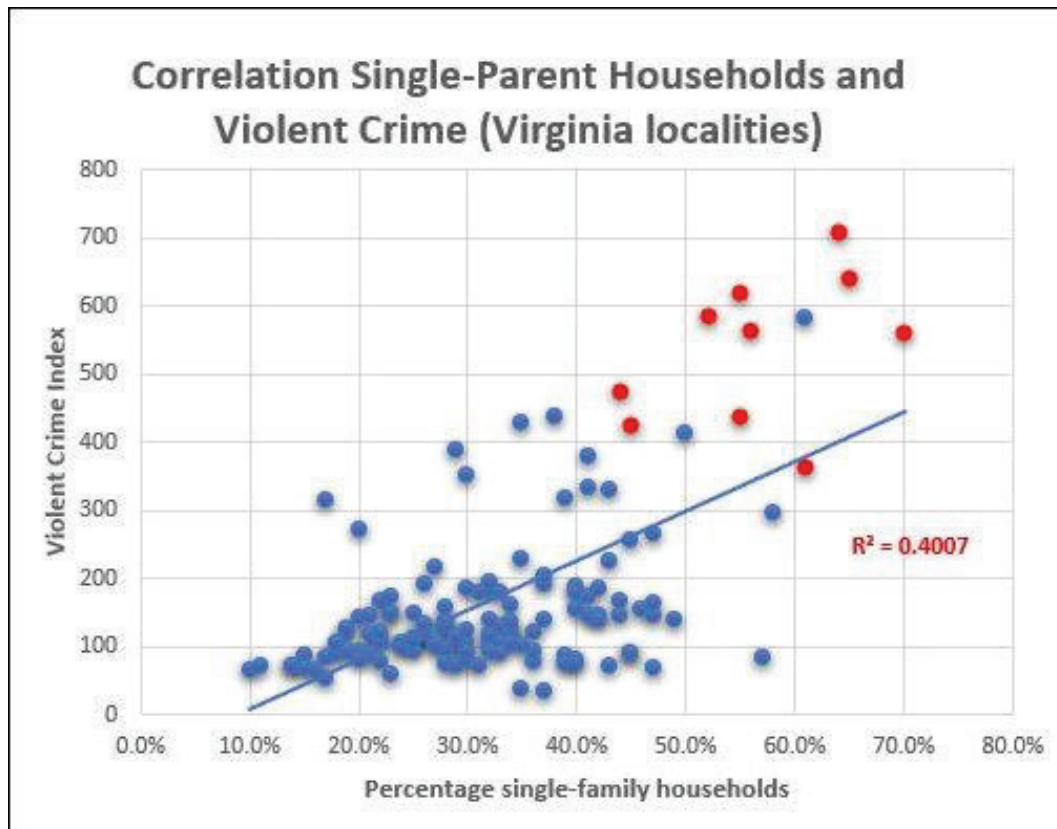
Sparklines (figure 7) are multiple-line charts of different data points in a vertical stack. They may or may not show scale, depending on the data presented. Sparklines are an effective way to show trends and patterns and work well with large data sets.

Figure 7. Sparkline example



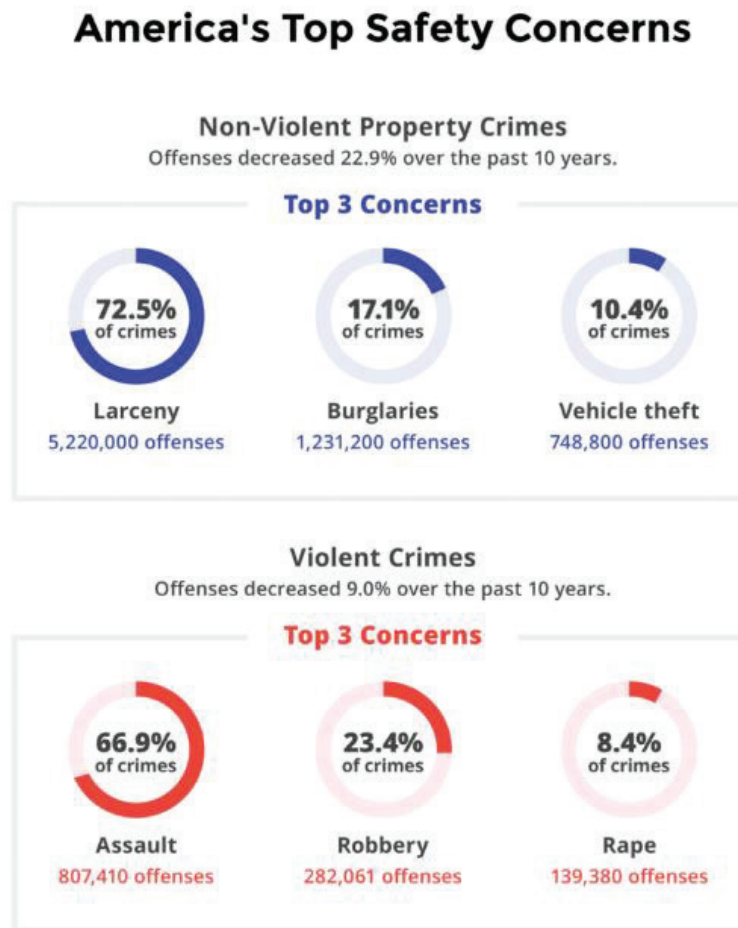
Scatterplots (figure 8) present correlations between two variables as an array of dots. When the data points are distributed on the chart, the correlation between the variables can be seen to be positive, negative, or nonexistent. Scatterplots effectively show relationships between two data sets. By adding a trend line, an analyst may be able to identify correlations between the data sets based on the mathematical best fit.

Figure 8. Scatterplot example



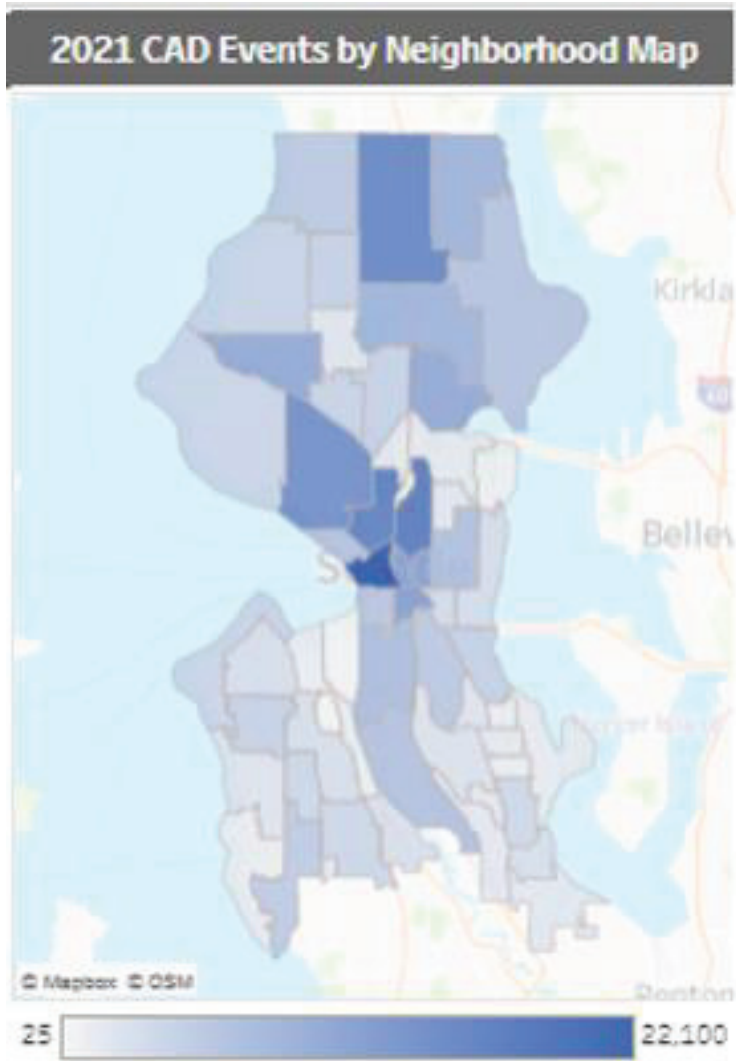
Gauge charts (figure 9 on page 21) are easy to interpret, as they use various colors to represent different values of the same metric. LEAs generally use gauge charts in situations where the expected value is already known. In this way, the different stakeholders who use the dashboard can understand where they stand just by looking at the gauge chart.

Figure 9. Gauge chart example



Heat maps (figure 10 on page 22) depict magnitudes through variations in color or shade. The screenshot in figure 10 illustrates an effective single-color heat map showing of the volume of service calls generated by different Seattle neighborhoods—the darker the hue, the higher the number of calls. Heat maps give an instant overview of data concentrations but do not provide an exact representation of the data.

Figure 10. Heat map example



Dashboard layout

The goal of dashboard design is to make data easy to understand by presenting it consistently and highlighting key data. Dashboard design best practices go beyond defining effective metrics and visualizations. Eye tracking studies show that designers should organize the placement of charts on a dashboard so users can easily find the information.²³ The examples of the SeaStat CAD dashboard (figures 1 to 3)²⁴ illustrate many attributes of good dashboard design:

- Provide what the users need from the dashboard. Stick to a single screen and provide an at-a-glance view.
- Allow users to control what data needs to be presented by providing filters and sort options.
- Use negative space to balance metrics, stats, and insights.
- Make drill-down and filtering intuitive.
- Make labels and data formatting consistent.
- Use consistent color schemes to deliver clear visibility.
- Use tabs to make it easy to navigate, and group visualizations of similar data in each tab.
- Provide a methodology tab to further explain what is behind the data.
- Provide all data in one dashboard using multiple tabs.

Dashboard tools provide many options for animations and special effects. These features can be tempting but can easily distract the user; designers should use them sparingly. The end user should see a simple data story with the main points highlighted and immediately clear.

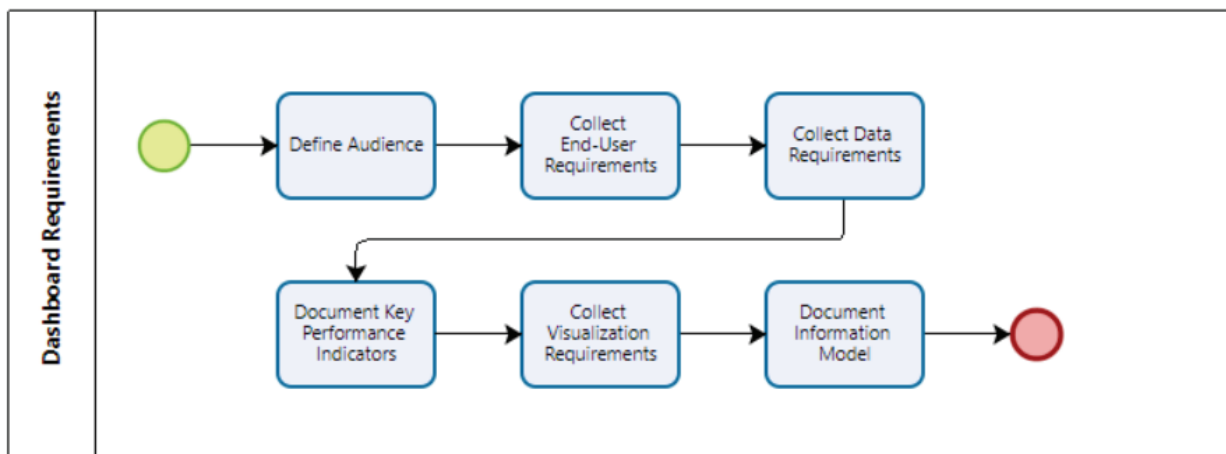
23. "Eye Tracking," Usability.gov, accessed June 29, 2022, <https://www.usability.gov/how-to-and-tools/methods/eye-tracking.html>.

24. "Computer Aided Dispatch Dashboard," Seattle Police Department, accessed June 29, 2022, <https://www.seattle.gov/police/information-and-data/computer-aided-dispatch-dashboard>.

4. Dashboard Business Requirements Process

Once the agency has defined its priorities and identified KPIs that measure progress toward those priorities, the next step is to gather the requirements for a dashboard tool to display those KPIs. To begin, the agency should define each audience that will use the dashboard, capture their requirements, and identify KPIs relevant to each audience. For each KPI, the agency should determine the data needed to produce the measure, identify what system(s) provide the data, and develop the supporting information model. It is imperative that the agency perform a rigorous information modeling process to ensure that the required data are accurate, consistent between perspectives, and regularly curated. The business process diagram in figure 11 depicts these high-level tasks to document the business requirements.

Figure 11. Business process diagram activities to document dashboard requirements



Define the audience

A well-designed dashboard clearly communicates information of interest and use to a given audience or user group. It is up to the project team to determine what those audiences are, consider the different perspectives of each group of end users, and present information that addresses their business needs and decision-making requirements. Steps in this stage of the design process include the following:

1. Define the audience (e.g., senior leadership, command staff, officers, agency staff, crime analysts, public).

2. Document the current business processes and reports. For example, how does senior leadership receive crime rate reports? How does command staff see response time information?
3. Describe the information timeframe. How often does the information need to be updated?
4. Determine the type of dashboard visualization that best suits the audience. Does the user want to see bar charts, pie charts, or another chart type?

Collect end-user requirements

The goal of this step is to identify and document end user requirements to use as input into the information model. Collecting end user requirements can be time-consuming, and shortcuts will invariably result in information gaps and inconsistencies in definitions, which may undermine users' understanding of and confidence in the data. Steps in this stage of the design process include the following:

1. Collect any short- or long-term goals and measures currently in place—for example, improving agency accountability or providing better service to the community. If these are lacking, the project team may need to add KPI development to the dashboard project plan and work through defining KPIs with each audience.
2. Collect what is currently being used for performance reporting (e.g., spreadsheets, manual reports).
3. Collect the questions each audience needs to have answered; these questions will inform the information model.

Collect data requirements

Begin a data collection plan to acquire the necessary data. This is often an iterative process: As data are presented on the dashboard, additional needs may arise that require revisiting the end user and data requirements collection processes. Steps in this stage of the design process include the following:

1. Identify the data source(s). What system(s) have the data needed for each visualization?
2. Inventory existing data systems and information about the data (metadata). Are the data authoritative? Are the data accurate and complete? Are the data available? Are there any restrictions on their use?

3. Determine what data will contribute to answering performance-related questions.
4. Determine what data elements will need to be extracted from the existing dataset and what elements will need to be derived to produce the visualizations.
5. Produce an information gap analysis. What data are needed to produce actionable information, and what parts of those data are currently available?
6. Revisit the *Collect End-User Requirements* step. Are there additional requirements that can now be met? Are there new requirements that can be visualized with the data available?

Document KPIs

Steps in this stage of the design process to establish and document KPIs include the following:

1. Does the agency have performance measurements in place? If so, start defining KPIs based on those.
2. Use the questions that each audience wants to ask and specifically identify the data elements needed to contribute to the answer. For example, one measure for improving agency accountability may be the use of force incident trends.
3. Determine if the answers to these questions can be framed quantitatively with the available data.
4. If not, determine if the answer can be calculated using available data.
5. Determine the best level of drill-down and filtering to explore the data.

Collect visualization requirements

Steps in this stage of the design process to collect visualization requirements include the following:

1. Identify the appropriate audience for each visualization—for example, which users will need to analyze trends and patterns of use of force incidents to establish evidence-based policies and training?
2. Define default visualizations based on the intended audience.
3. Determine interactive elements required for these visualizations, such as drill-downs and filters.

4. Define user preferences and personal view requirements.
5. Identify user notification requirements.
6. Storyboard the dashboard(s) for each role.

Develop an information model

Steps in this stage of the design process to create the information model used for the visualizations include the following:

1. Document attributes of the source of all data elements used in the dashboard (system, ownership, and update time frames).
2. Document all aggregation logic to ensure consistent calculations of sums, averages, means, and standard deviations. Data aggregation is the process where data is gathered and expressed in a summary form.
3. Document the derived data logic that illustrates how new data elements are computed from existing data. Derived data are data elements computed or extrapolated for other existing data. These data elements are needed to create new information not available from existing data.
4. Create an Entity-Relationship or similar diagram to illustrate how the information, such as people and events relate to each other. Entity-Relationship diagrams are graphical representations of the relationships between data tables.
5. If multiple dashboards use the same data, ensure data are accurately and consistently used across the dashboards.

5. Dashboard Functional Requirements

Identifying required measures through use cases

Use cases are an effective way to identify requirements. They help identify the measures the dashboards will use. Table 2 presents example use cases applicable to high-level KPIs and dashboard perspectives. LEAs can collect use cases and metrics from various state, local government, or law enforcement agency strategic plans, policing reform initiatives, and published studies. Each agency needs to evaluate its own policing goals and challenges to identify applicable use cases. The dashboard KPIs for crime rate, arrest rate, clearance rate, response times, public safety, use of resources, and community satisfaction have been incorporated into these high-level KPIs.

Table 2. Examples of high-level KPI and dashboard perspective use cases and metrics

Example	HIGH LEVEL KPI					PERSPECTIVE			Examples of use cases	Examples of metrics
	Crime Rate	Clearance rate	Public safety	Use of resources	Community service	Strategic	Operational	Tactical		
1	X					X			Senior leadership needs to be informed of their agency's overall crime rate to be aware of positive/negative trends and should be able to filter down to the underlying contributing factors.	The crime rate provides this information. The crime rate should be broken out by crime category.
2		X				X			Senior leadership needs to be informed of the clearance rate to be aware of positive/negative trends and should be able to drill-down to the underlying contributing factors.	The clearance rate calculation provides this information.
3			X			X			Senior leadership needs to be informed of the public safety trust level to be aware of positive/negative trends and should be able to drill-down to the underlying contributing factors.	Rate of violent crimes, such as murder, assault, rape, and robbery, which affect the public's perception of safety.

Example	HIGH LEVEL KPI					PERSPECTIVE			Examples of use cases	Examples of metrics
	Crime Rate	Clearance rate	Public safety	Use of resources	Community service	Strategic	Operational	Tactical		
4				X		X			Senior leadership needs to be informed of their agency's overall use of resources to be informed of the impact and effectiveness of decisions that shift the balances of base patrol activities and community policing and subsequent outcomes (e.g., reduced crime).	Counts of incident statistics (by crime, by date range, location, etc.).
5					X	X			Senior leadership needs to be informed of their agency's overall community service satisfaction rate to be informed of the impact and effectiveness of decisions that shift the balance of base patrol activities and community policing and subsequent outcomes (e.g., increased community service satisfaction).	Proportion of complaints against officers (internal, external, complaint type), resolution response type, active/closed status.
6	X		X				X	X	Command staff and officers need to know about auto theft crimes to assist in decisions on officer patrol assignments (location, time) and on citizen education to prevent auto theft.	Stolen vehicle crime rate (e.g., by location, offender, vehicle-type, cleared/uncleared).
7	X		X				X	X	Command staff and officers need to know about bias/hate crime motivation events to assist in decisions on the allocations and type of policing activities. Over time, analysis can determine the impact of those decisions on crime with bias/hate motivation indicators.	Counts of bias/motivation indicators by crime, offender demographics, time, location, cleared/uncleared.

Example	HIGH LEVEL KPI					PERSPECTIVE			Examples of use cases	Examples of metrics
	Crime Rate	Clearance rate	Public safety	Use of resources	Community service	Strategic	Operational	Tactical		
8	X		X				X	X	Command staff and officers need to know about incidents by location, time, and type to assist in short-term officer deployment decisions.	Counts of incident statistics (with the capacity to present by crime type, by date range, location, etc.).
9	X		X				X	X	Command staff and officers need to know about offender and victim demographics to assist in decisions on the allocation of type and location of policing activities and decisions on where to deploy hot-spot programs.	Counts of victim and offender demographics by crime, location, time.
10	X		X				X	X	Command staff and officers need to know about calls for service and officer encounters with homeless or transient persons to inform leadership of the extent and aspects of homelessness in their jurisdiction and inform decisions on police practices.	Distributions of encounters versus calls for service, demographic distributions, services, or resources provided to transient persons.
11	X						X	X	Command staff and officers need to know about incidents involving domestic violence to inform operational policies and practices to ensure that the agency follows proper investigative protocols for domestic violence incidents.	Domestic violence statistics (number of calls, associated offenses, percent of calls resulting in arrests, arrests resulting in charges, and charges referred to prosecution).
12		X	X	X			X	X	Command staff and officers need to know about arrest rates to show case-closing capabilities or gaps that may help improve the clearance rate.	Cleared/uncleared analysis by officer, by crime, backlog.

Example	HIGH LEVEL KPI					PERSPECTIVE			Examples of use cases	Examples of metrics
	Crime Rate	Clearance rate	Public safety	Use of resources	Community service	Strategic	Operational	Tactical		
13			X	X			X	X	Command staff and officers need to know how officers spend their time to assist in improving business processes, balancing assignments, or eliminating non-productive tasks.	Percent of total police staff on active duty, in-court appearances, the average and total time per police officer, distribution of crime duty officers by area, average time to complete a crime report, training hours.
14			X	X			X	X	Command staff and officers need to know about the number and type of traffic stops to inform management and leadership on officers' policing protocols regarding traffic stops.	Time spent on traffic stops, officers' reasons for traffic stops, outcomes of traffic stops, related use of force, driver demographics, car demographics, vehicle search rates, percent charges from traffic stops that are for crimes other than traffic violations.
15			X				X	X	Command staff and officers need to know about crimes involving alcohol/drug use to inform officer training in dealing with offenders under the influence. Over time, analysis can determine the impact of those decisions upon crime involving offenders under the influence of alcohol or drugs.	Counts of offenses committed while under the influence of alcohol or drug, filtered by crime, offender demographics, cleared/uncleared.
16			X				X	X	Command staff and officers need to know about officer-involved shootings to inform management and leadership of the circumstances of officer shootings and inform policies and practices.	Victim demographics, officer demographics, incident location, manner of shooting, manner of death, victim armed or not, signs of mental illness, threat level, whether victim fled, whether body camera was worn.

Example	HIGH LEVEL KPI					PERSPECTIVE			Examples of use cases	Examples of metrics
	Crime Rate	Clearance rate	Public safety	Use of resources	Community service	Strategic	Operational	Tactical		
17			X				X	X	Command staff and officers need to know about use of force to inform decisions on agency policies regarding the use of force and police training programs. Over time, analysis can determine the impact of those decisions upon use of force events.	Counts of subject or officer use of force, type of force, injuries, fatalities, subject, and officer demographics.
18			X				X	X	Command staff and officers need to know about police response and outcomes of encounters with homeless or transient persons to inform leadership of the trends or patterns of partnership programs with service providers, health centers, shelters.	Percentage of transient persons encountered who accepted help, type of help accepted, demographics of persons who accepted and declined.
19			X				X	X	Command staff and officers need to know about mental health circumstances in crime, traffic stops, domestic calls, and neighborhood policing; associated officer response; and positive/negative outcomes to inform management and senior leadership on trends and patterns of the vulnerable persons communities.	Person and officer demographics, incident location, response, outcome, percent of incidents with officer follow-up, percent encounters resulting in charges, victimization rate of vulnerable persons.

Example	HIGH LEVEL KPI					PERSPECTIVE			Examples of use cases	Examples of metrics
	Crime Rate	Clearance rate	Public safety	Use of resources	Community service	Strategic	Operational	Tactical		
20				X			X	X	Command staff and officers need to know about charge referrals to inform management of what factors contribute to the speed and quality of charges referred or not referred for prosecution.	Elapsed time to charge referral.
21				X			X	X	Command staff and officers need to know about time (regular versus overtime) and activities to inform management on what factors contribute to overtime. Time analysis can inform management on policy, police training, or business processes.	Staff time spent (by shift, by time period, by officer, by agency, by activity, daily, weekly, monthly).
22					X		X	X	Command staff and officers need to analyze calls for service statistics to assist in decisions on staffing and training of agency's dispatch centers.	Calls for service statistics (response times, calls by area, calls by time, time to answer calls, time spent on call, time of day that call came in, calls resulting in charges being filed, and calls resulting in officer dispatch).
23	X						X		Command staff needs to be informed of their agency's overall property crime rate with the ability to filter down to the lower-level data that produces the overall rate.	Agency-wide crime rate for property crimes (by time period, time range, rate-to-date of current year); this is an aggregation/roll-up of lower-level property crime measures.
24	X						X		Command staff needs to be informed of their agency's overall violent crime rate with the ability to filter down to the lower-level data that produces the overall rate.	Agency-wide crime rate for violent crimes (by crime, location, type, cleared/uncleared, offender demo, victim demo); this is an aggregation/roll-up of lower-level violent crime measures.

Example	HIGH LEVEL KPI					PERSPECTIVE			Examples of use cases	Examples of metrics
	Crime Rate	Clearance rate	Public safety	Use of resources	Community service	Strategic	Operational	Tactical		
25			X		X		X		Senior leadership and command staff need to know about officer complaints to inform management of the sources and circumstances of complaints to address concerns regarding officer response, behaviors, and policing activities.	Proportion of complaints against officers (internal, external, complaint type), resolution response type, active/closed status.
26			X		X		X		Command staff needs to be aware of the impact and effectiveness of patrol activities in protecting the general public and vulnerable persons from bullying, petty theft, and aggressive bias-motivated behavior.	Percentage of patrol time spent in each neighborhood.
27			X				X		Command staff needs to be aware of the impact and effectiveness of patrol activities in reducing low-level property crimes.	Rate of home burglary, auto theft, petty thefts, shoplifting, public drunkenness.
28				X			X		Command staff needs to know about case reporting practices to assist in understanding the timeliness and quality of reports and inform internal business processes for efficiency, officer time management, and training.	Rolling case backlog, average time to write/prepare case reports for review, review turnaround time, report rework, average time to complete review process by unit, crime, time range.
29				X			X		Command staff and officers need to account for officer activity and behavior, patterns of behavior and training received.	Use of force, community complaints, training metrics by officer.

Example	HIGH LEVEL KPI					PERSPECTIVE			Examples of use cases	Examples of metrics
	Crime Rate	Clearance rate	Public safety	Use of resources	Community service	Strategic	Operational	Tactical		
30					X		X		Command staff needs to be aware of the impact and effectiveness of Police Volunteer Programs that improve the level of community engagement to promote community safety.	Number of volunteer hours, number of volunteer community events, number of ongoing volunteer programs (e.g., volunteer clean-up days, youth mentoring programs).
31					X		X		Command staff needs to be informed of the impact and effectiveness of police youth programs to prevent and reduce juvenile crime, engage youth in community service activities, and to increase the overall trust between juveniles and law enforcement.	Number of formal and informal encounters with youth; percent of officers participating.
32					X		X		Command staff needs to be informed about police responses to 911 calls for service.	Percentage of officer time spent responding to 911 calls, percent of calls related to crime, percent of calls with no intervention, percent of cold calls, geographic call clusters.
33			X					X	Command staff need to know about the number of emergency calls to assist in decisions to improve emergency response processes and policies.	Average time to arrive on scene, percent of officers on scene with applicable training, outcome of police response by type of call.
34				X				X	Senior leadership needs to know about budget expenditures related to changes to or the implementation of new policing protocols, business processes, call management, and other programs.	Percent budget increase/decrease, filtered by time and by program changes.

Defining dashboard functional requirements

Dashboard functional requirements consist of usability and functionality features. A *usable* dashboard should provide information that is readily understandable and easy for users to find. A *functional* dashboard will also include design features that allow users to perform more complex tasks (e.g., filter data, configure visualizations, etc.) while still being simple enough for the users to easily find the information they need. The following dashboard functional requirements achieve both usability and functionality.

Usability

1. The dashboard should display the most important information users need in a way that allows them to easily locate it.
2. Each dashboard should confine its display to limit scrolling or switching between multiple web pages.
3. A dashboard should be limited to a single topic or area of concern. Tabs can be used to present multiple dashboards with multiple topics in a web page.
4. The level of detail and analytical capabilities provided in the dashboard should match the users' perspective and their ability to use the tool.
5. The dashboard should allow users to work with the information the way they want and to access that information quickly and easily.
6. The presentation of information in the dashboard should make it easy to answer high-priority questions.
7. Users should be able to intuitively use and navigate the dashboard, allowing them to drill into the details of the information presented.
8. The dashboard should be customized to the needs of its users.
9. The dashboard should embed explanations in natural language to help users understand the metrics shown in the visualizations and know where the data originates.

Functionality

1. Users need to be able to use and manipulate dashboards without installing any additional software on their computer.
2. The dashboards should be accessible using a web browser, and dashboard platforms must be compatible with all or a specified set of browsers.
3. The dashboard's home page should present high-level information that relates to the user.
4. The dashboard should have mechanisms to allow for drilling into additional detail.
5. The dashboard should allow users to customize their visualizations through filtering.
6. The dashboard should display the date(s) and source of the data used in each visualization.
7. The dashboard should allow users the ability to export the data used to produce a visualization in a variety of formats (e.g., Excel, CSV, PDF).
8. The dashboard should be able to present data on a map (e.g., geospatial representations).
9. The type of dashboard visualization should be modifiable by the user.
10. The dashboard should provide the ability for users to see and compare two or more subsets of data side by side; for example, a line chart may let the user view data from two geographic regions as separate lines.
11. The dashboard should provide alerts that highlight information based on pre-defined criteria. The dashboard should activate an alert when a metric goes beyond a specified threshold.

6. Dashboard Non—Functional Requirements

The term *non—functional requirements* refers to the technical and infrastructure capabilities needed to manage the environment of a dashboard system. System and database administrators address non—functional requirements to deploy, support, and maintain the dashboard. This section is intended as a general resource for the information technology (IT) staff to define the non—functional requirements that may be needed to support the dashboard system, including the following categories:

- Data exchanges and system interfaces
- Security
- Data administration, management, and integrity
- Application administration
- Application user interfaces
- Service level agreements to address system availability, maintainability, performance, and user support

Data exchanges and system interfaces

Dashboards typically use and aggregate data from multiple data systems. These data are frequently stored in a single data repository often called a *data warehouse*. To build the data repository requires developing programs to exchange, validate, and load data into a special database designed for performing data analytics. The process of collecting these data is called *extract, transform, and load* (ETL). The functions that the dashboard system must perform to gather data include the following:

- Enable the receipt of data from external sources via information exchanges.
- Provide data administrators the capabilities needed to manage ETL functions.
- Provide data administrators the ability to create and maintain the databases supporting the dashboard.
- Prevent corruption of the dashboard databases or their contents if one or more of the services the dashboard depends upon (such as an external database) becomes unavailable such that it continues to operate, possibly in a degraded mode.

Extract, Transform, and Load (ETL)

The ETL process supports acquiring data from authorized sources; curating, or transforming the data, such as by modifying them into a standard format and loading them into a database optimized for data analysis. The ETL process also addresses the frequency or schedule of data collection activities.

Source: "ETL (Extract, Transform, Load)," IBM.com, accessed June 30, 2022, <https://www.ibm.com/cloud/learn/etl>.

Security

The goal of system security is to prevent data from being compromised while at rest and in transit, and to ensure application integrity. System administrators should implement the dashboard within a secure network, if possible, with firewalls and network security measures in place. In addition to physical and transport layer security, the application should implement user authentication and authorization measures and role-based security. Applications generally accomplish user authentication and authorization through user IDs, passwords, and increasingly through two-factor authentication. Roles define access to resources and limit or grant privileges. In a dashboard environment, roles are typically limited to defining the audience for each dashboard. For example, crime analysts may have access to more data systems than dispatchers, and internal users such as patrol commanders will have access to more detailed information than the public.

Security requirements include the following capabilities:

- Create and assign user accounts.
- Create and associate user accounts to user roles.
- Create and associate business needs to user roles.
- Create and associate dashboard functionality and data access privileges to user roles.
- Integrate with a single or distributed user authentication service or a federated user authentication service.
- Mark a data element as sensitive or confidential.

Data administration, management, and integrity

Data administration refers to the capability to establish and maintain the dashboard's underlying information model, the framework that establishes the relationships between data groups, categories within groups, and elements within categories. (Note: These terms may differ depending on the database platform.)

The system administrator should base the dashboard's functional characteristics on an information model that supports attributes for people, incidents, locations, activities, and events. An example activity could be calls for service with categories of each type of call for service defined using separate data values such as arrest, citation, warning, etc. Similar data values or "enumerations" can be provided for each data element such as location, circumstances, and outcomes. Assess the dashboard's information model against the mandatory and optional functional characteristics of the dashboards. This task involves both business subject matter experts and technical data administrators.

Data management and integrity practices ensure that data are accurate, protected, and database referential integrity is safeguarded. As system administrators configure dashboard functional components, they should continually conduct validation tests to ensure that data relationships are accurate and complete. Ideally, data validation should occur in real time against configuration and validation rules, and the system should generate data validation and error reports or notifications. Data administrators should also be able to generate data relationship diagrams and data dictionary reports based on the data sources.

The dashboard application should allow system administrators to do the following:

- Design, configure, and maintain the underlying information model, including derived and calculated fields, as well as mapping fields to outside data sources.
- Configure and maintain templates for tables, charts, graphs, and presentations.
- Generate data dictionary reports and data relationship diagrams.
- Create scheduled and ad hoc backups.
- Restore backups.
- Generate configured and ad hoc connections to data sources.
- Create activity and audit logs.

Application administration

Dashboard components and functions should be configurable to meet an agency's current requirements and new or changing requirements over time. The dashboard should be flexible and customizable. Configuration capabilities should also maintain application and data integrity as components are reconfigured. This set of functions allows system administrators to customize features and functionality to meet the needs of the agency including by adding custom data fields graphical screens and interfaces.

Dashboard products should include user and technical documentation to provide guidance and instructions including on the following:

- Environmental and architecture requirements: database platform, server requirements, etc.
- How to implement capabilities: the attributes, characteristics, and qualities of the system
- How to customize configurable user-defined fields
- How to configure system-to-system interfaces
- Manuals for the end users (ideally, provided in the dashboard user interface, itself)

User access

The dashboard's non-functional capabilities control how users access and query data, view information in a variety of graphical representations, and drill down to the underlying data (within the parameters of the dashboard design). The non-functional capabilities of the dashboard platform allow system administrators to design, configure, and customize these access control capabilities.

Enterprise architecture integration

Many LEAs rely on their county, city, or other entities for IT support. This support frequently uses an enterprise architecture (EA) strategy that identifies reusable sets of standardized services. The EA strategy may dictate that application solutions comply within the standard services. When conducting a dashboard solution assessment, LEAs should consider the system's ability not only to meet functional standards but also to integrate into the enterprise services environment.

Enterprise network services provide the communication infrastructure between locations, facilities, and systems, as well as connectivity to law enforcement, courts, and other justice services. The dashboard system should not require any custom network connectivity; instead, it should be “network agnostic” and capable of using supported network protocols for security, reliability, functionality, and information sharing.

Enterprise hosting services provide the hardware and system software infrastructure—servers, database storage, operating systems—to support the dashboard environment. The system should be capable of operating in a variety of hosted environments, whether local servers, enterprise servers, or cloud-based environments. Dashboard user interfaces should be browser-based and deployable on a variety of browsers capable of use on all devices, e.g., desktops, laptops, tablets, and mobile phones.

Enterprise data services provide technology offerings for data storage, access, availability, and security. The database platform options likely include mainframe, cloud-based, and locally hosted database servers. Data availability services provide automatic failover capabilities to ensure high reliability, data backup, restoration, archiving, and recovery capabilities. Data security services provide encryption capabilities for data at rest and in motion and protection against malicious actors and data theft.

Service-level agreements

Service-level agreements (SLA) document the agency requirements for system availability, maintainability, performance, and user support.

Availability measures the time that a dashboard system needs to be available for use by customers. SLAs document the system availability requirements for users. The SLA should specify availability requirements based on the criticality of the system and should take into consideration the need for periodic maintenance and other scheduled downtime.

Maintainability is the ease and speed with which a system outage or problem can be identified and resolved. SLAs usually express and measure maintainability in “Mean Time to Repair,” which includes staff response and resolution times based on the severity of the problem. SLAs document system maintainability by defining problem severity levels. Severity level definitions take into consideration the extent of the user impact, the frequency of the problem, the impact on business processes, and the time to resolution.

Performance is generally expressed in metrics for online activity response times. Similar to system availability statements, broad performance statements should be realistic for their particular dashboard environment. Dashboard response times are often a function of resource availability and the size of the dataset.

System resilience should include items to reduce the likelihood that the system will become unavailable. Examples of provisions to include in the SLA include the following:

- The hosting entity or solution provider should take steps to reduce the probability of system failures and unplanned outages (e.g., load balancing servers to prevent overloads, providing redundancies to avoid single points of failure).
- The hosting entity or solution provider should be able to identify potential vulnerabilities and take steps to address them.
- The hosting entity or solution provider should be able to detect system problems as they occur and take prompt steps to remediate any issues (e.g., monitoring physical servers and specific applications/services).
- Disaster Recovery/Failover should be built into the architecture design and monitored to ensure that backups and redundant systems are current

User support should be available online and by phone during predetermined hours (e.g., 7:00 a.m. to 6:00 p.m. EDT). If patches and upgrades are part of the licensing or maintenance agreement, the SLA should apply these outside of normal office hours. Agencies should test all patches and upgrades prior to deployment in a production environment, and the provider should be able to roll back any system changes in the event the system becomes unstable or inoperable.

Appendix. Law Enforcement Data Dashboards Project Advisory Committee Members

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About SEARCH

SEARCH, the National Consortium for Justice Information and Statistics, is a nonprofit organization governed by a membership group of governor appointees from the 50 states, the District of Columbia, and the territories.

SEARCH has 53 years of experience supporting the information sharing, information technology, cybercrime investigative and digital forensics, and criminal records systems needs of state, local and tribal justice and public safety agencies and practitioners nationwide.

SEARCH's purpose is to

- improve the administration of justice through the effective application and responsible deployment of information and identification technologies;
- develop and promote constitutionally balanced and effective law and policy governing the use and management of justice information and identification technologies;
- enhance the efficiency, effectiveness, and quality of decision-making and information management through policy analysis, training, technical assistance, and systems development;
- inform and improve policy and practice in the administration of justice through evidence-based research and data.

For more information on SEARCH and its products, services, and resources, see www.search.org.

About PERF

The **Police Executive Research Forum (PERF)** is an independent research organization that focuses on critical issues in policing. Since its founding in 1976, PERF has identified best practices on fundamental issues such as police use of force; developing community policing and problem-oriented policing; using technologies to deliver police services to the community; and evaluating crime reduction strategies.

PERF strives to advance professionalism in policing and to improve the delivery of police services through the exercise of strong national leadership, public debate of police and criminal justice issues, and research and policy development.

In addition to conducting research and publishing reports on our findings, PERF conducts management studies of individual law enforcement agencies; educates hundreds of police officials each year in the Senior Management Institute for Police, a three-week executive development program; and provides executive search services to governments that wish to conduct national searches for their next police chief.

All of PERF's work benefits from PERF's status as a membership organization of police officials, who share information and open their agencies to research and study. PERF members also include academics, federal government leaders, and others with an interest in policing and criminal justice.

All PERF members must have a four-year college degree and must subscribe to a set of founding principles, emphasizing the importance of research and public debate in policing, adherence to the Constitution and the highest standards of ethics and integrity, and accountability to the communities that police agencies serve.

PERF is governed by a member-elected President and Board of Directors and a Board-appointed Executive Director.

To learn more, visit PERF online at www.policeforum.org.

About the COPS Office

The **Office of Community Oriented Policing Services (COPS Office)** is the component of the U.S. Department of Justice responsible for advancing the practice of community policing by the nation's state, local, territorial, and tribal law enforcement agencies through information and grant resources.

Community policing begins with a commitment to building trust and mutual respect between police and communities. It supports public safety by encouraging all stakeholders to work together to address our nation's crime challenges. When police and communities collaborate, they more effectively address underlying issues, change negative behavioral patterns, and allocate resources.

Rather than simply responding to crime, community policing focuses on preventing it through strategic problem-solving approaches based on collaboration. The COPS Office awards grants to hire community policing officers and support the development and testing of innovative policing strategies. COPS Office funding also provides training and technical assistance to community members and local government leaders, as well as all levels of law enforcement.

Since 1994, the COPS Office has been appropriated more than \$20 billion to add community policing officers to the nation's streets, enhance crime fighting technology, support crime prevention initiatives, and provide training and technical assistance to help advance community policing. Other achievements include the following:

- To date, the COPS Office has funded the hiring of approximately 136,000 additional officers by more than 13,000 of the nation's 18,000 law enforcement agencies in both small and large jurisdictions.
- More than 800,000 law enforcement personnel, community members, and government leaders have been trained through COPS Office-funded training organizations and the COPS Training Portal.
- Almost 800 agencies have received customized advice and peer-led technical assistance through the COPS Office Collaborative Reform Initiative Technical Assistance Center.
- To date, the COPS Office has distributed more than eight million topic-specific publications, training curricula, white papers, and resource CDs and flash drives.

The COPS Office also sponsors conferences, roundtables, and other forums focused on issues critical to law enforcement. COPS Office information resources, covering a wide range of community policing topics such as school and campus safety, violent crime, and officer safety and wellness, can be downloaded via the COPS Office's home page, <https://cops.usdoj.gov>.



Data dashboards can help law enforcement agencies manage, analyze, and display actionable information in a user-friendly interface. This publication, *Developing Technical and Functional Requirements*, is part of the three-part Designing an Effective Law Enforcement Data Dashboard series produced by the SEARCH Group, Inc and the Police Executive Research Forum. It provides agency project managers and IT staff seeking to implement data dashboards with a roadmap for developing the dashboard system's technical and functional requirements of a law enforcement dashboard system, including checklists and templates.

Each publication in this series is based on research and consultation with law enforcement leaders and subject matter experts and contains examples of real-world operational dashboards and tips for planning, designing, implementing, and sustaining data dashboards in a law enforcement agency.



COPS
Community Oriented Policing Services
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To obtain details about COPS Office programs,
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