



INTELLIGENT INFRASTRUCTURE MANAGEMENT

NEW SOLUTIONS FOR A CONNECTED WORLD





**STATE AND LOCAL GOVERNMENTS BEAR
75% OF MAINTENANCE AND
IMPROVEMENT COSTS FOR
CRITICAL ASSETS SUCH AS
ROADS, BRIDGES AND PARKS.**

Proper infrastructure asset management can help organizations stretch maintenance and improvement budgets, maximize the value of existing investments, attract additional federal dollars and more. However, even the most competent public works and department of transportation officials are staggering under the sheer number of assets to be monitored and serviced.

Intelligent infrastructure — that is, a system of sensors, platforms and applications that automatically collects, analyzes and reports on data — is revolutionizing the way government agencies manage physical assets. By modernizing their asset management solution to leverage new data sources from connected devices, organizations can improve decision-making through better insights that support ongoing infrastructure maintenance and future investment planning initiatives.

Moving forward, organizations can combine real-time data from physical assets and other sources to create powerful smart city solutions that go beyond traditional asset management practices. Think street lights that brighten when a bicyclist's mobile device indicates he or she is passing through an intersection. Or parking meters that help relieve traffic congestion by notifying motorists through their mobile device that a spot is available. The right intelligent infrastructure management solution and approach creates countless opportunities.

TRADITIONAL INFRASTRUCTURE MANAGEMENT CHALLENGES

The following trends are driving the need to modernize the traditional approach to infrastructure asset life cycle management:

FAILING INFRASTRUCTURE. Aging infrastructure, deferred maintenance and lagging investment have led to a decline in the condition of public infrastructure. In a recent assessment, the American Society of Civil Engineers (ASCE) gave U.S. infrastructure a D+ or "poor" rating.² Whether they repair, replace or upgrade failing infrastructure, state and local governments are under pressure to optimize spending and allocate resources efficiently.

FEDERAL COMPLIANCE. To receive full federal funding for core infrastructure investments, government organizations have to prove compliance and align with national performance goals that are part of regulations such as the Moving Ahead for Progress in the 21st Century Act (MAP-21), the Fixing America's Surface Transportation (FAST) Act and others. To do so, organizations must provide a comprehensive, transparent picture of their infrastructure assets, including their location, their value, the amount they are depreciating and more.

GROWING VOLUMES OF DATA. According to Gartner, 20.4 billion connected "things" will be in use by 2020.³ As organizations increasingly adopt mobile devices, video cameras, sensors and other network-connected technologies to monitor and manage infrastructure assets, the volume of data is skyrocketing. The data streams coming from moving assets (e.g., transportation fleets and waste management trucks) are especially large and complex. Breaking down data silos, integrating the data that connected technologies generate and using it meaningfully are significant challenges. In fact, most data coming from Internet of Things (IoT) devices today is not being used.⁴

MOBILITY/MOBILE WORKFORCE REQUIREMENTS.

Repair crews, civil engineers and other mobile field workers need infrastructure asset data at their fingertips to do their jobs more efficiently and effectively. Asset managers need to know the location of workers in the field to schedule their time and deploy them appropriately. With the right solution, mobile devices and applications can address these requirements. The



CAPITALIZING ON MOBILE-ENABLED ASSET MANAGEMENT

A CITY NORTH OF LONDON uses a mobile-enabled asset management system that incorporates modules for remotely managing and monitoring work orders. The city also photographs and documents work in progress using mobile devices. By implementing a system to manage the complex workflow between the customer services team, highway safety inspectors and the response team, the city has saved 100,000 pounds (U.S. \$130,000) over a 12-month period and increased in-the-field efficiency by 40 percent.⁵



challenge is managing and protecting the data that is generated, collected and shared across mobile devices — especially when workers use their personal devices to conduct business.

LIMITED RESOURCES. Despite an infusion of funding for smart city projects, overall federal funding for public infrastructure has been relatively stagnant. The gasoline tax, which funds the Highway Trust Fund, has not increased in more than 30 years.⁶ At the same time, the number of infrastructure assets that are failing or reaching end of life has risen precipitously. Besides funding gaps, government organizations are losing institutional knowledge and continuity as older workers retire. To make up for losses in funding and knowledge, organizations need to increase efficiency and productivity, as well as find new ways to inform decision-making.

CITIZEN DEMANDS. More than 75 percent of U.S. Americans own a smartphone,⁷ and they increasingly expect their state and local governments to provide the same types of mobile services as the private sector. They want location-relevant services that let them use their devices to do everything from receive traffic alerts and check roadwork schedules to report potholes, air quality and plant pests in their neighborhoods.

HARNESSING THE POWER OF CONNECTED TECHNOLOGIES

To address these asset management challenges and opportunities, forward-thinking organizations are deploying software solutions that harness the power of the real-time, location-based data coming from sensors. Located on roadways, lighting and other assets, sensors collect and broadcast information about the status of physical infrastructure. The software solutions provide the automated data collection, analysis and reporting capabilities that organizations need to make informed decisions about repair and maintenance of, and investment in, critical infrastructure assets. They also lay a foundation to help organizations realize the full economic value and opportunity that lies within sensors and other intelligent technologies. The McKinsey Global Institute estimates that IoT applications for transportation, public health and other municipal settings “could have an economic impact of \$930 billion to \$1.6 trillion per year in 2025.”⁸

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THE VALUE OF LOCATION INTELLIGENCE.

Embedded location intelligence is a core component of intelligent infrastructure. With traditional approaches to asset management, organizations send skilled workers to manually assess the condition of roads, bridges, sewers or other assets. Doing so is time consuming and costly, especially when it requires a high level of engineering expertise. Location intelligence allows organizations to minimize on-site visits and other tasks that require human intervention by linking an asset's physical location to business and operational data. If a bridge cracks or is hit by a car, for example, intelligent infrastructure can use geospatial data coming from one or more sensors on the bridge to automatically initiate a workflow that notifies the appropriate personnel, issues and prioritizes the related work order, deploys work crews and coordinates other associated actions.

As intelligent infrastructure initiatives mature, agencies can also use location intelligence to identify traffic congestion and calculate alternative routes for drivers, track specific work crews and deploy them efficiently, or analyze traffic patterns to identify areas that need additional services or would be ideal for development.

ESSENTIAL BUILDING BLOCKS. While each implementation has unique requirements, the essential building blocks for an intelligent infrastructure ecosystem include:

- ▶ **Intelligent infrastructure asset management software** that receives data from the IoT platform, applies business rules to that data and automatically initiates workflows
- ▶ **IoT platform** that receives location intelligence and other data from sensor-enabled assets; normalizes (standardizes), aggregates and analyzes data; and initiates a workflow to trigger the next step in a business process. This platform enables organizations to successfully leverage infrastructure asset management software and all the data coming from connected devices. Gartner predicts that by 2020, “65 percent of companies that adopted the IoT will utilize an IoT platform for at least one IoT project.” An IoT platform includes:
 - ▶ Sensor-enabled assets that are connected to the IoT; sensors allow you to monitor the condition of assets and either produce data or actuate responses to data



65%

OF COMPANIES THAT ADOPTED THE INTERNET OF THINGS WILL UTILIZE AN IoT PLATFORM FOR AT LEAST ONE IoT PROJECT.



COUNTY COUNCIL IMPROVES PROCESSES, SAVES MILLIONS

- ▶ An internet network that transmits data from sensor-enabled assets, the IoT platform and intelligent infrastructure asset management software
- ▶ A gateway to translate protocols, connect devices, filter and process data, provide security and perform other critical functions
- ▶ Data analytics capabilities that create valuable insights from the data generated
- ▶ Data storage

BEST PRACTICES FOR LAUNCHING AN INTELLIGENT INFRASTRUCTURE INITIATIVE

The following best practices will help organizations achieve success in their intelligent infrastructure undertakings.

GAIN C-LEVEL BACKING. Intelligent infrastructure projects require a long-term commitment, a well-defined strategy and new ways of thinking about assets. Executive sponsorship and oversight helps



IN JUST FIVE YEARS, a county council in eastern England has realized more than 1.5 million pounds (nearly U.S. \$2 million) in cashable savings and more than 3 million pounds (nearly U.S. \$4 million) in non-cashable savings (through cost and resource efficiencies) by using an intelligent infrastructure solution to reduce the costs of managing highway and transportation assets. The county council is responsible for thousands of miles of roads and walkways, as well as more than 200,000 assets such as street lights, road signs and bridges. The intelligent infrastructure solution provides a single, unified platform across all highway departments, allowing the council to reduce maintenance costs, gain an accurate view of its assets, and improve and expedite asset maintenance processes throughout the county. Inspectors and maintenance crews use their mobile devices to file reports from the field, which increases worker productivity, improves the geographical accuracy of reports and keeps the public up-to-date with the status of repairs.¹⁰

ensure projects align with organizational goals, stay on track, and are properly funded and staffed. In addition, strong executive support helps create buy-in and overcome cultural resistance to change.

ESTABLISH A CROSS-FUNCTIONAL TEAM.

Some organizations make the mistake of creating siloed solutions that serve one particular department or function. To avoid redundancies; contain costs; and ensure solutions, data and processes can be shared across the enterprise, establish a multidisciplinary team that sets the overall strategy for intelligent infrastructure. When stakeholders are enlisted from all functional areas, it helps encourage buy-in and creates synergies around the development of smart city projects and other innovations.

ALIGN PROJECTS/SOLUTIONS WITH KEY PERFORMANCE INDICATORS (KPIs).

The best intelligent infrastructure solutions solve real-world problems, address multiple strategic goals and KPIs, have tangible benefits and can grow with the organization. As your intelligent infrastructure team

evaluates solutions, consider how well their capabilities align with both strategic and operational objectives. Also keep in mind scalability and alignment to long-term, overarching digital transformation and IoT goals.

KNOW THE VALUE OF YOUR ASSETS.

To optimize spending and make better decisions, it's important to know the value of each asset and how that value will change throughout its life cycle based on the asset management strategy. Data about where, when and why assets will fail allows an organization to predict their condition over time; determine maintenance costs; and decide whether to repair, tear down or invest in new assets. It allows you to move from a reactive to a preventive maintenance cycle, which is more efficient and cost effective.

PREPARE FOR LARGE VOLUMES OF DATA GENERATED BY SENSORS AND OTHER SOURCES.

Data analysts spend 50 to 80 percent of their time gathering and preparing data for modeling.¹¹ These tasks leave little time for extracting actionable insights, and they will only grow more burdensome as the volume of data swells. To enable data analytics and



HOW GOVERNMENTS BENEFIT FROM INTELLIGENT INFRASTRUCTURE

- ✓ Gain full visibility into infrastructure assets and their life cycle
- ✓ Serve citizens more effectively
- ✓ Improve community safety and quality of life
- ✓ Manage big data
- ✓ Improve operational efficiencies
- ✓ Maximize workers' time and productivity
- ✓ Meet and demonstrate regulatory compliance
- ✓ Proactively allocate resources and plan budgets
- ✓ Control costs and make informed spending decisions
- ✓ Meet smart city goals



other intelligent infrastructure processes, develop a plan for preparing and managing the life cycle of millions of pieces of structured and unstructured data that will come from disparate sources using a variety of protocols.

INCLUDE CITIZEN-CENTRIC SERVICES.

Citizen-centric services not only address constituent demands for more convenience and engagement with their government, they help asset managers and city planners do their job more effectively. Residents can use location intelligence on their mobile devices to report abandoned cars, graffiti, broken water mains and potholes; collect and submit data related to health, public safety and the environment; crowdsource updates on traffic and large gatherings of people; and more. This data can then be integrated into the intelligent infrastructure system to inform workflows and other processes.

START WITH A GATEWAY PROJECT. Organizations can lay the groundwork for an intelligent network and future smart city projects by starting with a project that can be used as a backbone for other assets to communicate. Many municipalities start with intelligent street lights. Intelligent street lights have been on the market for a long time so they are a more mature technology in terms of communications. Electricity runs to them so they can be used to power other technologies, and their height makes connections with mobile and radio networks more reliable. Agencies can also use them as a network access point for other sensors that are at or below street level (e.g., in storm drains).

UNDERSTAND THE EMERGING VENDOR ECOSYSTEM.

Hundreds of vendors are entering the market to supply sensors, platforms and other solutions that support intelligent infrastructure. Because the market is relatively immature, the gap between expectations and realities can be wide for both vendors and government organizations. In addition, not all vendors have the financial stability, business model or other success factors required to remain in business for the long haul. It's important to consider these factors and each potential vendor's longevity, portfolio, pricing model and experience in the public sector. Many vendors focus on a specific industry, and infrastructure asset management in the public sector has distinct requirements (e.g., compliance and legacy systems integration) that not all vendors can meet.

LOOK FOR SOLUTION PROVIDERS THAT ALIGN WITH THE ORGANIZATION'S NEEDS.

When investing in an intelligent infrastructure solution, define business and technical needs clearly and find potential providers that most closely match those needs. Find out the vendor's actual record of success in realizing benefits by delivering solutions like the one your organization requires. Be aware that most vendors do not offer end-to-end intelligent infrastructure platforms and many do not have location intelligence embedded into their solutions. Finally, look for the following features and capabilities:

- ▶ Scalability and the ability to upgrade
- ▶ Built-in integration with other business intelligence solutions
- ▶ Capability to integrate with cloud services, back-office applications, big data, mobile devices, video feeds and other technology
- ▶ An easy-to-use interface that provides a geographic map of assets and related information
- ▶ The flexibility to connect to and handle data from heterogeneous assets
- ▶ The capability to turn data into an actionable event via a trigger
- ▶ A mobile platform
- ▶ A self-service portal

OPPORTUNITIES ABOUND

Leading government organizations are adopting intelligent infrastructure solutions to address current asset management challenges while also paving the way for the states and cities of tomorrow.

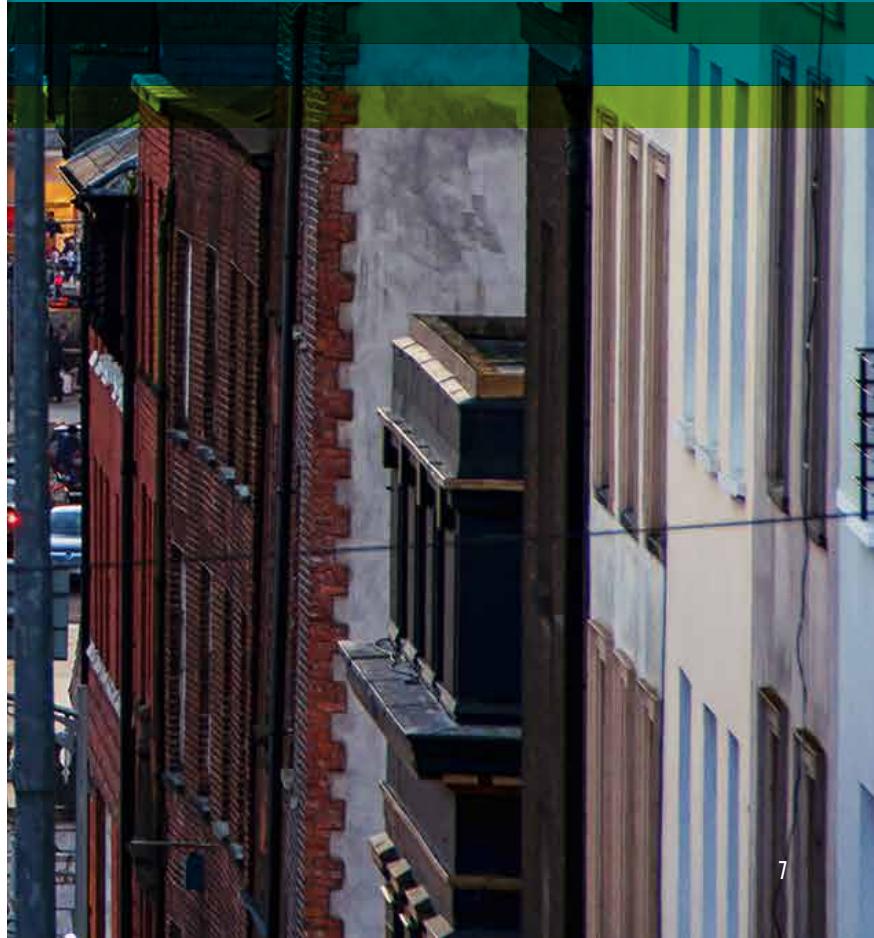
Federal agencies recognize the value of intelligent, connected technologies, and provide funding to help communities execute IoT projects as well as conduct research and development programs.

For example, the U.S. Department of Transportation recently allocated \$40 million to help one city deploy intelligent technologies that are intended to improve surface transportation, and the Environmental Protection Agency provided \$40,000 to help two communities set up a process for deploying air quality sensors.¹²

State and local governments can take advantage of these opportunities to not only modernize infrastructure asset management and solve some of their most pressing challenges, but also jumpstart their smart city projects. Doing so is critical to ensure continued economic growth and improved quality of life in U.S. communities, now and in the future.

PRECISE LOCATION DATA SMOOTHES THE WAY

THE CITY COUNCIL of one of Ireland's largest cities deployed an intelligent infrastructure asset management solution to gain real-time visibility into the management of its roadway assets, track and prioritize work, measure performance and project the funding needed to sustain infrastructure. Prior to the solution, the council relied on multiple legacy systems to track the status of important assets — but the process required significant manual intervention. The new solution provides a detailed, unified view of all inspection requests, which are displayed on a map with precise location data. Mobile workers can access and update the data in real time. In addition, the solution integrates with the council's customer relationship management (CRM) software, so when citizens report needed repairs online, their reports are forwarded quickly to the appropriate personnel.¹³



This piece was developed and written by the Center for Digital Government Content Studio, with information and input from Pitney Bowes.

1. <https://www.cbpp.org/research/state-budget-and-tax/its-time-for-states-to-invest-in-infrastructure>
2. Ibid.
3. <http://www.gartner.com/newsroom/id/3598917>
4. <http://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/the-internet-of-things-the-value-of-digitizing-the-physical-world>
5. http://support.pitneybowes.com/SearchArticles/VFP05_KnowledgeWithSidebarHowTo?id=kA180000000CtYUCA0&popup=false&lang=en_US
6. <https://insight.kellogg.northwestern.edu/article/can-the-private-sector-solve-the-us-infrastructure-crisis>
7. <http://www.pewinternet.org/fact-sheet/mobile>
8. <http://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/the-internet-of-things-the-value-of-digitizing-the-physical-world>.
9. <https://www.gartner.com/doc/3380746?aeld=&srclId=1-7389946276&campaignId=>
10. <https://www.pitneybowes.com/content/dam/pitneybowes/uk/en/legacy/docs/international/uk/software/pdf/case-studies/lincolnshire-council-cs.pdf>
11. https://www.nytimes.com/2014/08/18/technology/for-big-data-scientists-hurdle-to-insights-is-janitor-work.html?_r=1
12. [http://www.executivegov.com/2017/07/gao-reports-federal-support-for-internet-of-things-projects-in-communities/?NL=IOT-001UBER_20170727_IOT-001UBER_751&sfvc4news=42&c1=article_14_2](http://www.executivegov.com/2017/07/gao-reports-federal-support-for-internet-of-things-projects-in-communities/?NL=IOT-001UBER&Issue=IOT-001UBER_20170727_IOT-001UBER_751&sfvc4news=42&c1=article_14_2)
13. http://www.fujitsu.com/si/Images/CS_2016Sep_Dublin%20City%20Council_Eng_v%201.pdf

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