# Smart Communities:
## Delivering Intelligent Community Design With GIS

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# Introduction

One of the defining characteristics of smart communities is their quest to make residents' lives better. They aren't wedded to a specific tool or app to drive lasting change. Instead, they are powered by a deep understanding of who lives, works and plays in the community; how to support a neighborhood's changing demographics; and how events such as natural disasters and aging infrastructure could affect residents' quality of life.

Smart communities are forward-thinking. They use the resources they have – or acquire new ones – to plan for neighborhoods that are more livable and inclusive for current and future generations.

Achieving this outcome requires a different way of thinking that embraces new ideas and technologies to design our communities. Modern departments plan roads, transit systems, responses to homelessness and solutions to other public challenges using a more iterative approach with constant performance management and feedback mechanisms.

Advances in technology are driving government leaders to envision communities where digital and physical worlds align to provide effective and timely solutions for residents. They must think through the implications of drones in the air and driverless vehicles and what questions to consider now to prepare for decades to come. For example, will it be necessary to have traffic signals with the traditional red, yellow and green lights if intersections communicate directly with vehicles? Government leaders should be ready to proactively develop strategies that incorporate these new advances.

All government organizations, from small municipalities to entire states, face vexing planning issues that often revolve around questions of where and how to grow while maintaining their unique character. They must account for new technology and upcoming trends and lifestyle changes. They must also consider the repercussions of not shifting with these dynamic changes, including disadvantages for residents and a loss in economic competitiveness.

For these reasons, planning and engineering is a major technology tenet for delivering smart communities that adapt to change. This tenet spans all departments and, in many ways, is the unofficial first step to embracing smart. Any meaningful and lasting endeavor to transform a community begins with proper planning. Data-driven performance and civic inclusion support those planning and engineering efforts, which lead to operational efficiency when they are done well.

GovLoop partnered with Esri, a leader in geographic information systems (GIS), to delve into the specifics of planning and engineering: what it is, why it's important and how communities such as Oshkosh, Wisconsin, and Seattle are leading the charge in this area.

*Esri's Smart Community Information System establishes four technology tenets governments need to deliver smart communities. They are:*

**1**

**Planning & engineering**

**2**

**Operational efficiency**

**3**

**Data-driven performance**

**4**

**Civic inclusion**

# What Does Planning and Engineering Entail and Why Does it Matter?

We face new opportunities to shape the future of our communities each day. But putting those ideas into action requires a collaborative effort among government, businesses and residents. Whether your mission is public health, transportation services or economic development, planning and engineering processes must be top of mind.

When planning and engineering is at the forefront, communities always consider this question: **Are the decisions I'm making improving the lives of citizens and achieving sustainable growth?**

In other words, smart communities balance the needs of people, infrastructure and the environment when reimagining the future. This approach applies to all government projects, regardless of the department.

For example, let's say your city is building a new transit line. You must first plan and understand your community's demographics. Do you know who needs better access to transit? Are places of employment, local business and housing opportunities accessible to them?

The same is true for health and human services departments responding to homelessness. The development and placement of services need to take into consideration demographics, transportation networks and location of shelters to ensure that they are readily available and accessible to the people who need them most.

Historically, designing and planning a community involved only a loose connection to the overall population. But now, communities are increasingly considering human movement, sentiment and demographics to inform design. They understand that failing to do so puts residents at a great disadvantage, whether it's the inability to find adequate housing, efficiently travel around the community or access medical services nearby. Communities could find themselves at an economic disadvantage as well.

Overall, smart approaches bridge the divide between what is taking place technologically and how communities build for the future. When communities learn and adapt through real-time data, they deliver intelligent infrastructure design that supports urban mobility, resiliency and sustainability. This is critical because the decisions made today will affect communities for generations to come.

# How GIS Shapes and Elevates Planning and Engineering

Location plays a critical role in everything governments do. Communities nationwide have identified GIS as a foundational platform in building comprehensive smart community strategies. Having a location-centered view of your community is crucial to meeting residents' needs, whether you're deciding how to design a new stretch of roadway or where to place public parks.

For example, communities that embrace GIS technology not only engage and collaborate with residents in transformative ways, but they can also use data to express the value of what's being done to support all residents. GIS impacts and elevates planning and engineering by empowering communities to balance the needs of people, infrastructure and the environment in a thoughtful, collaborative and data-driven manner.

To achieve these possibilities, communities must adopt solutions that support capabilities such as 3D mapping and modeling. For example, 3D mapping provides real-world context and makes it easier for cities to visually communicate the proposed and potential impacts of zoning changes, new construction, and other planning and engineering efforts. Likewise, residents and business owners can better understand the implications of those plans and provide meaningful feedback.

In addition to supporting holistic 3D planning for real-world context, smart communities can achieve balance when they embrace GIS technology that:

## Facilitates human-centered design.

Location is personal and at the heart of everything communities do, so it's vital that planning and engineering approaches keep the human perspective at the forefront as they tackle tough problems.
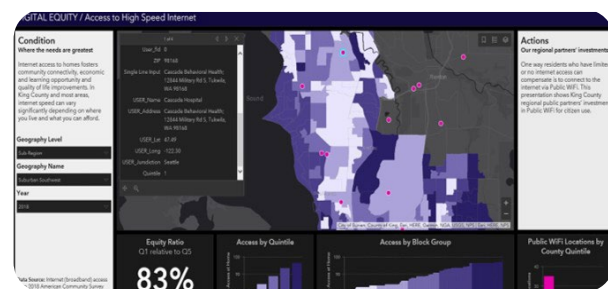


*King County, Washington, is identifying where neighborhoods with low to no access to broadband are in order to work toward equal access and economic mobility for all.*

## Boosts mobility.

Armed with location-based data, governments can understand how residents move around a county or city. Understanding their lifestyles and behavioral patterns will help officials realize the impact and benefit of improved transit services, investment in infrastructure and location of services or development.
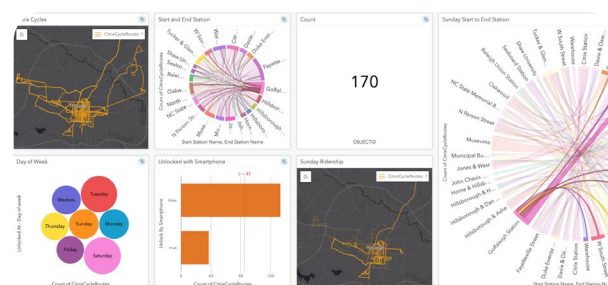


*The city of Raleigh, North Carolina, is understanding the behaviors and trips of bikeshare riders to improve urban mobility and the safety of pedestrians and cyclists.*

## Enables modeling in a digital world.

GIS supports the concept of a digital twin and enables cities to embrace more immersive technologies such as 3D and virtual or augmented reality. Organizations using these technologies will provide a new and improved way to design communities through real-world context and accurate visualization.



*Seeing industrial businesses leave their community, Oshkosh, Wisconsin, decided to use GIS to develop a new plan called Imagine Oshkosh to secure economic and investment opportunities for the future. This included 3D visualization to accurately show what redevelopment would look like and convey the area's potential to developers, businesses and the community.*

## Balances the built and natural environments.

Communities must balance the "built" environment, or development, and the "natural" environment, which includes parks and open spaces. Having the proper balance is key.
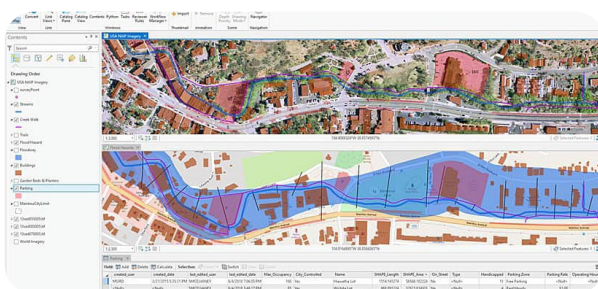


*Recognizing the neglect of Fountain Creek, once a cherished geological feature of Manitou Springs, Colorado, the city decided to build a 2-mile walk along the creek to improve its use as a public space. Using GIS, the city developed the Manitou Springs Creek Walk to give residents and visitors safe walking, biking and running routes that connect to local shops and restaurants. The walk would also help promote more active living, reduce traffic congestion and improve environmental quality.*

## Uses infrastructure as a sensor.

Sensor data provides communities with constant feedback and areas for improvement. Today, mobile devices, street infrastructure and vehicles are among the potential collectors of real-time data that communities can tap into. Once analyzed and visualized, data from those sensors can be used to make decisions and improve how a community functions.
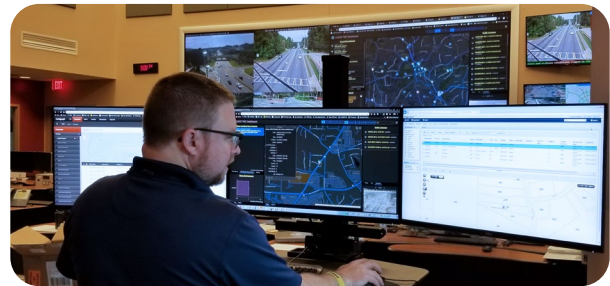


*Cobb County, Georgia, is supporting traffic management and increasing transportation safety with real-time GIS and artificial intelligence by monitoring vehicle and pedestrian traffic through sensors in the road, Waze data and camera feeds.*

## Fosters resilience and sustainability.

GIS has the power to minimize the impact of shocks and stresses and accelerate a community's recovery time. When planning and engineering professionals incorporate GIS into their community's response activities, they can better manage resources before, during and after an event.
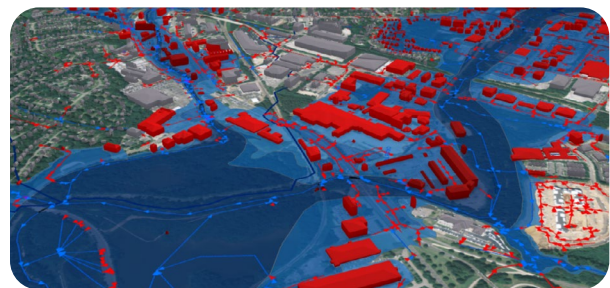


*In an area vulnerable to sea-level rise and hurricanes, the city of Raleigh, North Carolina, is using 3D analysis to help understand flooding risk to inform their stormwater strategy.*

**Ultimately, residents should be at the center of the smart community equation. Their needs should drive the technology decisions you make.**

# Planning and Engineering Success Stories

## Oshkosh, Wisconsin

**Challenge:** The city of Oshkosh regularly faces decisions that require the community to balance residential and business interests, as well as infrastructure and environmental needs. Elected officials must understand the potential impacts of planning and engineering projects because they're making decisions that affect generations to come, said Kelly Nieforth, the city's Economic Development Services Manager. This was especially true when Oshkosh, one of the smallest cities in the nation to boast a Fortune 500 company, overcame initial public disapproval, time constraints, major infrastructure challenges and more in a quest to retain its largest employer, Oshkosh Corp., and save hundreds of local jobs.

**Solution:** The city is a longtime user of ArcGIS and Esri tools, especially for planning purposes and for showing the community what's possible, Nieforth said. It's hard for people who aren't in planning or working on projects to visualize that potential. Some people may see only rundown buildings, but others can see a bustling, revitalized area. As part of its proposal to retain Oshkosh Corp. and become the location for the company's new global headquarters, the city used ArcGIS to look at potential sites, and settled on offering a portion of the city's municipally owned golf

course. Oshkosh also teamed with Esri partner Houseal Lavigne Associates and used CityEngine, an advanced 3D modeling software, to quickly create an interactive and immersive environment for the community and elected officials to weigh in on before proposing that golf course site to Oshkosh Corp. board members. "It helped us put our thoughts in a visual representation" and to have a conversation, Nieforth said.

**Outcome:** Not only did the company accept the proposal, but city residents who were initially concerned that a massive office complex would hinder their lakefront views became proponents of the project. In 2018, the city's parks department began work on a plan to turn the portions of the golf course not sold to Oshkosh Corp. into a park. Previously, if people wanted to enjoy the lakefront, they had to pay, said Nieforth, an Oshkosh native. GIS played a vital role in fostering civic engagement and providing an inclusive environment for residents to voice their concerns and to be heard. Nieforth expects that dialogue will continue to flourish as the city looks to tools such as ArcUrban to understand the impacts of zoning codes and to drive conversations with an increasingly informed community.

# Seattle, Washington

**Challenge:** With the boom of Amazon, Microsoft and the many internet and health care companies that call Seattle home, the city has added 105,000 new residents since 2010 and is the decade's fastest growing U.S. city. Seattle is in the process of updating its 20-year comprehensive plan, which will assess the city's capacity to accommodate that growth. By law, King County is one of several in the state that must determine if they have adequate amounts of residential, commercial and industrial lands to meet the growth needs. In previous years, planners would use an Access database before plotting that data on a map.

**Solution:** Seattle recently implemented a new building permit system and invested in 3D capabilities to visualize the whole city alongside zoning requirements using ArcGIS Urban software. "For the first time, we are going to use GIS and 3D capabilities to refine our analysis but [also] share it out to the public and to our decision-makers," said Jennifer Pettyjohn, a Senior Planner for the city.

"We have quite a large land use code that is a lot of legalese," Pettyjohn said. The city's zoning rules and land-use code are complicated. If printed out, they would create a stack of paper at least 10 inches high. The classifications of zoning codes have all been coded into ArcGIS Urban to improve understanding. The goal is to use the technology to understand where Seattle is now in terms of land use and accommodations for projected growth and to create different scenarios to consider how best to support future residents.

**Outcome:** "We have had a lot of growth, [and] we expect a lot of growth," Pettyjohn said. "What that means is our planning decisions have to be more transparent. We have to demonstrate that we can look at many different scenarios of how we plan to accommodate the growth." For example, there's a need to understand the impact of new development and what happens to people and jobs when buildings and neighborhoods transform. The impact of gentrification and whether it factors into the growing homelessness problem are of particular concern. Seattle plans to share its technical and methodological advancements with its regional peers to help them compose their buildable lands report. Internally, GIS enables the city to better store its data and provides a single system of record. Not only that, but now planners and developers can turn that data into visualizations. "I've been doing this for 30 years," Pettyjohn said. "I can't believe that I can put out a 3D model on the internet. It's pretty exciting."

# Empowering Your Organization With the Right Tools

Smart communities are thriving all around us. We are witnessing the rise of state and local governments that are answering the call to improve the lives of their residents. Jurisdictions like the ones mentioned in this piece are taking a purposeful approach to delivering a smart community, and they're using the following tools to take the next steps toward achieving effective planning and engineering decisions.

- **ArcGIS Pro** is Esri's powerful, single desktop GIS application. It supports data visualization, advanced analysis and authoritative data maintenance in both 2D and 3D.

- **ArcGIS Urban** is an immersive 3D experience designed to improve urban planning and decision-making. Use it to quickly visualize projects in your local context and leverage location intelligence to drive better decisions.

- **ArcGIS Hub** is an easy-to-configure community engagement platform that organizes people, data and tools through information-driven initiatives. Create genuine engagement, increase transparency and hold stakeholders accountable by tracking progress and improving outcomes.

- **ArcGIS Online** is the foundational cloud-based mapping and analysis solution. Use it to make maps, analyze data and to share and collaborate.

- **ArcGIS Dashboards** is a configurable web app that provides location-aware data visualization and analytics for a real-time operational view of people, services, assets and events. These dynamic dashboards allow you to view the activities and key performance indicators most vital to meeting your organization's objectives.

- **ArcGIS Solutions for State and Local Government** are a set of more than 450 ready-to-use solutions you can deploy in days, not months. From reporting code violations, addressing blight, monitoring social equity, these applications help you serve the needs of your entire organization.

- **ArcGIS Community Analyst** is a web-based tool that allows you to view and analyze demographic and lifestyle data to better understand your overall community and make better policy decisions.

# Conclusion

Today's evolving smart communities need a long-term strategy that puts residents at the center of their plans, whether they're reevaluating zoning regulations or reviewing the impacts of active developments on residents, infrastructure and the environment.

Smart communities place a high value on incorporating reliable data, analysis, intuitive technologies — such as GIS — and mechanisms that facilitate open communications with the public into their strategy.

But to effectively engage with the community, governments must ensure that transparency and accountability are driving those interactions. Emphasizing people and location to guide planning efforts makes smart worth the journey.

**To learn more, visit: <u>go.esri.com/smart-design</u>**

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When Esri was founded in 1969, we realized even then that geographic information system (GIS) technology could make a difference in society. Working with others who shared this passion, we were encouraged by the vast possibilities of GIS.

Today our confidence in GIS is built on the belief that geography matters - it connects our many cultures and societies and influences our way of life. GIS leverage geographic insight to ensure better communication and collaboration.

Explore our website to discover how our customers have obtained the geographic advantage by using Esri software to address social, economic, business, and environmental concerns at local, regional, national, and global scales. We hope you will be inspired to join the Esri community in using GIS to create a better world.

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