

A GUIDE FOR SMART COMMUNITIES: Using GIS Technology for Local Government Management



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Esri builds ArcGIS, the world's most powerful mapping and spatial analytics software. The company believes The Science of Where can unlock data's full potential in every organization. For local governments looking for ways to build safe, healthy, and resilient communities for their constituents, mapping and analytics using GIS offer new insights for delivering services more effectively and engaging residents more fully. GIS technology gives governments and their citizens access to the information they need to make more informed decisions. To learn more about Esri, please visit esri.com.

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Foreword

We live in an age of tremendous creativity and innovation. For local governments, this means taking new approaches to problem solving. Seeing the big picture but understanding all the interconnected details. Adapting quickly when necessary but simultaneously keeping the long-range view of a resilient and sustainable community.

Beyond that, innovation requires us to shake things up and do things differently. It's not just about brainstorming or blue-sky thinking. It requires taking advantage of employee experience and competence, and then considering how local government processes, procedures, and systems could or should work. It's based on understanding what our residents expect when they interact with government.

Esri has worked with the International City/County Management Association (ICMA) for over twenty-five years to encourage creativity and innovation in local governments. A geographic information system (GIS) enables government staffs to easily tap into existing data and citizen feedback and to use that information to answer the most important questions about what is best for the community. This guide shows you how a local government can create new efficiencies, generate cost savings, demonstrate return on investment, and engage everyone using GIS. We'll explore how 2D and 3D GIS help developers and residents alike understand real and potential impacts of a new development. We'll share the power of storytelling with maps and how a simple mobile strategy leads to real-time decision making.

We have moved from the Information Age to the Innovation Age. Our future lies not in collecting and processing data, but instead, defining the challenges faced by local governments and analyzing what policies will produce the desired results. Smart communities must approach technology with creative minds. This guide highlights how location intelligence is enabling communities to respond faster with more confidence and understanding.

Jack Dangermond
Founder and President
Esri





Defining Smart Communities: The Journey to a City of the Future

Amy Ahner, Director of Administrative Services, Village of Glenview, Illinois

The Smart Cities movement has garnered tremendous attention from local government leaders over the past five years, but what do we mean by a “smart city” or a “smart community”? For some communities, becoming a smart city is all about technology and integrating it into the daily operations of local government departments. It’s having access to real-time data for work crews in the field. For others, it’s about automating systems, enabling residents to make service requests from their smartphone or on the government’s website. Or perhaps it’s becoming the “paperless office” that we’ve all heard about for the past two decades.

At this moment in time, however, there is no single universal definition of what it takes to be a smart community though there are many organizations and businesses dedicated to exploring this topic. In response to member interest in this topic, ICMA formed the Smart Communities Advisory Board. Board members have a strong interest in providing new content and education to enable our members to become IT-savvy managers. Defining what it means to be a smart community for their jurisdiction is part of the journey to becoming a smart community.

Implementing technology for technology's sake or because of a desire to keep up with the community next door is not smart. Local government managers need to first identify what challenge(s) or problem(s) they want to resolve in the community. Only after this has been done should a community begin to consider technology options. Technology should not drive purchasing and implementation decisions, but rather it should be used to address community challenges or achieve desired goals. For example, in Dubai, officials want the city to be the "happiest place on Earth"—definitely a goal that requires creativity and innovation to address. But the city is well on its way to achieving this goal. Local government leaders have installed Happiness Meters throughout the city to enable residents to rank their happiness with everyday services. In the case of a city manager in Florida, the thing that keeps him awake at night is the desire for his community to "not to become the next Atlantis." He has seen the effects of climate change at work in his community and wants to reverse the effects as well as prevent more problems.

Such goals may seem lofty, but they offer a clear understanding of what the communities need from technology. Smart communities have an overriding purpose that leaders want to address. To do so, they establish milestones and track metrics to determine their progress. They ask questions to determine what needs to happen for the community to achieve its goals.



See how Fairfax County, VA, uses 3D GIS to understand how new development affects the community.

Considering the rapid pace of technological and digital change, what questions should a manager be asking when the discussion turns to the topic of smart communities? Here are a few for your consideration:

- *Managers ask about what they can do to keep systems secure from security breaches.*
 - Do our current technology policies address social media use and storage?
 - What are our data breach notification requirements? How are we securing public data?
 - What is our greatest risk or weakest point in the network, and what should we do to address it?
 - Do our current policies and procedures employ best practices to connect devices to the network?
- *Managers ask about strategies to implement the technology and to change operations.*
 - What can we do to increase connectivity and speed by expanding broadband and/or fiber optic networks in the community? Who are the providers? How are we integrating communications with the capital improvement plan?
 - What investments in the infrastructure backbone would we need to support a series of networked cameras or a dashboard initiative to track performance?
 - If the community wanted to organize a crowd-funding project, what technology support would be necessary?
 - Should we host a hack-a-thon?



■ ***Managers ask about technology trends to stay ahead of the curve.***

- What services can be migrated to the cloud? Does our current cloud service provider meet the FedRAMP government security standards?
- Do we meet international standards for data backup and disaster recovery and have we documented that goal in a plan?

■ ***Managers think about their community purpose and ask how technology can enrich it and achieve desired goals.***

- What smart city projects align with our community vision (trendsetter, modern city, quiet suburb, etc.)?
- What would enable greater communication between citizens and public services?
- Can GIS and smart technology be used to attract economic development and talent?

■ ***Managers ask about how to store and use data.***

- What collected and stored data is public and what is private? Do we need a data classification policy?
- Can predictive analytics be used to address community problems?
- How can data help us better understand how staff is spending their time?

- How can data be accessed easily and used to measure performance?

The IT-savvy manager understands that smart communities have a purpose. Communities are networks of institutions that work together to address social and economic issues. These managers also understand the importance of adopting six foundational pillars on which to build to become a smart community:

1. Organize your data.
2. Improve operational efficiency.
3. Emphasize civic engagement.
4. Develop a “mobile first” mindset.
5. Provide the tools for data-driven decisions.
6. Set up the infrastructure for the Internet of Things (IoT).

This guide reviews specific GIS trends and community projects that use relevant data and innovative technology to improve service delivery and decision making, which may be valuable to jurisdictions on the path to becoming smart communities.



Trends in the Use of Local Government Data and Technology

Professor Stephen Goldsmith, Daniel Paul Professor of the Practice of Government and Director of the Innovations in American Government Program at Harvard's Kennedy School of Government.

No sector will benefit more from digital disruption and tools than a government led by a senior manager committed to using available technologies to drive higher-quality services to citizens. We are at a once-in-a-century opportunity for dramatic change, yet that change rests on concepts in part foreign to government. These digital tools envision a distributed system where information is broadly spread over agencies, neighbors, and sectors. Creating insight from this information will provide the opportunity for managers to drive more and better-organized data to the field.

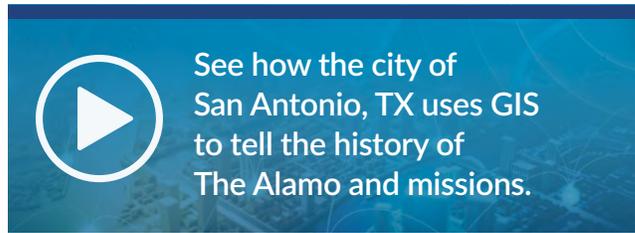


Enormous technological changes in the last few years alone have made GIS platforms and their related solutions indispensable in producing changes in the quality of life in communities around the world. While these changes affect all sectors, I view them through the lens of the public sector, having spent thirty years in or involved with local government. Officials now possess powerful tools to improve outcomes, responsiveness, and civic engagement that were unimaginable as little as five years ago. And yet, these tools will only reach their potential if we can figure out how to integrate them into day-to-day governance.

Let's look first at some of these technology breakthroughs and the challenges that inhibit their application. At the most basic level we simply have more potentially useable data than organizations have capacity to effectively utilize. Four big trends reflect this opportunity/challenge gap:

1. The movement from analog to digital has produced massively more data but that data are often trapped in the transactional, siloed systems utilized by a single city agency.
2. Mobile devices allow field workers access to critical information in real time, which can enhance their problem-solving abilities—but only if it is organized in a manner relevant to the area in which they are working.
3. Social media provides opportunities for community engagement in the coproduction of city services but, again, only if the observations are curated and tagged geographically.
4. Cloud computing and open-source code allow workers in one city to benefit from applications developed in another—if the latter officials share a similar GIS platform and a commitment to openness.

Government can play an important role in unlocking knowledge. In my recent book, [A New](#)



[City O/S: The Power of Open, Collaborative, and Distributed Governance](#), we call out Los Angeles's GeoHub as one powerful example of how city managers can build these foundations. In Los Angeles, the GeoHub organizes public data on a well-visualized GIS platform, allowing public employees to see what other agencies are doing in a given geographic area and allowing residents to gain more knowledge about and contribute to solutions in their neighborhood. Much of the GeoHub data can be utilized and analyzed by citizens, who can fully see what activities and challenges are occurring in their community and, as a result, make contributions that can be easily connected to public employees' stream of work. In one such initiative, Vision Zero, Los Angeles has provided easily visualized data from various agencies and made the insights available to residents as part of a citywide initiative that concentrates on pedestrian and bike safety. Here Los Angeles is taking massively more available digital information, integrating it across departments, visualizing it for community participation, and, in turn, improving the insights of its city workers.

The open data movement further reinforces the importance of GIS as an organizing platform. A few years ago, residents could not see real information about how their government responded to various issues. In the early days of open data, some cities provided reports to the public but not in a way that was meaningful. Imagine the difference between a spreadsheet of city data on street and sewer repairs and a high-quality, well-designed map reflecting complaints and the time to resolution, revealing clear trouble spots and service areas. This evolving open data movement will next add even more value when it takes city enterprise performance

data and integrates the observations of citizens. Thousands of unorganized and often ignored comments add little more than frustration unless they are also curated and GIS tagged. The GIS platform provides context, allowing an organization to produce more value from its other IT expenditures—an important benefit for cash-strapped public entities.

The digital revolution includes the Internet of Things (IoT), where things like streetlights, people with wearables, and smartphones are constantly connected. Data produce understanding when contextualized. A city that can organize and mine

these types of data, giving it geospatial relevance, will jump ahead in terms of responsiveness.

GIS today can turn data into the knowledge necessary to produce value. When data are organized geographically and effectively visualized, they tell a story that will drive both results and policy, as well as engender the civic support of citizens. Trust in government can be renewed through accurate information that leads to enhanced responsiveness. GIS is context, literally a civic switchboard knitting together that which will produce a high quality of life.



Got Data? Visualize It to Get Results

Lori Sassoon, Deputy City Manager/Administrative Services,
City of Rancho Cucamonga, California

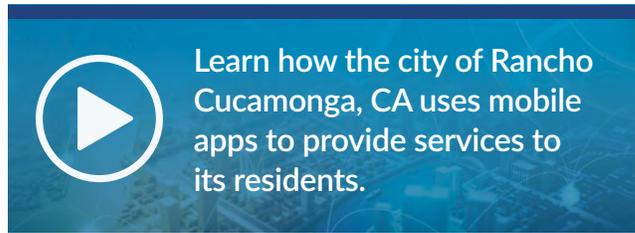
We took a fresh look at the business of the city and how we deliver services. That introspection resulted in developing a mobile app strategy to better reach citizens where they are and help them communicate with us. A key component of this strategy is GIS. Maps and place-based information resonate with everyone, from citizens to managers to elected officials, regardless of the communication channel, enabling all of us to work on and solve community problems together.



Public works, police, fire, recreation, libraries, social services—all the essential functions of local government involve collecting all sorts of data. Often the data sit in disparate computer systems and even in paper files. It’s a treasure trove of information, and it can be hard to wrap our arms around it all. In the meantime, we’re all looking for ways to use that data to evaluate our performance and help solve important problems in our communities.

GIS provides a platform to organize our data and visualize it in ways that make it useable to individuals and teams. Before going out to collect more data, our team first reviews what data are already being stored and maintained, and then uses that information to make data-driven decisions about resource allocation, policy development, and personnel deployment.

The city of Rancho Cucamonga has made a practice of fostering the use of its existing data for new innovations whenever it can. For example, data collected during processing permits and business licenses are cleaned and used in the city’s [RC2GO mobile app](#) to direct citizens to local restaurants and other area small businesses. Like Rancho Cucamonga, many local governments and public agencies have used GIS tools in creative ways. The following is a selection of popular GIS tools for local government managers.



Dashboards

Dashboards provide a quick visual reference in a familiar way. Dashboards draw from different data sets. When the data are displayed alongside one another and in real time, they provide a comprehensive view of operations and what’s happening in the group. Rancho Cucamonga’s city manager and other leaders use an executive dashboard that showcases police and fire incidents, vehicle locations from the automatic vehicle location (AVL) system, and citizen requests for service. Users can drill down into the data to learn more details, such as finding out the location of a fire incident or seeing photos of the incident that were uploaded on the scene. The executive dashboard is an app accessible on smartphones and tablets.

Creating Dashboards

The Rancho Cucamonga’s GIS Team works closely with city staff to understand workflows and other needs of the city departments. Once

Table 1. City of Rancho Cucamonga, Popular Public Applications

Data Set(s)	App	Description
Service Request	RC2GO Mobile App (iOS / Android)	Allows residents to report issues around the city, and city services can respond quickly.
RC Major Projects	City Projects and Private Development	Displays the major improvement projects and developments taking place around the city.
Public Parcels	My Community	Allows residents to look up information related to properties around the city. This includes zoning, general plan, trash pickup day, school district, etc.



Table 2. City of Rancho Cucamonga, Popular Internal Applications

Data Set(s)	App	Description
Service Request, Incidents, Inspections	Executive Dashboard	Allows executive staff and department leads to view live data from multiple sources. Popular examples include fire incidents, resident service requests, and city inspections.
Service Request, Sidewalk Inspections	Concrete Repairs	Using information gathered from RC2GO, this app allows Public Works crews to respond to damaged sidewalks around the city. Work crews use mobile devices to view and update the status of locations. Before and after photos are taken as work progresses. Office staff monitor and update inspections in the field and an overview of all inspections can be viewed by superintendents and supervisors.
Service Request, Graffiti Removal	Graffiti Removal	Service Request information from RC2GO identifies graffiti reported by residents. Field crews using mobile devices record removal activity and update the service request status. Photos are taken of the graffiti before removal and Police Department personnel review these for gang-related activity.

the needs are identified, the team brainstorms and develops different solutions. Rolling these solutions out to city staff requires that the applications be tested against staff workflows. Then staff are trained on how the application(s) works.

Our GIS staff allow users across the enterprise to log in and access GIS maps, apps, and data. Setting up and deploying a dashboard is a quick process. We select a dashboard theme and then

we target a map and data set within the organization. For the data to be “live,” field staff update the data using mobile devices. Office-based personnel can also update the same data.

Story Maps

Esri story maps take a map to the next level, bringing in more details and information than could be seen in a traditional paper map. As a multimedia

experience, story maps are accessed online. Users can drill down in the map to see more details, photos, and even video to provide a more complete and compelling picture. Residents can access links on the city's website for quick retrieval.

Our GIS staff use story maps in a number of ways. We have also trained many non-technology staff members in various departments to create their own story maps. Among the subjects we've covered are military banner locations, public art, and pending development projects. San Bernardino County's economic development staff created a rich story map with video and photography elements that showcases the county's craft beer, food, and nightlife in a fresh and modern way.

ArcGIS for Stable Local Government Solutions

GIS novices can create a story map in a matter of hours once the story to be shared has been organized. Application templates can be customized to the jurisdiction's needs. Esri provides templates on a wide variety of topics. Among the topics that Rancho Cucamonga has used are Land Records, Address Management, Public Works, Emergency Management, and Planning and Development. Other useful application templates include Crowd Source Reporter, Crowd Source Manager, Web AppBuilder, and Dashboard Themes.

Data Aggregation

GIS lets users pull information from disparate systems and display the data together in digital and paper maps. For example, library user data from the library management system might be viewed on a map along with recreation class registration from a separate software system to see if patterns of use emerge.

Creating Aggregated Data

The GIS Team exports data from different systems into ArcGIS Online. This allows different data sets to be brought together, viewed, and manipulated by city staff. GIS enterprise platforms provide the tools to use our data in these highly effective ways.

Not all agencies have staff with the needed GIS skills to maximize the use of these tools. Throughout the Midwest and down to Texas, many local governments have opted to establish regional GIS services. A regional GIS solution enables smaller jurisdictions and agencies to pool resources and share their expertise. Rancho Cucamonga provides GIS services to smaller public agencies across California, helping them to ramp up their GIS programs and show police, fire, public works, planning, and other departments how GIS can help them manage and use their data for improved decision making and workflow. With regional and shared-service approaches, the resource and expertise barriers for using the technology become lower for even the smallest of agencies.

Resources

No.	Publication Name	Source	Brief Description	Link
1	Best Practices For Local Government Geospatial Programs	Federal Geographic Data Committee (FGDC)	This article gives some common elements that contribute to a foundation on which successful local government geospatial programs are built.	https://www.fgdc.gov/ngac/ngac-local-gov-gis-best-practices-paper.pdf
2	5 Innovative Ways Municipalities Use GIS	GovPilot.com	An introduction to how GIS is letting citizens engage with their governments in innovative new ways.	https://www.govpilot.com/blog/5-innovative-ways-municipalities-use-gis
3	Keeping Lake Beautiful with a simple to use Mobile Application	Lake County, Florida	A case study about Lake County's Geographic Information Services (GIS) Division working with Keep Lake Beautiful, an affiliation of Keep America Beautiful, to create a mobile application that allows citizens to submit problems and observations around Lake County.	https://www.lakecountyfl.gov/pdfs/gis/case_study_keep_lake_beautiful_crowdsourcereporter.pdf
4	GIS Collaborates with the Property Appraiser to create Digital Tax Maps	Lake County, Florida	A case study about how Lake County's new Property Appraiser is using GIS technology to bring accurate and up-to-date digital tax maps to citizens, developers, and businesses.	https://www.lakecountyfl.gov/pdfs/gis/case_study_digital_tax_maps.pdf

No.	Publication Name	Source	Brief Description	Link
5	My Public Services Web App Helps Locate Valuable Services	Lake County, Florida	A case study about how Lake County GIS implements the My Public Services web map application in collaboration with county municipalities; the app allows the user to locate an address and see various public services and facilities that are nearby.	https://www.lakecountyfl.gov/pdfs/gis/case_study_my_public_services.pdf
6	GIS's Evolving Promise for Local Government	Governing	The development of GIS technology in Loudoun County, VA and how it improves decision making and helps guide smart growth.	http://www.governing.com/blogs/bfc/col-loudoun-county-virginia-gis-improve-decision-making.html
7	Exploring the City of Darwin Map Portal	GIScloud.com	An insight into citizen engagement with the help of public maps in the City of Darwin.	http://www.giscloud.com/blog/exploring-the-city-of-darwin-map-portal/
8	GIS Web Mapping Enables Self Service - and Savings	Directions Magazine	Continuing developments in GIS technology, specifically in web mapping, provide both more cost-effective means of delivering customer services and measurable improvements in customer satisfaction through smart, self-service solutions.	https://www.directionsmag.com/article/1703

No.	Publication Name	Source	Brief Description	Link
9	Cutting costs, expanding transparency are goals of Colorado's new GIS portal	Statescoop	Colorado released a geospatial portal that showcases geospatial services and transforms how state agencies use and understand their data.	http://statescoop.com/colorado-launches-gis-portal-to-cuts-costs-expand-transparency
10	GIS Helps Communities Showcase Unique Strengths	Government Technology	In an era of unprecedented competition, municipalities turn to new mapping tools to aggressively market and sell to targeted business prospects.	http://www.govtech.com/opinion/GIS-Helps-Communities-Showcase-Unique-Strengths.html
11	Louisiana City Makes Election Data Available Through GIS	Government Technology	East Baton Rouge Parish has combined data from the Louisiana Secretary of State's office with its online maps to allow users to view precinct-by-precinct election breakdowns.	http://www.govtech.com/data/Louisiana-City-Makes-Election-Data-Available-Through-GIS.html
12	GIS Story Maps	University of Delaware	An introduction to GIS story maps and where and how they are used in Delaware cities.	http://www.completecommunitiesde.org/planning/gis-story-maps/
13	In-Depth Survey/Interviews with Local Government GIS Leaders	NYC Geospatial Information System and Mapping Organization (GISMO)	Results from survey/interviews with thirteen local government GIS leaders.	http://www.nysgis.net/EmergingGIS/NYSGISA_EmergingGIS_Interview_Summary.pdf

No.	Publication Name	Source	Brief Description	Link
14	MassGIS projects showcase	Mass.gov	A showcase of how MassGIS has completed a variety of analysis projects for various agencies. These projects often supported significant legislative or policy initiatives.	https://www.mass.gov/service-details/massgis-projects-showcase
15	How GIS Can Save Money and Increase Efficiency for Cities	Western Cities	The City of Santa Rosa has discovered several fiscal advantages in using GIS software to manage municipal assets; handle data related to these assets; and provide better information for residents, business owners, policy-makers, and staff.	http://www.westerncity.com/Western-City/June-2009/How-GIS-Can-Save-Money-and-Increase-Efficiency-for-Cities/
16	An Analysis of Benefits from Use of Geographic Information Systems by Ozaukee County, Wisconsin	Ozaukee County Land Information Office	This document analyzes the benefits of the Ozaukee County Land Information Program by a detailed account of the County's demographic information, the GIS program, available data sets, goals, and objective as well as the cost benefits of GIS to the County.	www.co.ozaukee.wi.us/1805/Benefits-from-Use-of-GIS
17	1000 GIS Applications & Uses – How GIS Is Changing the World	GIS Geography	Summaries of GIS applications from 50 different industries.	http://gisgeography.com/gis-applications-uses/

GIS: HELPING GOVERNMENTS BUILD SMART COMMUNITIES



Prioritizing Community Engagement



Community engagement requires meeting constituents where they are. GIS technology offers innovative solutions that make it easier for community members to participate. There are apps that make it possible to direct citizens to voter polls with the shortest lines or for residents to provide feedback on strategic plans online.

Tackling Social Inequities

In the **public health field**, the opioid epidemic has resulted in the overdoses of thousands of people across the country. Using GIS technology, local government can track the location of Rx disposal stations, collect overdose data for locating treatment centers, and monitor Narcan distribution programs.

Promoting Prosperous Communities

In our rapidly changing global economy, local government leaders must adopt new strategies for pursuing their **economic development** goals. GIS technology helps leaders understand this new marketplace and what it takes to grow the economy.





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